MARINE MAMMALS AND HUMAN ACTIVITIES
CATANIA, ITALY

35th European Cetacean Society conference
10-12 April 2024

ABSTRACT BOOK

European Cetacean Society

MARE CAMP

Dolphin watching and conservation in the Gulf of Catania

Cover photo © Clara Monaco, Marecamp Association

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FOREWORD

Dear colleagues and members of the European Cetacean Society,

Several studies conducted in the European Seas by many research groups have highlighted the correlation between demographic variations of cetacean populations and worsening in the Mediterranean water quality, especially near coastal areas more susceptible to anthropogenic pressures, which adds value to the role of marine mammals as important flag species, apex predators and bio-indicators of the general health of the marine ecosystem. At the same time, this emphasizes the need for targeted conservation management actions to spatial prioritization, and to preserve marine mammal habitats by addressing sustainable anthropogenic activities.

Being a common concern of many other coastal regions worldwide where the attention of the scientific community, local authorities, and citizens toward marine mammals is essential, especially in areas not yet protected as the Gulf of Catania which needs to take urgent measures, the main theme chosen for the 35th Annual Conference of the European Cetaceans Society is "Marine mammals and human activities: how to reach a sustainable development of coastal areas?".

This book of abstracts includes all contributions of the scientists coming from many countries all over the world who joined the 35th ECS Conference held in Catania, Italy, from 10th to 12th April 2024. All the abstracts included were evaluated in anonymous form by a large number of international experts on various topics related to the marine mammals field, so as to guarantee scientific contents and quality of the different thematic sessions.

We sincerely thank the presenters, chairpersons, student volunteers, attendees, collaborators, and supporters who contributed to the success of the Conference. We have done our utmost to ensure that this event was organized to the best of your expectations.

May this book serve as a source of inspiration and knowledge exchange, fostering collaboration and driving progress in our shared quest for marine mammal conservation.

Wishing you enriching insights and fruitful connections as you delve into the pages of this abstract book.

Clara MONACO, Ph.D.
On behalf of the Organizing Committee
Conference Chair

Marecamp Association
www.marecamp.com

HOSTING ORGANIZATION

The 35th ECS Conference was organized by the **Marecamp Association** at the University of Catania and the Ciminiere of the Metropolitan City of Catania.

Marecamp is a voluntary association based in Catania, founded in 2014 following the merger of other pre-existing organisations, which carries out research, training and outreach activities promoting coastal culture and Sicilian marine resources, with particular attention to the eastern Ionian area. Partner of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and the contiguous Atlantic area (ACCOBAMS), it is registered in the Single National Register of the Third Sector (RUNTS) and recognized by the Sicilian Region. Its activities, conducted by experts animated by a great passion for the sea, are aimed at disseminating knowledge about cetaceans to a wide public, and at supporting the availability of data on the health status of the different species for the scientific community and decision-makers. The main aim is to encourage the maintenance of marine mammal populations in Sicilian waters, guiding the community towards the adoption of good sustainable practices, and offering ideas to orientate management plans aimed at protecting threatened species and environments. The association's proceeds are allocated to the realisation of free experiences for less fortunate children, and to support scientific research and protection activities for cetaceans resident in the Gulf of Catania promoted as part of its historic program “Dolphin watching and Conservation in the Gulf of Catania”.

The organization of the 35th ECS Conference also enjoyed collaborations with the Department of Biological, Geological and Environmental Sciences of the **University of Catania**, hosting parallel workshops on 8-9th April, and with the **Politecnico del Mare** high school of Catania for welcoming conference attendees.

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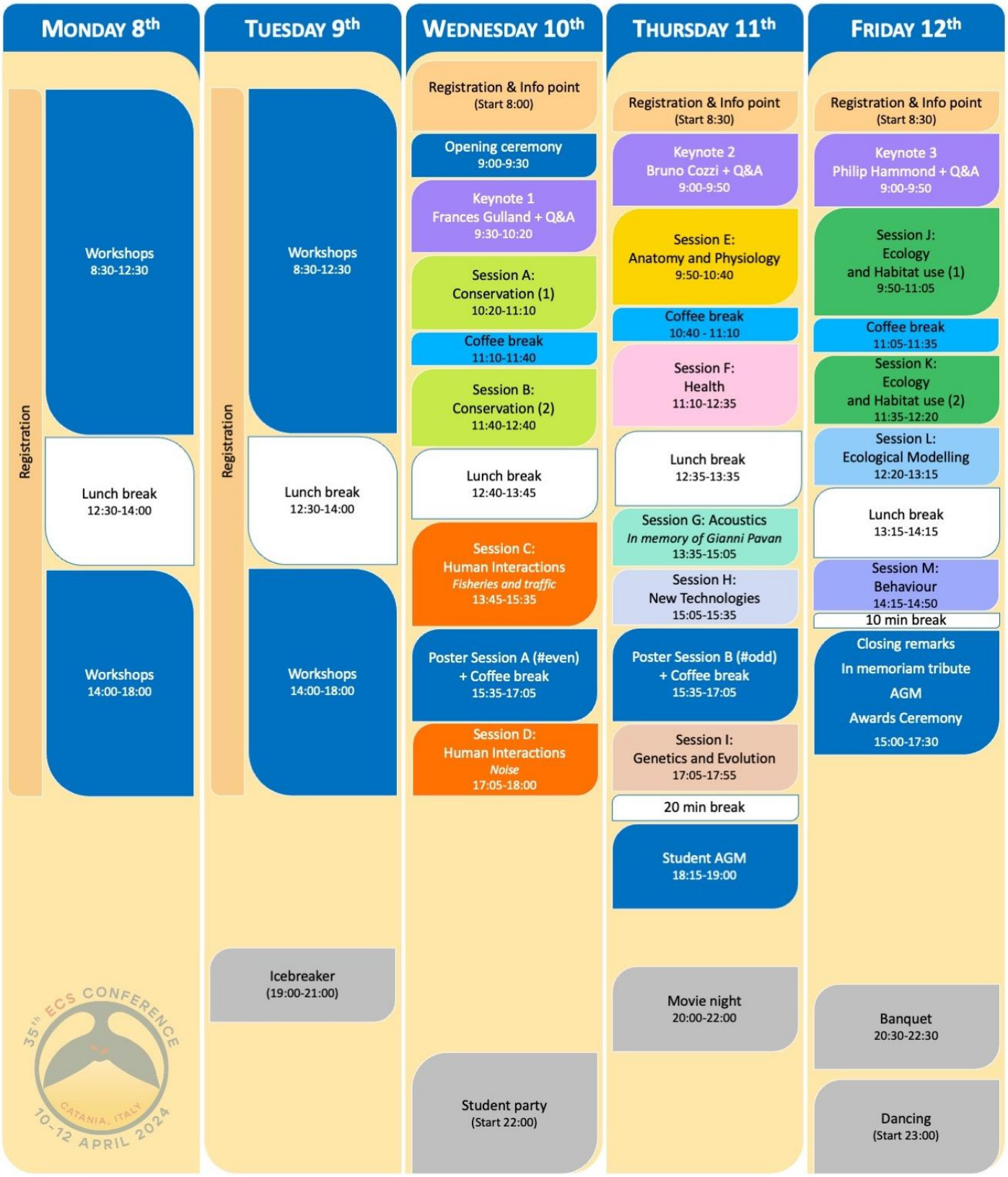
SCHEDULE AT A GLANCE



SCIENTIFIC PROGRAM – PLENARY SESSIONS

Le Ciminiere di Catania Exhibition and Congress Center
Piazzale Asia/Rocco Chinnici, Viale Africa 12, 95129, Catania

April 10th

9:00-9:30 – **Opening Ceremony**

- **Clara Monaco**, Local Organizing Committee and Scientific Committee Chair (Marecamp Association, hosting organization)
- **Dario Garofalo**, Marecamp President
- **Enrico Trantino**, Mayor of the Municipality and the Metropolitan City of Catania
- **Christian Mulder**, Rector's Delegate for Ecology and Climate emergency (Department of Biological, Geological and Environmental Sciences, University of Catania)
- **Alessandra Raffa**, Local Organizing Committee member (Marecamp)
- **Joan Gonzalvo**, European Cetacean Society Chair

9:30-10:20 – **1st Keynote Speaker: Frances Gulland**
Marine mammals and human activities, how to reach sustainable development of coastal areas: a comparison of three cases: the Vaquita, Mekong River Dolphin and North Atlantic Right Whale

10:20-11:10 – Session A: Conservation (1)
Chairs: Clara Monaco & Frances Gulland

Start	End	Title	Author	Format
10:20	10:35	Our coastal future: from prey to anthropogenic stressors, predicting marine mammal habitat in the Anthropocene ocean	Anita Gilles	ORAL
10:35	10:50	Climate change impacts on the West Indian manatee and their seagrass resources	Emma Deeks	ORAL
10:50	11:05	Holistic welfare monitoring of Indo-Pacific humpback dolphins: a novel conservation approach	Agathe Serres	ORAL
11:05	11:10	Empowering local communities: a marine mammal conservation and community science initiative in Chocó, Colombian Pacific	Ann Carole Vallejo	SHORT

11:10-11:40 – **Coffee break**

11:40-12:40 – Session B: Conservation (2)
Chairs: Aurélie Moulins & Lonneke IJsseldijk

11:40	11:55	The growing network of Important Marine Mammal Areas (IMMAs): a 2023 update on the global programme to assist conservation of marine mammals	Caterina Lanfredi	ORAL
11:55	12:10	Testing a vulnerability index to compare ten important areas for cetacean conservation in the Mediterranean Sea	Antonella Arcangeli	ORAL
12:10	12:25	Governing marine protected areas for harbour porpoise conservation: The case of the Sylt Outer Reef and the Whale Sanctuary in the German North Sea	Wiebke Homes	ORAL

12:25	12:30	Are Marine Protected Areas spatially relevant for cetacean conservation? A case study of the Portuguese coast	Camilla Aiuti	SHORT
12:30	12:35	Update on the common dolphin population status in Portuguese continental waters	Catarina Eira	SHORT
12:35	12:40	Enhancing biodiversity conservation and public awareness through citizen science and whale watching with eDNA monitoring	Eleonora Barbaccia	SHORT

12:40-13:45 – **Lunch break**

13:45-15:35 – Session C: Human Interactions (fisheries and traffic) Chairs: José Carlos Báez & Joan Gonzalvo				
13:45	14:00	Comparison of population models to better understand anthropogenic impacts on marine mammals	Peter Evans	ORAL
14:00	14:15	Cetacean stranding research reveals impacts of human activities	Lonneke Ijsseldijk	ORAL
14:15	14:30	Relationship between fishing strategies and by-catch: a case study on common dolphins (*Delphinus delphis*) in the Bay of Biscay	Mathieu Brevet	ORAL
14:30	14:45	A mitigation measure against dolphin depredation: the Acoustic Alert System	Alessandra Raffa	ORAL
14:45	15:00	Pearls are not just for girls - Application of acoustic reflectors in set nets to reduce bycatch of harbour porpoises and other odontocetes while keeping fish catches high	Thomas Noack	ORAL
15:00	15:15	Bottlenose dolphins adjust their signature whistles during fishery interactions: the influence of human activities on individual recognition and cooperation	Maria Silvia Labriola	ORAL
15:15	15:20	Using multi-sensors devices to assess fin whales' behaviour and interactions with marine traffic in the Mediterranean Sea	Simone Panigada	SHORT
15:20	15:25	Assessment of the Cuvier's beaked whale's (*Ziphius cavirostris*) exposition to maritime traffic in the Ligurian basin.	Anna Borroni	SHORT
15:25	15:30	Community science to understand AIS and non-AIS vessel activity, and their interactions and potential impacts on whales, dolphins and seals around coastal Scotland	Lauren Hartny-Mills	SHORT
15:30	15:35	Winter distribution of cetaceans in the Irish and Celtic Seas and implications for assessment of anthropogenic impacts	Jaz Harker	SHORT

15:35-17:05 – Poster Session A (#even) + Coffee break

17:05-18:00 – Session D: Human Interactions (noise) Chairs: Virginia Sciacca & Ida Carlen				
17:05	17:20	Shipping noise induces changes in fin whale songs	Valentina Caradonna	ORAL

17:20	17:35	Vocal compensation to anthropogenic noise in long-finned pilot whales	Milou Hegeman	ORAL
17:35	17:50	Underwater noise monitoring in Italian waters, a wide area dataset	Michele Manghi	ORAL
17:50	17:55	Response of harbor porpoises (*Phocoena phocoena*) to different types of acoustic harassment devices before the construction of offshore wind farms	Julika Voss	SHORT
17:55	18:00	Harbour porpoise detections decline in response to a scientific seismic survey during site characterization of a tidal energy development: considerations for Environmental Impact Assessments.	Gemma Veneruso	SHORT

April 11th

9:00-9:50 – **2nd Keynote Speaker: Bruno Cozzi**
Open unsolved questions in dolphin and whale anatomy

9:50-10:40 – Session E: Anatomy and Physiology
Chairs: Bruno Cozzi & Andrew Bronwlow

9:50	10:05	Assessing biomarkers in common dolphin: Insights from blubber cortisol analysis	Sofia Albrecht	ORAL
10:05	10:20	The circulating milieu of bottlenose dolphins (*Tursiops truncatus*) may hold the key to preventing arterial aging	Yara Bernaldo de Quirós	ORAL
10:20	10:35	To click or to headbutt? Specific features of the melon in large bottlenose and Cuvier's beaked whales	Jean-Marie Graic	ORAL
10:35	10:40	Revisiting a case of anencephaly in a neonate Indo-Pacific bottlenose dolphin with virtopsy	Tommaso Gerussi	SHORT

10:40-11:10 – **Coffee break**

11:10-12:35 – Session F: Health
Chairs: Giovanni Di Guardo & Sandro Mazzariol

11:10	11:25	Influenza A virus infection in grey and common seals in the UK	Gail Leeming	ORAL
11:25	11:40	A new threat for the Med? Triazole-resistant *Aspergillus sydowii* in cetaceans from the Spanish Mediterranean	Victor Garcia-Bustos	ORAL
11:40	11:55	Pathological study of an open Patent Ductus Arteriosus (PDA) in a 20-year-old Killer Whale (*Orcinus orca*)	Nakita Câmara	ORAL
11:55	12:00	Marine macro-litter ingestion by deep diving cetaceans stranded in North-western Iberian Peninsula	Sara Sá	SHORT
12:00	12:05	PCB, pesticides, PBDE and HBCDD in harbor porpoises from Swedish waters 2005-2019	Anna Roos	SHORT
12:05	12:10	Perfluoroalkyl substances in NW Mediterranean striped dolphins: Unveiling biomagnification and temporal shifts (1990–2021)	Odei Garcia-Garin	SHORT
12:10	12:15	Spatiotemporal trends spanning three decades show toxic levels of chemical contaminants in marine mammals	Rosie Williams	SHORT

12:15	12:20	Bridging the gaps in the life-cycle of *Anisakis* spp. infecting oceanic cetaceans in the western Mediterranean	Alicia García-Gallego	SHORT
12:20	12:25	Parasitofauna of bottlenose dolphin (*Tursiops truncatus*) in North-Western Adriatic Sea	Federica Marcer	SHORT
12:25	12:30	Screening of Cetacean Morbillivirus, Avian Influenza Virus and Herpesvirus in the exhaled breath of humpback whales (*Megaptera novaeangliae*) along their North Atlantic migratory route	Helena Costa	SHORT
12:30	12:35	TB or not TB? A case of suspected *Mycobacterium avium paratuberculosis* (MAP) in a Risso's dolphin (*Grampus griseus*).	Nicholas Davison	SHORT

12:35-13:35 – **Lunch break**

13:35-15:05 – Session G: Acoustics ~ *In memory of Gianni Pavan* **Chairs: Michele Manghi & Gabriella La Manna**				
13:35	13:50	Potential acoustic and environmental predictors of delphinid mass strandings	Maia L. D'Souza	ORAL
13:50	14:05	Acoustic detection of Mediterranean monk seals (*Monachus monachus*) in the inner Ionian Archipelago	Angela Amlin	ORAL
14:05	14:20	Song notes and patterns of the Mediterranean fin whale in the Ionian Sea: towards effective monitoring for conservation	Virginia Sciacca	ORAL
14:20	14:35	Shared non-signature whistles produced by bottlenose dolphins	Laela Sayigh	ORAL
14:35	14:40	Acoustic characterization of long-finned pilot whales' (*Globicephala melas*) pulsed calls from the North-western Mediterranean Sea	Giorgia Pino	SHORT
14:40	14:45	Look Who's Talking": new insights into bottlenose dolphins' sociality gained from signature whistles	Daniela Silvia Pace	SHORT
14:45	14:50	Bottlenose dolphin mothers modify signature whistles in the presence of their own calves	Nicole El Haddad	SHORT
14:50	14:55	Can you hear me? Playback experiment highlights porpoise detection range differences between commonly used PAM devices: C-POD, F-POD, and SoundTrap	Nicole Todd	SHORT
14:55	15:00	IPI distribution as a tool for passive acoustic monitoring of well-known sperm whale units	Yaly Mevorach	SHORT
15:00	15:05	Quantitative within-individual signature whistle variation in bottlenose dolphins	Jure Železnik	SHORT

15:05-15:35 – Session H: New Technologies **Chairs: Morgana Vighi & Salvatore Viola**				
15:05	15:20	A wave glider for passive acoustic monitoring of cetaceans in the Mediterranean Sea	Francesco Caruso	ORAL
15:20	15:25	KM3NeT as an underwater acoustic monitoring infrastructure	Dídac Diego-Tortosa	SHORT
15:25	15:30	Playing hide and seek with harbour porpoises: evaluating theodolites and drones as land-based visual observation methods	Thaya Miranda Dinkel	SHORT
15:30	15:35	To track or not to track – CetTrack: a new open-source tool to track animals using cheap drone footage	Michael Dähne	SHORT

15:35-17:05 – Poster Session B (#odd) + Coffee break

17:05-17:55 – Session I: Genetics and Evolution Chairs: Andre Moura & Guido Pietroluongo				
17:05	17:20	Ecological and spatial correlates of population structuring in a metapopulation of North Atlantic killer whales	Chérine Dominique Baumgartner	ORAL
17:20	17:35	Environmental DNA reveals spatial and temporal variability of cetaceans and their prey species in a Scottish marine protected area	Elisabeth Boyse	ORAL
17:35	17:50	Unveiling the enigmatic natural history of Mediterranean Common Dolphins: Ecological and evolutionary insights for conservation challenges	Martina Pasino	ORAL
17:50	17:55	Optimizing environmental DNA field sampling and laboratory protocols across a multinational initiative to detect and quantify the presence of whales in the North-East Atlantic and Mediterranean Sea	Lauren Rodriguez	SHORT

18:15-19:00 – **Student AGM**

20:00-22:00 – **Movie night**

This session is open for free also to the external audience.
Those without a badge who are not yet registered for the Conference must reserve their place by filling out this online form.

The Marine Mammals Management Toolkit: building technical capacity of managers for the effective management of marine mammals
Marine mammal twinning

Advantages of using aerial drones for monitoring marine mammals
Răzvan Zaharia, Oceanic-Club

Life DELFI: a conflict to resolve
Monica Blasi, Filicudi Wildlife Conservation

Novel technique for the successful disentanglement of a habituated adult grey seal (*Halichoerus grypus*)
Dan Jarvis, Seal Research Trust

Blinded by sound
Ove Mikal Pedersen

Disentanglement
Kirstin Hansen, Ocean Friends

Whalesonic – getting closer to understanding the vocalization of whales
Florian Schmidt, University of Veterinary Medicine Vienna

The Aquatic Animals study plan in Animal care bachelor programme
Laura Cavicchioli, University of Padova

Siso the sperm whale
Carmelo Isgrò, MuMa

John Coe & Aquarius
Alison Lomax, Hebridean Whale and Dolphin Trust

In memory of Gianni Pavan
Michele Manghi, NAUTA

Dolphin-Fisher coexistence: managing foraging interactions for mutual preservation
Dario Garofalo & Clara Monaco, Marecamp Association

The information chain - Data collection and use in LIFE Conceptu Maris
Antonella Servidio, Triton Research

Blow
Beatriu Tort, Edmaktub Association

Centinela Foundation
Alessandro Bocconcelli, Tánana Pictures

April 12th

9:00-9:50 – **3rd Keynote Speaker: Philip Hammond**
Long-term studies of cetacean populations to improve ecological understanding and inform conservation

9:50-11:05 – Session J: Ecology and Habitat use (1) Chairs: Philip Hammond & Laura González				
9:50	10:05	Dynamic habitat suitability models of minke whales on the west coast of Scotland	Tim Awbery	ORAL
10:05	10:20	Interannual and seasonal variations in abundance of small cetaceans in the NE Atlantic	Oriol Giralt Paradell	ORAL
10:20	10:35	Bryde's whales population dynamics in Madeira archipelago: an indication of the species recent arrival to the area?	Luis Freitas	ORAL

10:35	10:50	Environmental drivers affecting the density of Southern Right Whales (*Eubalaena australis*) in the Brazilian calving ground	Marina Batochio	ORAL
10:50	11:05	Oscillation of stable isotopes in fin whale baleen plates unveil behavioural responses to climate patterns	Marc Ruiz-Sagalés	ORAL

11:05-11:35 – **Coffee break**

11:35-12:20 – Session K: Ecology and Habitat use (2) Chairs: Gabriella La Manna & Mario Acquarone				
11:35	11:50	Mercury isotopes as useful chemical tracers to study ecological niche partitioning in cetaceans	Joan Giménez	ORAL
11:50	12:05	Size, growth and age of Mediterranean male sperm whales	Nino Pierantonio	ORAL
12:05	12:10	Beyond borders: investigating Cuvier's beaked whale (*Ziphius cavirostris*) Distribution and Habitat Suitability at the Southeastern Edge of the Pelagos Sanctuary	Ludovico Sebastiani	SHORT
12:10	12:15	Foraging habitats of six species of odontocetes inferred through stable isotopes analysis	Rita Ferreira	SHORT
12:15	12:20	Geographical distribution of two fin whale (*Balaenoptera physalus*) populations across the Weddell Sea	Svenja Wöhle	SHORT

12:20-13:15 – Session L: Ecological Modelling Chairs: Simon Ingram & Antonella Arcangeli				
12:20	12:35	Estimating densities and total abundance of four small dolphin species in a significant portion of the North Atlantic	Miguel Martins	ORAL
12:35	12:50	Evaluating fin whale distribution in the Mediterranean Sea using Generalized Additive Models (GAMs) and Hurdle Models	Francesca Grossi	ORAL
12:50	13:05	Long-Term Monitoring and Analysis of the Orca Population in the Strait of Gibraltar (1999-2023): Insights into Population Status and Network Dynamics	Margarida Perfeito	ORAL
13:05	13:10	A matter of scale: Identifying the best spatial and temporal scales of environmental variables to model the distribution of harbour porpoise	Tiffany Goh	SHORT
13:10	13:15	Seasonal dynamics and environmental preferences of cetacean behaviours in the Gulf of Taranto (Northen Ionian Sea) for informed management strategies	Carla Cherubini	SHORT

13:15-14:15 – **Lunch break**

14:15-14:50 - Session M: Behaviour Chairs: Morgana Vighi & Clara Monaco				
14:15	14:30	Diel foraging patterns of deep-diving offshore common bottlenose dolphins (*Tursiops truncatus*) tagged near Bermuda	Jeanne Shearer	ORAL
14:30	14:35	Foraging behavior of Chilean blue whales (*Balaenoptera musculus chilensis*) in the Chiloense Ecoregion	Alex Bocconcelli	SHORT
14:35	14:40	Marine Mammal feeding strategies in a warming Arctic	Mario Acquarone	SHORT

14:40	15:45	Movement patterns and connectivity of the rough-toothed dolphin, *Steno bredanensis*, in the northeast Atlantic	Ashlie McIvor	SHORT
14:45	14:50	Small odontocetes behavioural response to vessel traffic in the Northern Ionian Sea (Central eastern Mediterranean Sea)	Francesca Santacesaria	SHORT

10 minutes break

15:00-17:30 – Workshops closing remarks, In memoriam tribute, ECS AGM, and Awards ceremony

SCIENTIFIC PROGRAM – POSTER SESSIONS

Le Ciminiere di Catania Exhibition and Congress Center
Piazzale Asia/Rocco Chinnici, Viale Africa 12, 95129, Catania

AC – Acoustics		
No.	**Title**	**Presenter**
AC-01	Variability of signature whistle emission in a bottlenose dolphin unit off the eastern Liguria coast (Italy)	Bianca Bonelli
AC-02	Optimisation of effort in a cetacean passive acoustic monitoring programme	Julia Carlstrom
AC-03	Circadian acoustic patterns of bottlenose dolphins (*Tursiops truncatus*) under human care	Maria Ceraulo
AC-04	Assessing *Tursiops truncatus* population dynamics through its signature whistles in Ibiza and Formentera islands (western Mediterranean)	Margalida Cerdà
AC-05	Dolphin vocalizations occurrence in ambient sound of the Gulf of Oristano (Sardinia, Italy).	Valentina Corrias
AC-06	Acoustic tracking of sperm whales in the Gulf of Catania	Letizia Stella Di Mauro
AC-07	Whistles production of common dolphins during specific behavioral contexts in two regions of Portugal (Algarve and Lisbon Coast)	Claudia Erber
AC-08	Expediton WhaleSonic: Synchronized acoustic and video data of killer whales and humpback whales in northern Norway	Lena Gies
AC-09	The use of opportunistic platforms for bioacoustics research in cetaceans in south of Portugal	Susana Gil
AC-10	Automated whistle extraction for precise scaled annotations	Loïc Lehnhoff
AC-11	Analyses of sperm whales trumpet vocalization emitted in the Balearic feeding ground	Lara Nocera
AC-12	Monitoring of harbor porpoises (*Phocoena phocoena*) in a noisy estuarine habitat: C- or F-PODs that`s the question	Marco F.W. Gauger
AC-13	Signature whistles as a tool to estimate dolphin population size from a single fixed hydrophone	Elena Papale
AC-14	Preliminary analysis on the emission contexts of the bray-call sequences of the Mediterranean common bottlenose dolphin	Giulia Pedrazzi
AC-15	Methods for the classification of patterns in the songs of the Mediterranean fin whale	Giuseppe Morello
AC-16	First acoustic recordings of killer whales (*Orcinus orca*) encountered in the canary archipelago	Matteo Puddu
AC-17	Whistle characteristics of rough-toothed dolphins (*Steno bredanensis*) in the Madeira archipelago	Laura Redaelli
AC-18	First results of passive acoustic monitoring of odontocetes on the south-west coast of mainland Portugal	Beatriz Reis
AC-19	Dive into Sperm Whale Vocal Diversity: Insights from Opportunistic Recordings off São Miguel Island	Margarida Rolim
AC-20	The effects of environmental and socio-behavioural factors on the structure of signature whistles in common bottlenose dolphins (*Tursiops truncatus*)	Fabio Ronchetti
AC-21	Temporal acoustic occurrence of *Odobenus rosmarus* in Svalbard islands (Norway)	Paolo Rossini
AC-22	Understanding Simultaneous Detections in Harbour Porpoises	Léon Rostock

AC-23	Acoustic chain, DB and data analysis within the “Italian Integrated Environmental Research Infrastructures System (ITINERIS)” project	Simone Sanfilippo
AC-24	Acoustic behaviour of different clusters of common dolphin (*Delphinus delphis*) in the South of Samos Island, Greece	Beatriz Tintoré

AP – Anatomy & Physiology

No.	Title	Presenter
AP-01	Structural and ultrastructural (Electron microscopy) contributions to the dolphin’s hypophysis	Paula Alonso Almorox
AP-02	A conspicuously white common dolphin sighted in the Istanbul Strait and Black Sea, Türkiye	Ayaka Amaha Ozturk
AP-03	What body condition measurements and blood draws tell us about the vulnerability of harbour porpoise (*Phocoena phocoena*) populations?	Kirstin Anderson Hansen
AP-04	Bottlenose dolphin (*Tursiops truncatus*) immortalized fibroblasts on novel 3D in vitro collagen-free scaffolds	Cinzia Centelleghe
AP-05	Dental anomalies in Grey seals from the Bothnian Sea	Linnea Cervin
AP-06	Cetacean’s Humerus bone radiodensity: variations between different families and diving behaviour	Francesco Maria Achille Consoli
AP-07	Suture ossification in cetacean skulls is delayed and shows strong phylogenetic signal	Valeriia Telizhenko
AP-08	β-amyloid immunohistochemistry in cetacean brains from Italy	Ksenia Orekhova
AP-09	Physiological and behavioural responses of Bottlenose Dolphin *Tursiops truncatus* to gustatory, olfactory and trigeminal chemical stimuli	Pablo Pezzino
AP-10	Biogeochemical proxies used to monitor nutritional condition in deep-diving Sowerby’s beaked whale	Tessa Plint
AP-11	Teeth as indicators of past and present cetacean ecology	Shirin N. Rahman
AP-12	Inner ear of the harbour porpoise using synchrotron phase-contrast imaging	Laura Rojas

BE – Behaviour

No.	Title	Presenter
BE-01	Beyond the waves: a closer look at the aerial behaviour of bottlenose dolphins (*Tursiops truncatus*) in the Strait of Sicily	Jessica Alessi
BE-02	Potential effects of geographic isolation on patterns of sociality of coastal dolphin populations	Thibaut Bouveroux
BE-03	Finding Goby – Is bottom grubbing a learned technique?	Ann-Kristin Craul
BE-04	Dive behavior of orcas in the Strait of Gibraltar: a preliminary study	Baringo Francisco
BE-05	First documented observation of potential feeding behaviour of humpback whales (*Megaptera novaeangliae*) in its breeding range off southern coast of Tanzania	Davis Godfriend Orio

BE-06	Lateralised lunge feeding behaviour in Southern Hemisphere fin whales at Antarctic feeding grounds	Alexander Nicolas Rychwalski
BE-07	Unveiling the brotherhood: social lives of Gibraltar's sperm whales	Nikolina Šokčić
BE-08	Interplay of apex predators: a study on the interaction dynamics between bottlenose dolphins and seabirds in the Strait of Sicily	Carlotta Vivaldi
BE-09	Bottlenose dolphin vocal behaviour during a lethal bycatch event in the Gulf of Catania, Ionian Sea	Ilaria Saldutti

CO – Conservation

No.	Title	Presenter
CO-01	The importance of public engagement within an island community	Jen Adams
CO-02	Eyes on nature: protecting the cetaceans in a cosmopolitan waterline of Istanbul with the power of citizens	Aylin Akkaya
CO-03	Five years of integrated and long-term monitoring for cetacean management in the continental shelf of French Mediterranean sea with the MPA network	Andrea Antich Gabriel
CO-04	Avoiding the data-gap trap: using sparse data on threats to explore conservation status of poorly studied species	Erin Ashe
CO-05	Examining the status of Risso's dolphin (*Grampus griseus*) populations in the Western Mediterranean: are integrated data sources indicating a widespread presence decline?	Arianna Azzellino
CO-06	From current condition to future scenarios of striped dolphins (*Stenella coeruleoalba*) in the ADRION Region: Species Distribution Models (SDM) and Extension of Suitable Habitat (ESH) in relation to climate conditions	Marta Azzolin
CO-07	Population Abundance Trends of Long-Finned Pilot Whales and Bottlenose Dolphins at the Special Area of Conservation ¨Underwater valleys of the Mazarrón scarp"	Eduardo Belda
CO-08	Large scale cetacean conservation: The complex case of the Lesser Antilles	Lucas Bernier
CO-09	Stranding data as precious source of information to better address field research on cetaceans	Giulia Cipriano
CO-10	Striped dolphin (*Stenella coeruleoalba*) population size fluctuation among the second and the third period of the Habitat Directive	Matteo Costantino
CO-11	Grey seal research and conservation in the Gulf of Riga (Latvia)	Alessandro Di Marzio
CO-12	Acoustic monitoring reveals variations in habitat use of the Amazonian manatee in relation to climatic events	Florence Erbs
CO-13	Perilous surveys for a species in peril: the Atlantic humpback dolphin (*Sousa teuszii*) in Guinea, West Africa	Tilen Genov
CO-14	Ocean literacy programs in Sicily, Italy, for cetacean conservation and aware citizens	Florinda Giaretto
CO-15	Citizen Science and iEcology revolution: a critical review of innovations in cetacean monitoring and conservation awareness	Christian Mulder
CO-16	Cetacean conservation trajectory: review of Trinidad and Tobago's whaling heritage to modern strategies	Anna Karamiseva

CO-17	Framework for the use of strandings data as a tool for monitoring cetacean population dynamics and health	Rachel Lennon
CO-18	Assessing the role of a small Marine Protected Area in coastal dolphin conservation	Krista Lokar
CO-19	Citizen science on the Catalan coast: a preliminary study to raise awareness on cetacean presence	Núria Marco Magraner
CO-20	The enigmatic humpback whales of the Pitcairn Islands	Katherine McCoy
CO-21	SHORE: EmpOweR Students as the agents of cHangE	Luca Melotti
CO-22	Cetacean research for conservation in the Calabrian Ionian Sea (Central Eastern Mediterranean)	Maria Assunta Menniti
CO-23	The importance of the biological collections: an assessment of the biological reference collection of cetaceans of the Macaronesia (CBRCM)	Nuria Muñoz
CO-24	How climate change impacts on marine mammals' stranding events	Sarah Mureddu
CO-25	Have You Spotted Them? Leveraging Participatory Platforms to highlight the need for a future Risso's Dolphin Network in NE Atlantic	Oihana Olhasque
CO-26	Exploring *Tursiops truncatus* distribution and conservation potential in the Tuscan Archipelago and Corsica: a Citizen Science approach within the Pelagos Sanctuary	Laura Pintore
CO-27	A strategy for ocean literacy: joining marine science and art in undergraduate university curriculum	Barbara Putnam
CO-28	Cetaceans monitoring in the MPA "Isola dell'Asinara": results and considerations for sustainable use	Valeria Sanna
CO-29	Montenegro Dolphin Research: Reporting upon the success of Seven Years of Investigating Cetaceans in a Previously Data-Deficient Region, highlighting Regional Conservation Implications	Evie White
CO-30	Assessing the welfare challenges posed by climate change to European marine mammals, with a focus on seals	Mark Peter Simmonds
CO-31	Cetacean conservation within the Ligurian Sea: status and proposal for its improvement	Erica Stoppa
CO-32	Update on Harbour porpoise status in Portuguese waters: abundance, distribution and strandings data	Andreia Torres-Pereira
CO-33	The Mediterranean Marine Mammal Tissue Bank: a tool for biodiversity conservation and management	Davide Trez
CO-34	Spot the Monk as promoter of "Open Science": everybody is welcome to its Observatory!	Elena Valsecchi
CO-35	WDC Shorewatch: Empowering communities to fill crucial seasonal data gaps for cetacean conservation	Alice Walters
CO-36	Bright Extinction: warning signs of the looming extinction of an extremely well studied killer whale population	Rob Williams
CO-37	"Whalecoin", recovering whale populations as carbon offset credit within extension of the EU Emissions Trading System to maritime transport	Roberto Crosti
CO-38	Strength in collaboration; making data FAIR	Poppy Cooney
CO-39	The role of setting cetacean bycatch thresholds to achieve European legal obligations	Sarah Dolman
CO-40	Should I stay or should I go? Identifying Critical Habitat for sperm whales in Eastern Mediterranean Sea of Turkey	Ceyda Özdemir

EH – Ecology & Habitat use		
No.	**Title**	**Presenter**
EH-01	Isotopic niche of blue whale and fin whale hybrids from Iceland as compared to their parental species	Alex Aguilar
EH-02	Diet of striped dolphins (*Stenella coeruleoalba*) in the French part of the Pelagos Sanctuary	Nathalie Di-Méglio
EH-03	Risso's dolphins invading Arctic waters: increasing evidence of multiyear site fidelity following range extension in the North Atlantic	Alexander Eckerle
EH-04	Bottlenose dolphin (*Tursiops truncatus*) photo-identification off Emilia-Romagna Po Delta Park (northwestern Adriatic Sea): preliminary results on occurrence and site fidelity	Andrea Ferrari
EH-05	Cetacean diversity along the south-east coast of Sicily, Mediterranean Sea	Silvia Frey
EH-06	Long-term trends in the diet of the striped dolphin, *Stenella coeruleoalba*, in the western Mediterranean: an update	Marica Galli
EH-07	Looking at the details: compound specific stable isotopes tell the diet history of east Australia migrating humpback whales	Jasmin Groß
EH-08	Should I stay or should I go? Different occurrences of six bottlenose dolphin groups identified in the Azores	Alba Haro
EH-09	Migratory variations of baleen whales off southeastern São Miguel island, Azores	Sandra González-Campos
EH-10	Residency patterns and site fidelity of the common bottlenose dolphin (*Tursiops truncatus*) in the coastal waters of Montenegro	Yarnick Herben
EH-11	Using data collected aboard a whale-watching vessel to investigate the habitat preferences of cetaceans off the Southwest coast of Ireland	Kate Hill
EH-12	Minke whales migrating to Scotland's west coast show longest history of sightings in Europe	Alison Lomax
EH-13	Diet of three oceanic Delphinidae species in the Canary archipelago	Lisa Klemens
EH-14	Habitat use of cetaceans near Barcelona – preliminary insights	Chiara Kurz
EH-15	Risso's dolphin (*Grampus griseus*) occurrence and site fidelity in continental shelf and slope waters of SW Portugal	Sara Magalhães
EH-16	Use of photo-identification data to define female reproductive parameters of bottlenose dolphins (*Tursiops truncatus*) in the Tiber River estuary (central Mediterranean Sea, Italy)	Alex Mattiussi
EH-17	Cetaceans of the Southern Atlantic Coast of Morocco: the Dakhla Region	Boughariou Mohamed
EH-18	Mesopelagic cephalopods are critical prey for several marine megafauna species	Mónica A. Silva
EH-19	Distribution and composition of the Risso's dolphin (*Grampus griseus*) population along the north coast of Tenerife (Canary Islands)	Elisabet Badosa
EH-20	Diet of minke whales (*Balaenoptera acutorostrata*) stranded along the west coast of Iberia	Silvia S. Monteiro
EH-21	Survival rates of long-finned pilot whales in southeastern Spanish waters	Aixa Morata
EH-22	Female, juvenile and calf sperm whale (*Physeter macrocephalus*) records from Ireland	Seán O'Callaghan
EH-23	Exploring cetacean habitats and diversity: a multidisciplinary expedition to the high-seas Vasco da Gama Seamount and Vigo Bank, NW Iberia	Cláudia Oliveira-Rodrigues
EH-24	Population parameters of the sperm whale in the oceanic waters of Madeira Island	Teresa Paço
EH-25	Abundance and distribution of marine mammals in north-eastern Sicily, Ionian Sea	Clara Monaco
EH-26	Photo-identification and capture-mark-recapture techniques for population studies on Bottlenose Dolphin (*Tursiops truncatus*) in the Gulf of Catania, Ionian Sea, Italy	Giuliana Pellegrino
EH-27	Cetacean group composition in the Pelagos Sanctuary with a focus on calves and newborns	Jessica Picozzi

EH-28	Where whales are born	Simone Poletto
EH-29	First confirmed live record of Sowerby's beaked whales (*Mesoploden bidens*) in mainland Portugal	Alfredo Rodrigues
EH-30	Beaked whales' distribution in the Azores based on whale watching and stranding data.	Alexandre Branco
EH-31	Prevalence of killer whale (*Orcinus orca*) "rake mark" scars on Icelandic humpback whale (*Megaptera novaeangliae*) flukes	Zaynab Sadozai
EH-32	Diet of the harbour porpoise using multi-analysis approach	Johanna Stedt
EH-33	Does it pay to stick around? Reproductive success of a resident male sperm whale (*Physeter macrocephalus)*	Stéphanie R.A. Suciu
EH-34	Using whale watching data to explore the habitat preferences of two oceanic dolphins in São Miguel Island (Azores)	Marc Tolosa
EH-35	Stomach Contents of Stranded Cuvier's Beaked Whales on the Turkish Aegean Sea and Northern Cyprus (Eastern Mediterranean Sea) Coasts	Arda M. Tonay
EH-36	Joint Mediterranean P-ID catalogue of the bottlenose dolphin (*Tursiops truncatus*): preliminary results within the LIFE DELFI project	Noemi Toni
EH-37	Isotopic niche of fin whales (*Balaenoptera physalus*) in the Catalan coast feeding ground, NW-Mediterranean Sea	Beatriu Tort
EH-38	Stomach contents of small cetaceans stranded on the south-western coast of the Black Sea near Zonguldak	Nastassia Uluduz
EH-39	Teleost diet of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) in the North and Baltic Sea	Thea Bohn Vinkel
EH-40	New records of minke whales in the Pelagos Sanctuary	Biagio Violi
EH-41	Cave usage by an adult male Mediterranean monk seal as inferred by camera traps	Luigi Bundone
EH-42	Unusual stomach contents in a Black Sea harbour porpoise found dead after the Kakhovka disaster	Karina Vishnyakova
EH-43	Expanding trophic understanding in teuthophagous cetaceans: isotopic relationships between cephalopod soft tissues and beaks	Manel Gazo
EH-44	Insights on marine mammals occurrence in the Ross Sea, Antarctica	Nohelia Farías Curtidor
EH-45	Abundance and distribution of cetaceans in the western English Channel, and their exposure to key threats	Beth Harvey
EH-46	Summer spatial distribution of cetaceans in the high seas of the Eastern North Atlantic region and evidence of possible distribution shifts	Anxo Gende
EH-47	Movements of Atlantic white-sided dolphins tagged in the Faroe Islands	Sara De Clerck
EH-48	Pioneering photo-ID catalog: first characterization of a bottlenose dolphin (*Tursiops truncatus*) population along the Palermo coastline	Andrea Calascibetta
EH-49	Twenty six days in the Ligurian Sea: the longest permanence of a young humpback whale in the Pelagos Sanctuary	Giulia Calogero
EH-50	Fine-tuning the isotopic niche of a marine mammal community using a multi-element approach and variable spatial scales	Alessandra Cani
EH-51	Population Dynamics of Risso's dolphins (*Grampus griseus*) in the Pelagos Sanctuary (northwestern Mediterranean Sea): perspectives from whale-watching operators in the Gulf of Genoa	Alessandro Verga
EH-52	Analysis of the presence of *Balaenoptera physalus*, *Physeter macrocephalus* and *Ziphius cavirostris* in the Gulf of Genoa: is anything changing?	Guido Gnone

EM – Ecological Modelling		
No.	**Title**	**Presenter**
EM-01	Movement patterns and inferred behaviour of short-finned pilot whales with different residency patterns in Macaronesia from satellite telemetry	Antonella Servidio
EM-02	Influence of benthic topography on minke whale (*Balaenoptera acutorostrata*) presence in the south coast of Portugal	Luke Ainsworth
EM-03	Seasonal habitat preferences and use of prey-dense areas by foraging minke whales (*Balaenoptera acutorostrata*) in the southern outer Moray Firth with implications for spatial management	Duncan MacDougall
EM-04	Inter-annual variability in cetacean encounters across long-term studies	Sam Walmsley
EM-05	Insights into fin whale movements and foraging behaviour around Elephant Island, Antarctica	Viola Panigada
EM-06	Cetacean diversity in the ADRION Region (Adriatic Sea and Northern Ionian Sea)	Giorgio Rosestolato
EM-07	Short-beaked common dolphin sightings in the Tagus Estuary: what can environmental variables tell us about it?	Paula Coelho
EM-08	Further is better: a comparative analysis of two Risso's dolphin (*Grampus griseus*) distribution models in relation to physiographical variables in the Northwestern Mediterranean Sea.	Carla A. Chicote
EM-09	Influence of environmental variables on the bottlenose dolphins' spatial distribution and habitat use	Martina Pelagatti
EM-10	A literary deep dive: Assessing the reporting rates of cetacean availability bias for estimating abundance from digital aerial surveys	Ruth Peters-Grundy
EM-11	Abundance of common bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Trieste and adjacent waters of the northern Adriatic Sea	Shakira G. Quiñones-Lebrón
EM-12	Diving and surfacing characteristics of coastal minke whales (*Balaenoptera acutorostrata*) in the Moray Firth, Scotland: Implications for visual estimates of population size	Jade Rogers
EM-13	Long-term monitoring of harbor porpoise (*Phocoena phocoena*) in the Pomeranian Bay, Baltic Sea, reveals increasing detection rates over the last decade	Alexander Schubert
EM-14	Cetacean species occurrence in the South-West of Portugal: a 19-Year overview	Inês Afonso
EM-15	Exploring the use of presence-only data: addressing knowledge gaps in UK marine mammal spatial and temporal trends	Emma Borsier
EM-16	Assessing environmental variability in large-scale surveys for distribution and abundance of highly mobile species	Veronica Frassà
EM-17	Modelling the spatio-temporal distribution of cetaceans in the Western Mediterranean	Greta Jankauskaite
EM-18	Navigating the depths: a comprehensive review of cetacean distribution models and conservation insights	Eugenia Pasanisi

ET – Emerging Topics		
No.	**Title**	**Presenter**
ET-01	Automated tracking algorithm for groups of common dolphins (*Delphinus delphis*)	Fadia Al Abbar
ET-02	Marine Ranger app – Citizen science tool for collecting data on marine mammals in the Mediterranean	Jure Miočić-Stošić

ET-03	Evaluation of UAS-Photogrammetry accuracy in determining age-class structure of critically endangered bottlenose dolphins	Carmen Andres
ET-04	Enhancing Cetacean photogrammetry precision: is integration between barometric and lidar altitude data needed?	Giulian Capasso
ET-05	Whales from above: knowledge acquired from long-endurance fixed-wing Remotely Piloted Aircraft Systems (RPAS)	Marina Costa
ET-06	Implementation of a deep-learning algorithm for automatic identification of cetaceans from aerial videos: a promising tool for detection and identification of different species	Maria V. Delahoz
ET-07	Using a drone for the non-invasive collection of humpback whale blow samples in the breeding grounds of Cape Verde	Harriet Dawson
ET-08	An autonomous surface vehicle to investigate presence, distribution, and acoustic behavior of delphinids in the Central Mediterranean Sea.	Anaëlle Evrard
ET-09	Protecting Mediterranean Sperm Whales: AI Powered Identification and Insights	Sammie Fuller
ET-10	Inter-annual morphometric assessment of fin whales based on drone photogrammetry	Dorothy Mészáros
ET-11	Click and fly: body length estimates methodologies for sperm whales	Carlo Guidi
ET-12	Robust real-time detection of right whale upcalls using neural networks on the edge	Matthew D. Hyer
ET-13	Automated recognition of bottlenose dolphins based on individually distinct signature whistles	Frants H. Jensen
ET-14	Assessing morphometric, allometric and body condition parameters of short-finned pilot whales (*Globicephala macrorhynchus*) through aerial photogrammetry	Mónica Montoya Vallribera
ET-15	Automatic detection of marine mammal whistles in spectrograms using YOLO-V8	Carlos Alberto Quiroz-Rangel
ET-16	A deep learning classification model for multiple baleen whale species using ANIMAL-SPOT	Lorenzo Scala
ET-17	Integrating satellite tracking and photographic-identification to understand pilot whale connectivity between Madeira and the Canary Islands and support conservation	Mieke Weyn
ET-18	A two-step photogrammetry method for use with fast-moving whales	Andrew Wright
ET-19	Use of aerial and lateral photogrammetry for gender morphometric identification of free-ranging short-finned pilot whales (*Globicephala macrorhynchus*)	Alfredo de la Moneda Rodríguez
ET-20	The effectiveness of the low-cost acoustic recorder “HydroMoth” in cetacean research: preliminary results of the presence/absence of the bottlenose dolphin (*Tursiops truncatus*) in the Aeolian Archipelago (Sicily, Italy)	Monica Blasi

GE – Genetics & Evolution

No.	Title	Presenter
GE-01	Uncovering environmental DNA potential as a complementary cetacean monitoring technique in the north coast of continental Portugal	Luís Afonso
GE-02	The integration of 3D Printing in skeletal musealization: advancements, applications, and implications for heritage conservation	Luca Ceolotto
GE-03	eWHALE: combining environmental DNA sampling, whale watching and citizen science for stakeholder-driven marine biodiversity protection in the North-East Atlantic and the Mediterranean	Lorenzo De Bonis

GE-04	Extensive immune reaction and highly expressed novel genes hint at a potentially molecular adaptation in the lung of non-healthy harbour porpoises (*Phocoena phocoena*)	Eda Dönmez
GE-05	Comparative analyses of tissue and preservation suitability for genetic analysis in stranded cetaceans	Miguel Leal e Rigor
GE-06	Where are you from? The origin of *Pseudorca crassidens* (Owen, 1846) in the Mediterranean Sea explained by genetic analysis on historical and modern samples.	Tatiana Fioravanti
GE-07	Metagenomic and metatranscriptomic analyses of an ill dolphin from the Adelaide Sanctuary in south Australia	Luciana Moller
GE-08	Discovering genetic diversity over time: analysis of historical and modern samples of Risso's dolphin (*Grampus griseus*, Cuvier 1812) in Mediterranean Sea	Lucrezia Latini
GE-09	eDNA based haplotype analysis of the Shannon bottlenose dolphins (*Tursiops truncatus*)	Jack McKee
GE-10	Lost in the deep: a story of gene loss in sperm whales	Nádia Silva
GE-11	Female philopatry may modulate the response of an Antarctic pinniped to global warming	Jazel Ouled-Cheikh
GE-12	Eco-trophic-molecular assessment of the Maldivian cetofauna relying on eDNA analysis	Alessia Rota
GE-13	Fostering collaboration: ACCOBAMS best practices on cetacean population genetics	Anna Schleimer
GE-14	Mediterranean monk seal occurrence in the Southern Adriatic and Northern Ionian Seas as inferred by eDNA analysis.	Sofia Bonicalza
GE-15	Comparative skull shape analyses of coastal and offshore bottlenose dolphin (*Tursiops* spp.) skulls, using high resolution 3D modelling: implications for evolutionary processes and local conservation	Morgane Dromby
GE-16	Evolution of the energetic landscape in odontoceti sperm cells: co-elimination and metabolic shifts in toothed whales	Raul Valente
GE-17	BlowOmics: novel perspectives on non-invasive cetacean research using microRNA biomarkers in the exhaled breath (blow)	Courtney Alice Waugh

HE – Health

No.	Title	Presenter
HE-01	Prevalence of viral skin lesions in two different dolphin species in the Western Ligurian Sea, Italy	Davide Ascheri
HE-02	The cause of death as a source of bias in stomach content analysis of stranded cetaceans: an exploratory analysis in Mediterranean striped dolphins, *Stenella coeruleoalba*	Francisco Javier Aznar
HE-03	*Streptococcus phocae septicaemia* in two stranded common dolphins (*Delphinus delphis*) from Cornwall, southwest England – evidence for grey seal interactions?	James Barnett
HE-04	Abstract-Strandings of the Cetaceans in the Moroccan mediterranean and it's north atlantic adjacent waters between 2015 and 2022	Said Benchoucha
HE-05	First insights into effectiveness of ballistics as a euthanasia method for stranded cetaceans: Utility of behaviour and post-mortem computed tomography	Rebecca M. Boys
HE-06	Anisakis spp. (Nematoda: Anisakidae) diversity in dwarf sperm whale, *Kogia breviceps* (Cetacea: Kogiidae) stranded at the edge of its distribution range	Paolo Cipriani
HE-07	Organochlorine contaminants and heavy metals in skin biopsies of the Critically Endangered Common Bottlenose Dolphin *Tursiops truncatus* Gulf of Ambracia subpopulation	Guia Consales

HE-08	A silent threat: heavily contaminated common dolphins (*Delphinus delphis*) with evidence of impacts and health deterioration in the Northwest coast of Mainland Portugal	Ana Correia
HE-09	A review on *Toxoplasma gondii* infection in Mediterranean cetaceans	Mélodie De Trez
HE-10	Preliminary analysis of the kidney pathological findings of a Risso's dolphin (*Grampus griseus*) stranded along the Central Adriatic Sea	Gabriella Di Francesco
HE-11	Epizootic effects on long-finned pilot whales (*Globicephala melas*) social structure in the Strait of Gibraltar	Juliette Drevelle
HE-12	Alzheimer-Like β-Amyloid Plaques in the brain of a striped dolphin	Federica Giorda
HE-13	New beaked whale atypical mass stranding linked to military activities around the strait of Gibraltar (2022)	Antonio Fernandez
HE-14	Microplastics in marine mammals of Arctic waters	Mathilde Piette
HE-15	Evaluating the effectiveness of the Valencian Community Stranding Network (central Spanish Mediterranean) to detect stranded cetaceans and sea turtles	Patricia Gozalbes Aparicio
HE-16	An overview of marine mammals stranding in Sicily: a focus on Marecamp recordings	Giulio Guarino
HE-17	Delphinidae affected by chronic pathologies in the Gulf of Catania	Carolina Petralia
HE-18	Assessment of contamination by organic UV filters in two deep-diving cetacean species in NE Atlantic	Eva Iñiguez
HE-19	Cause of death of harbor seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) stranded on northern France coastline (1995-2021)	Thierry Jauniaux
HE-20	Cuvier's beaked whale atypical mass stranding event in Cypriot Coastline (2023)	Evridiki Kontemeniotou
HE-21	Three decades of anisakid nematode infections in harbour porpoises of the North- and Baltic Sea: trends and health effects	Kristina Lehnert
HE-22	Use of coproparasitological methods for identification of gastrointestinal and respiratory parasites in stranded cetaceans within the central and northern regions of Portugal coast	André Lobão
HE-23	Arteriosclerosis in Baltic Seals over two decades	Mariana Macieira
HE-24	Prevalence of *Anisakis simplex*, *Pseudoterranova decipiens*, and *Contracaecum osculatum* in Danish Harbour Seals (*Phoca vitulina*) and Grey Seals (*Halichoerus grypus*)	Betina Maia V. de Miranda
HE-25	Pathogenic microorganisms and gut microbiome profile in cetaceans from Pelagos Sanctuary (Northwestern Mediterranean Sea): how far terrestrial and coastal processes influence the marine environment?	Marianna Marangi
HE-26	Strandings of small cetaceans on the Moroccan coasts between 2015 and 2022 – *Delphinus delphis* and *Stenella coeruleoalba*	Badreddine Mekyassi
HE-27	Metagenomic survey of unusual mortality of Caspian Seals in 2022	Marat Kumar
HE-28	Cetacean strandings on the south-west coast of mainland Portugal: first three years of a regional network	Francisco Neves
HE-29	Unveiling unprecedented insights: a pioneering long-term examination of cetacean strandings in Romanian waters of the Black Sea	Romulus-Marian Paiu
HE-30	Overlap between cetaceans distribution and marine litter in the western Ligurian Sea	Andrea Carolina Pedrazzini
HE-31	Far away from home: gastrointestinal parasites as indicators of the geographical origin of a grey seal (*Halichoerus grypus*) stranded in Western Mediterranean Sea	Claudia Pons-Bordas
HE-32	Fine-scale distribution of the lungworm *Halocercus delphini* in the lungs of the striped dolphin, *Stenella coeruleoalba*: implications about migration pathways and functional significance	Rachel Vanessa Pool

HE-33	Trace elements and emerging contaminants in an isolated population of highly vulnerable marine predators	Annalisa Sambolino
HE-34	Suitability of tissue imprints on FTA®cards for dolphin morbillivirus and herpesvirus detection: comparison with gold standard frozen tissue	Haiyang Si
HE-35	9.5 kg ambergris coprolite linked to a lethal septicemia in a stranded male Sperm Whale in La Palma (Canary Islands)	Eva Sierra
HE-36	Preliminary analysis on cetaceans stranded along Sri Lankan coasts following the X-Press Pearl disaster	Luca Spadotto
HE-37	Identification of *Crassicauda anthonyi* in renal lesions of Cuvier's beaked whales (*Ziphius cavirostris*) stranded in Canary Island	Zuleima Suárez-González
HE-38	Update on mercury concentrations in harbour porpoises (*Phocoena phocoena*) stranded in the Portuguese Coast	Ana Sofia Tavares
HE-39	Food stimulation in Bottlenose Dolphin (*Tursiops truncatus*) activates the autonomic nervous system, causing heart rate reduction.	Angelo G. Torrente
HE-40	The intestinal microbiome of a stranded killer whale: insights into cause of death and anthropogenic pollution	Broos Van de Moortel
HE-41	Guidelines for rescue and rehabilitation of stranded harbour porpoises (*Phocoena phocoena*)	Annemarie van den Berg
HE-42	Into the dolphin skin: a first assessment of skin lesions in the bottlenose dolphins (*Tursiops truncatus)* of South-western Sicily	Alessandra Vanacore
HE-43	Delving into *Brucella pinnipedialis* pathogenesis and transmission in stranded bottlenose dolphins	Ignacio Vargas-Castro
HE-44	Chronic discospondylitis in a live stranded minke whale (*Balaenoptera acutorostrata*)	Matthew Perkins

HI – Human Interactions

No.	Title	Presenter
HI-01	Impact of the presence of visitors on the behavior and cortisol levels in captive bottlenose dolphins (*Tursiops truncatus*)	Belén Alonso Estanillo
HI-02	Combining whale-watching and research on male sperm whales in Northern Norway	Zoë Morange
HI-03	Accidental interaction between cetaceans and the surface longline by the Spanish fleet from Atlantic Ocean	Jose Carlos Baez
HI-04	Particular aspects of the presence and behaviour of cetaceans during offshore operations in the Western Black Sea Basin between May and July 2022	Ramona-Andreea Bivoleanu
HI-05	Marine traffic overlap with cetacean distribution in the 'Mediterranean Cetacean Migration Corridor' Marine Protected Area	Natalia Amigo
HI-06	Widespread social adaptation to foraging and scavenging behind trawlers: the case of bottlenose dolphins in the NW Adriatic Sea	Silvia Bonizzoni
HI-07	Harbour porpoises and operational offshore wind farms; occurrence and responses in time and space	Jacco Leemans
HI-08	Behavior and adaptive strategies of Bottlenose dolphin (*Tursiops truncatus ponticus*) to anthropogenic factors in the Black Sea	Ventseslav Delov

HI-09	The most frequently injured body parts and organs during dolphin-fisheries interactions in the Croatian part of the Adriatic Sea	Martina Đuras
HI-10	Codamozza/Fluker: the amazing journey of a fluke-less fin whale throughout the Mediterranean Sea	Maddalena Jahoda
HI-11	Impact assessment of anthropogenic pressures: acoustic masking and ship strike risks in fin whales during southward migration at the Cape of San Antonio (Alicante, Spain)	Blanca Feliu Tena
HI-12	Research trends and knowledge gaps in the impact of vessels on cetacean species: a Systematic Map	Valeria Ferrari
HI-13	A study focused on the effectiveness of the acoustic deterrent DiD-01 in trammel nets in Salina Island (Aeolian archipelago, Italy)	Vittoria Fiandino
HI-14	Energetic Cost of Behavioural Responses to Human-Induced Disturbance in Wild Dolphins, A Non-Invasive Approach	Lorenzo Fiori
HI-15	Multipurpose strategies to mitigate interaction between dolphins and small-scale fisheries in eastern Sicily	Stefano Floridia
HI-16	Anthropogenic impacts on cetacean populations in the Strait of Sicily	Carla Tumino
HI-17	Preliminary study on common bottlenose dolphin's (*Tursiops truncatus*) interactions with fisheries in the Western Ligurian Sea	Elena Fontanesi
HI-18	Bottlenose dolphins (*Tursiops truncatus*) and trawler interactions in the Central Adriatic Sea	Maša Frleta-Valić
HI-19	Increase of cetacean exposure to whale-watching activities in Madeira	Pauline Gauffier
HI-20	Key points to reduce the impact of interactions between killer whales (*Orcinus orca*) and sailing vessels in the Strait of Gibraltar	Ángela María González
HI-21	Threats to cetaceans from vessel traffic and litter in Calabrian Ionian Sea	Maria Grandinetti
HI-22	ATLANTIC WHALE DEAL Project: mitigating ship strikes and enhancing carbon sequestration in the Atlantic	Eliette Hamard
HI-23	Relationship between bycatch and biological traits of small cetaceans in Galicia (NW Spain, 2021-2023)	Alberto Hernandez-Gonzalez
HI-24	Co-occurrence of bottlenose dolphin and fisheries activities within the Marine Protected Area of Camargue	Céline Tardy
HI-25	Assessing the effectiveness of acoustic deterrent devices to reduce common bottlenose dolphin depredation on small-scale fishery in Sardinia	Gabriella La Manna
HI-26	Common dolphin (*Delphinus delphis*) breathing interval and dive responses to swim-with-dolphin tourism activities in São Miguel, Azores	Bianca Vaz
HI-27	Anthropic pressure on cetaceans stranded along the Ligurian coast within the Pelagos Sanctuary	Virginia Mattioda
HI-28	Combining visual and acoustic approaches to determine seasonal and amongst-day variation in site use by marine mammals and their prey at a tidal stream energy demonstration zone.	Eleanor Falch
HI-29	DELFISHPAM project: passive acoustics to assess dolphins' interaction with fishing and aquaculture activities in the Maltese Islands	Patrizia Patti
HI-30	Cause of death and evidence of human interaction in cetaceans stranded along the Italian coastline between 2015 – 2020	Guido Pietroluongo
HI-31	Cetacean presence off the east coast of Tenerife on the context of the development of offshore wind energy in the Canary Islands	Alicia Rodríguez-Juncá
HI-32	Stranded perchance: how well do ocean currents explain cetacean mortality patterns in the actively fished waters of Goa, India?	Imran Samad
HI-33	Distribution and responses of cetaceans to anthropogenic pressure	Giulia Oliva

HI-34	Evaluating and comparing whale-watching activities in the Strait of Gibraltar and the Salish Sea to inform future management measures	Alessia Scuderi
HI-35	Towards safer waters: a multidisciplinary approach for minimizing orca-vessel interactions in the Strait of Gibraltar	David Silgado
HI-36	First UK HRA compensation measures for marine mammal species: vessel collision risk for a declining harbour seal population in The Wash, England	Gemma Starmore
HI-38	Bottlenose dolphins and small-scale fisheries in the Pelagos Sanctuary: searching new mitigation strategies to the conflict – TursioNet Project	Camilla Testori
HI-39	Skin marks analysis to assess bottlenose dolphin anthropogenic threats in the Roman seas (central Mediterranean)	Alice Turchi
HI-40	Socio-economic impact of whale-watching in Madeira	Philippe Verborgh
HI-41	Increasing observations of fatal fluke entanglements of Indo-Pacific bottlenose dolphins with discarded fishing gear in the Northern Red Sea, Egypt	Angela Ziltener
HI-42	Numerical simulations of long-distance propagation of the signal of seismic surveys in the Ionian Sea. Implications for the impact on marine mammals	Alice Affatati
HI-43	Underwater sound modelling of floating offshore wind farms in the Strait of Sicily	Marzia Baldachini
HI-44	A review of Noise Abatement Systems and their applicability to English and Welsh waters	Rachael Barber
HI-45	Preliminary study of the noise generated by salmon aquaculture operations in Chilean Patagonia	Davide Bittelli
HI-46	Evaluating the efficacy of the DiD-01 acoustic deterrent in reducing human-dolphin interactions in artisanal fisheries around Filicudi, Aeolian Islands (Sicily, Italy)	Danielle Desrochers
HI-47	Static and dynamic acoustic monitoring of cetaceans at a future off-shore wind farm site in the central Mediterranean Sea	Sara Ferri
HI-48	Underwater detonations: Mitigation measures to prevent injury of harbor porpoise (*Phocoena phocoena*)	Karoline Hots
HI-49	Effect of anthropogenic noise sources on beaked whales' fine-scale diving biomechanics and its energetic implications	Lucía Martina Martín López
HI-50	Bottom trawling: characterization of acoustic noise and interaction with cetaceans in the central Mediterranean Sea	Gerardo Sorrentino
HI-51	Cetaceans in Galicia (Spain): bycatch trends and an unusual stranding "Outbreak" in 2023	Raquel Puig – Lozano
HI-52	How significantly do human interactions impact cetacean strandings? A comprehensive analysis over the years of data collection in the Italian National Stranding Data Bank.	Ilaria Ceciarini
HI-53	Does exceeding the legally permissible number of vessels impact feeding and socializing in bottlenose and common dolphins off southern Portugal?	Alicia Quirin
HI- 54	Interaction between Mediterranean monk seals *Monachus monachus* and marine fish farms in Greek waters	Joan Gonzalvo

KEYNOTE SPEAKERS

Frances Gulland currently serves as Chair of the US Marine Mammal Commission, having been appointed to that position by President Biden on May 4th 2022. In 2000, she joined the Commission's Committee of Scientific Advisors, and in 2011, was appointed to serve as one of three Commissioners and confirmed by the Senate. Dr. Gulland is a veterinarian specializing in marine mammal medicine. She is a Research Associate at the University of California, Davis, and worked for 25 years at The Marine Mammal Center in Sausalito, California, where her focus was treatment of stranded marine mammals and research into the causes of disease in these animals. She received a veterinary degree from the University of Cambridge, United Kingdom, in 1984, and a Ph.D. in zoology in 1991. Dr. Gulland has served on a number of federal and state advisory panels, including the Working Group on Marine Mammal Unusual Mortality Events, the Hawaiian Monk Seal Recovery Team, and California's Ocean Protection Council and Oiled Wildlife Care Network.

How to reach sustainable development of coastal areas: A Comparison of Three Cases: The Vaquita, Mekong River Dolphin and North Atlantic Right Whale

In this talk she compare the cases of three critically endangered species, the vaquita, the Mekong River dolphin, and the North Atlantic right whale, to illustrate how human activities and economic development affect cetacean conservation. The population status, threats and challenges to their conservation will be reviewed and contrasted, illustrating the need for managing human activities to protect coastal cetacean populations.

Bruno Cozzi was born in Milan on June 30, 1956. He obtained his degree in Veterinary Medicine (with honors) in 1980 at the University of Milan, and his PhD in Health Sciences [Neurobiology] in 1993, at the Institute of Medical Anatomy, Department B, University of Copenhagen. His scientific production is focused on comparative neuroanatomy of large domestic herbivores, marine mammals, and man. He published several scientific papers, > 100 of which are currently listed in PubMed, Scopus, and other databases. He wrote textbooks of veterinary anatomy, human neuroanatomy, and dolphin and whale anatomy in Italian, English, German, and Japanese. He was part of the Italian Scientific Delegation to the International Whaling Commission (2004-2005; 2007-2011). During his career at the Universities of Milan and Padova, he taught Veterinary Anatomy and Neuroanatomy. A former full professor, after retiring in October 2023 he is currently a senior scientist of the University of Padova.

Open unsolved questions in dolphin and whale anatomy

Marine mammal sciences have progressed tremendously in the last fifty years, thanks to the combined efforts of scientists belonging to different disciplines. New technologies have brought results. However, there are still quite a number of unsolved questions concerning the anatomy and physiology of cetaceans. The neuroanatomical and neurophysiological basis of the diving capabilities of beaked and sperm whales remain largely unexplored. The cortical organization and relative connections that enable dolphins and whales to navigate in the liquid environment are still poorly understood. On the whole, much remain to investigate on the sensory structures of these species.

Philip Hammond is research professor at the University of St Andrews in Scotland. His primary interest is in population dynamics and ecology, in particular the applied aspects of how seals and cetaceans interact with human activities. Research foci include investigating the habitat use, foraging ecology and diet of marine mammals; estimating abundance, survival and reproductive rates; and modelling marine mammal populations. He co-founded the Scottish east coast bottlenose dolphin project which continues to study the dynamics of a small coastal population in a changing environment. He helped initiate the series of SCANS cetacean surveys to estimate abundance and model distribution of cetaceans in European Atlantic waters, coordinating the first three surveys in 1994, 2005 and 2016. He has supervised >40 PhD students working throughout the world and published >150 research papers. He has contributed to the IWC Scientific Committee, the ICES WG on Marine Mammal Ecology and the IUCN Cetacean Specialist Group, and is an associate editor of Marine Mammal Science and a member of the SMM Conservation Committee.

Long-term studies of cetacean populations to improve ecological understanding and inform conservation

In the last few decades, long-term studies of cetacean populations have gone from being a rarity to almost commonplace. Focusing on two case studies with similar motivation but otherwise with widely different characteristics (SCANS surveys in the European Atlantic and Scottish east coast bottlenose dolphins using photo-id), this presentation aims to highlight the value of such long-term studies whilst also recognising the challenges and limitations.

ABSTRACTS - ORAL PRESENTATIONS

CONSERVATION

Our coastal future: from prey to anthropogenic stressors, predicting marine mammal habitat in the Anthropocene ocean

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Marine mammals are important top predators in the North and Baltic Sea. All species have a high conservation status in Europe and are sensitive to disturbances in their environment, therefore considered indicators of marine ecosystem health. However, to carry out assessments and design effective management measures, both the demands on their habitat and the influences of anthropogenic stressors must be parameterized. Here, we integrate mammals into a novel cross-scale end-to-end model system (E2E) developed in an interdisciplinary manner to assess the full range of impacts from physical to higher trophic levels in a consistent framework. We parametrized responses of marine mammals to stressors and integrate those in species distribution models. The coupling is tested via aggregate biomass production of fish, as the main prey compartment for marine mammals, that is already included in the coastal model system. This virtual environment enables us to study the impacts of climate change and increasing anthropogenic activities on key species and evaluate conservation measures. A suite of modelling techniques will be coupled, ranging from predictive modelling of harbour porpoise habitat, based on an extensive 20-year data series from visual national monitoring survey and large-scale SCANS surveys (Small Cetaceans in European Atlantic waters and the North Sea), to movement models of harbour seals. This will allow conclusions on the effects of behavioural responses as caused e.g. by offshore wind energy development and noise emissions. The simulation of the impacts of future accelerated growth of energy production on marine mammals at a local and regional scale is carried out using the process-oriented parameterization and the E2E ecosystem model. This generates urgently needed knowledge for action to implement political and societal targets, as outlined in the EU Marine Strategy Framework Directive, and enables the evaluation of efficacy of management strategies for marine mammals under future climate conditions.

Climate change impacts on the West Indian manatee and their seagrass resources

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How climate change alters persistence and distribution of endangered species is an urgent question in current ecological research. However, many species distribution models do not consider consumers in the context of their resources. The distribution and survival of the West Indian manatee (Trichechus manatus), listed as a Vulnerable species on the IUCN Red List, critically depend on seagrass resources and freshwater sources for drinking. We parameterized Maxent models with Bio-ORACLE environmental layers, freshwater proximity data, and modelled seagrass distance layers, to determine manatee and seagrass distributions under future climate change scenarios. We used two plausible IPCC Representative Concentration Pathways (RCP45 and RCP26, respectively) for the year 2050. The model fits had high accuracies and predicted a marked decline in seagrass coverage (RCP26: -1.9%, RCP45: -6%), coinciding with declines in manatee ranges (RCP26: -9%, RCP45: -11.8%). We also found that over 94% of the projected manatee distribution for all scenarios fell within the seagrass distribution. The analysis showed a decline in seagrass coverage to significantly impact manatee distributions, since the distance to seagrass ecological layer contributed significantly to manatee distributions, along with distance to freshwater sources. Our findings suggest that manatees will lose substantial range due to future climate change, but the extent and direction of this change will be mediated by the degree of warming and its impact on the resources manatees depend on.

Holistic welfare monitoring of Indo-Pacific humpback dolphins: a novel conservation approach

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Welfare assessment has been suggested to be useful in addition to traditional methods for the conservation of free-ranging animals. Even though several initiatives have been recently made to develop welfare assessment frameworks for some cetacean species and/or some specific scenarios (e.g., strandings), no detailed, transparent, and standardized welfare assessment tool that can be used for systematic monitoring of threatened cetaceans has been created until now. For species like Indo-Pacific humpback dolphins (Sousa chinensis) who form small populations in coastal regions often subject to intense human activities, a holistic standardized welfare assessment tool could be useful for conservation purposes. Such a tool could be used by biologists to monitor dolphins for better understanding their living conditions and potential causes of demographic variations, to better inform conservation measures, and ensure their effectiveness. The development of a welfare assessment tool for free-ranging Indo-Pacific dolphins will be introduced. Specifically, describing how parameters were chosen for inclusion, the satellite studies necessary to better understand and evaluate measurement methods for these parameters, the development of a scoring framework, and the challenges encountered.

The growing network of Important Marine Mammal Areas (IMMAs): a 2023 update on the global programme to assist conservation of marine mammals

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Since 2016, the IUCN Marine Mammal Protected Areas Task Force (MMPATF) has been working to identify a global network of Important Marine Mammal Areas (IMMAs). IMMAs are defined as discrete portions of habitat, important to marine mammal species, that have the potential to be delineated and managed for conservation. IMMAs are identified to help ensure the favourable conservation status of marine mammals by attracting the attention of policy- and decision-makers to the opportunity or need to implement management measures. To date, 75% of the global ocean waters have been examined by the IMMA programme during ten regional workshops, engaging over 300 experts. In total, the IMMA work has resulted in the identification of 280 IMMAs and 185 Areas of Interest, the latter not yet supported by sufficient robust scientific information to meet the IMMA criteria, but which highlight areas for future research and monitoring. Identified IMMAs provide important habitat for 91 of the 134 recognised marine mammal species. 66 % of IMMAs were identified based on important habitat for a threatened marine mammal species. 58% of IMMA surface areas occur within Exclusive Economic Zone waters, while 42% fall within Areas Beyond National Jurisdiction (ABNJ). IMMAs identified to date occupied 7% of the ABNJ surface providing scientific knowledge to contribute to the current goal of protecting 30% of the ocean by 2030. By the end of 2023, 640 downloads of the IMMA spatial layers have been accessed by users from over 80 different countries and used in impact assessments or to support conservation initiatives such as marine spatial planning, maritime traffic routing, designation of Particularly Sensitive Sea Areas or marine protected areas. Conservation and management actions within IMMAs are now being implemented while the MMPATF works to complete the global assessment and promote marine mammal conservation on a global scale.

Testing a vulnerability index to compare ten important areas for cetacean conservation in the Mediterranean Sea

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The identification and designation of critical cetacean conservation areas, as required by legislations and international initiatives such as the EU-Habitats Directive, Barcelona Convention SPA/BD, and IUCN-IMMA, encounters complexities due to the necessity of integrating diverse priorities for different species. In 2017, a study in the Western Mediterranean utilized an index combining species diversity (Shannon_H, dominance), abundance (SPUE, group size), rare species, and juveniles to pinpoint priority areas and seasons. Here, the index was used to compare 10 important areas for Mediterranean cetaceans (Alboran-Gibraltar/AG; Eastern-Spanish-slope-area/ESSA; Spanish-Cetacean-Migration-Corridor/SCMC; NW-Mediterranean/NWMed; Pelagos; Tyrrhenian Sea/Tyr; Sardinia-Sicily channels/SSCC; Western-Ionian-Sicilian coast/WIon; Eastern-Ionian-North-Hellenic-Trench/EIon; Adriatic) using the consistent datasets from the FLTMedNet 2008-2021, harmonized

within the Life CONCEPTU MARIS project. Pelagos and AG emerged as priority areas, followed by NWMed, Tyr, SCMC, SSCC, and WIon. The Western Mediterranean displayed relatively higher diversity, but only four areas (Pelagos, SCMC, NWMed, SSCC) hosted all eight common species. Most areas showed a high dominance of a few species (Dominance-index > mean values): *S. coeruleoalba* dominated in almost all areas, with similar abundance to B. physalus in NWMed and *T. truncatus* in EIon. AG stood out with statistically different diversity, being also the only area featuring *D. delphis* as the predominant species. Juveniles were widespread, particularly in AG (26% of sightings), SCMC, and EIon. Areas demonstrated variable importance for less common species, with AG and Tyr crucial for *D. delphis*, AG, NWMed, SCMC, and Pelagos for G.melas, Pelagos and NWMed for *P. macrocephalus*, WIon for *G. griseus*, and EIon for *Z. cavirostris*. The index facilitated direct comparisons among diverse areas. Future efforts should incorporate seasonality and area-specific actions to support the transition from static to dynamic conservation strategies.

Governing marine protected areas for harbour porpoise conservation: The case of the Sylt Outer Reef and the Whale Sanctuary in the German North Sea

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Marine ecosystems and biodiversity are embedded in complex socio-ecological systems and in the North Sea, they are under extreme anthropogenic pressure from cumulative uses such as fishing, maritime transport, the construction of offshore windfarms, pollution and resource extraction leading to habitat destruction. The increasing industrialization of the North Sea profoundly changes environmental conditions and challenges current processes of marine spatial planning. This results in trade-offs between conservation and use, and particularly impacts marine predators with migratory routes. Although special protection in the form of protected areas is in place for the only endemic whale species in the North Sea, the harbour porpoise (*Phocoena Phocoena*), its abundance is declining and their distribution shifting, which necessitates the urgent need for a transformative shift towards more effective conservation governance arrangements. This study therefore assesses current governance structures in the marine protected areas (MPAs) Sylt Outer Reef (SOR) and the Whale Sanctuary (WS) in the German North Sea using the MPA Governance framework by Jones. The 20 semi-structured interviews that were conducted between October 2023 and December 2024 investigated the mechanisms of a diverse range of economic, legal, communication, knowledge and participation incentives. It was found that both MPAs fail to effectively protect harbour porpoises, despite having in place different institutional structures and processes. While all communication incentives are well represented in both MPAs, there is a strong need to strengthen economic and legal incentives, such as increasing the capacity for enforcement (SOR) and implementing protection from incoming users (WS). To further improve governance effectiveness, other incentives that combine top-down, bottom-up and market approaches are being recommended. This study contributes to the wider academic debate on how to best shape marine predator conservation for an adaptive ecosystem-based management.

HUMAN INTERACTIONS

Comparison of population models to better understand anthropogenic impacts on marine mammals

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Several population models have been developed to track the potential impacts of human activities upon wildlife including marine mammals. Here, we compare three modelling approaches: Potential Biological Removals (PBR), Population Viability Analysis (PVA), and Population Consequences of Disturbance (iPCoD) on the populations of six marine mammal species (grey seal, harbour porpoise, bottlenose dolphin, Risso's dolphin and minke whale). These species vary in the extent of our knowledge, their life history parameters and demographic status, and therefore provided a useful assessment of the strengths and limitations of each approach, and the suitability of particular models for data-deficient species as well as better-known species. Anthropogenic pressures used in the models included annual estimates of direct mortality from fisheries bycatch and from ship strikes, as well as indirect (sub-lethal) impacts through effects upon reproduction from contaminants. Sensitivity analysis was performed to determine the effects of uncertainty around particular parameters. The importance of defining population structure at the outset was demonstrated whilst in some cases, using more than one model provided greater insight into potential effects of a particular anthropogenic pressure on the population demography of a species. The findings should be useful in decision making on which modelling approaches to use for particular species and groups of species, and for setting thresholds to avoid unsustainable population impacts.

Cetacean stranding research reveals impacts of human activities

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Stranded cetaceans have been reported on Dutch shorelines for decades. To determine the impact of human activities in causing these events, a post-mortem surveillance program was established at the Faculty of Veterinary Medicine in 2008. From 2008-2023, 9082 cetaceans were recorded, representing 14 species (11 odontocetes, 3 mysticetes); of which 22% were investigated post-mortem. The harbour porpoise is by far the most abundant (8970 strandings, 21% necropsied). Incidental bycatch is the largest anthropogenic cause-of-death-category (CoD, 17%), while other types of trauma are less frequently diagnosed (ship strike 4%, debris ingestion/entanglement <1%). Infectious disease is the largest CoD-category (32%), followed by grey seal attacks (24%). There were two notable mass stranding events involving hundreds of dead porpoises. The first took place in summer 2011 and affected mostly juveniles, with emaciation as most likely mortality cause. The second was in August 2021 and affected mainly adult females, most likely following Erysipelothrix rushiopathiae infection. The most common stranded odontocetes after porpoises are common dolphins (n=16), white-beaked dolphins (n=15), sperm whales (n=13) and Sowerby's beaked whales (n=12). Rarest species found stranded are bottlenose dolphins (n=3), bottlenose whales (n=2) and killer whales (n=2). The most common baleen whale is the Minke whale (n=18), although mostly stranded in advanced decomposition, followed by fin whales (n=14), which entered our country mainly bow-caught on container vessels. Many of the delphinids live-stranded and presented infectious diseases and signs of starvation. For the deep-diving (out-of-habitat) species, the most common CoD were related to live stranding, followed by ship strikes. There seems to be an increase in beaked whales and common dolphins since the program started, while Lagenorhyncus-numbers decrease, which is probably related to climate change. Continued monitoring of species composition of stranded cetaceans and their causes of death can provide an early warning for ecosystem change related to anthropogenic activities.

Relationship between fishing strategies and by-catch: A case study on common dolphins (*Delphinus delphis*) in the Bay of Biscay

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By-catch is a major cause of the decline of marine megafauna worldwide. However, obtaining accurate estimates of the risk of by-catch can be challenging due to limited and non-representative samples and inadequate knowledge of the by-catch context. We aim to address this issue by building a comprehensive framework that, based on standardized data on fishing vessel activity and by-catch of a given species, classifies vessels into strategic groups (according to their fishing behavior) and examines their degree of association with by-catch. The method was applied to French fishing vessels operating in the Bay of Biscay to determine the variation in existing fishing strategies' frequency of common dolphin (*Delphinus delphis*) by-catch over the last two decades, and to identify the fishing behaviors most associated with by-catch risk. The study used multiple data sources, including a declarative approach from fishermen and an approach based on onboard observers. Our findings consistently showed that both the trammel net fishery targeting sole and the gillnet fishery targeting hake and gadid were associated with particularly high levels of by-catch. Similarly, pelagic trawling targeting sardines or tuna were also associated with high levels of by-catch. In addition to studying the technical profile of by-catch risk, we also considered the phenotypic sensitivity profiles of individuals to by-catch risk and how these might vary by fishing method. The study revealed that smaller body-sized common dolphins were more sensitive to by-catch, and that larger dolphins were more likely to be caught when using trawl gear and when fishing for sole or hake compared to coastal fish species. These findings suggest that dolphins may have varying sensitivities to different fishing methods, which could be influenced by their age and body condition.

A mitigation measure against dolphin depredation: the Acoustic Alert System

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Some dolphin species exhibit opportunistic behaviour when they interfere with fishing gear for feeding purposes, an action known as depredation. This behaviour involves partially or entirely removing catches from nets and lines, causing damage to the gear and loss of the catch which determines serious socioeconomic issues for fishers. Dolphins employ this behaviour aiming to conserve energy while maximizing gains, especially in overexploited marine regions. This type of interaction between coastal cetacean species and small-scale fisheries has been reported in fishing fleets around the world and, despite the attempts, a unique effective mitigation solution has not been found. Consequently, cetacean conservation and the sustainability of small-scale fisheries are at risk and necessitate urgent local and national management plans to be addressed. Efforts to solve these conflicts have been focused on strategies involving acoustic deterrents. However, most of the tests carried out in the Mediterranean have not provided positive results. A study to develop an Acoustic Alert System (AAS) was initiated by the Marecamp Association in the Gulf of Catania (Ionian Sea) to counteract the "feeding in net" behaviour displayed by common bottlenose dolphins on artisanal gillnets and trammel nets. This innovative system, a pioneering initiative on a global level, detects feeding vocalizations emitted by dolphins nearby the nets, assisted by operators onboard a sentry boat using hydrophones to be able to send an alarm warning to fishers to pull up the net in the presence of dolphins. Results indicate a reduction in the gear damages during depredation events, increased catches, and reduced risk of by-catch when the AAS is activated. This experimentation was included in the “Mitigating dolphin depredation in Mediterranean fisheries – Joining efforts for strengthening cetacean conservation and sustainable fisheries” project (Depredation-2) supported by the Mava Foundation. Next steps of the research foresee to make the AAS automatic.

Pearls are not just for girls - Application of acoustic reflectors in set nets to reduce bycatch of harbour porpoises and other odontocetes while keeping fish catches high

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Incidental catch in set nets poses a significant global threat to marine mammals like the harbour porpoises (*Phocoena phocoena*). Addressing this challenge is crucial for the conservation of these species and the sustainability of fisheries. This study aims to mitigate bycatch of porpoises and other odontocetes in gillnets while ensuring the profitability of targeted fish species catches. Leveraging the echolocation abilities of odontocetes, our approach involves enhancing the gillnets' acoustic detectability by attaching small acrylic glass spheres. These spheres are designed to produce a strong echo, making the “PearlNet” acoustically “more visible” to odontocetes, thereby helping them recognize these nets as impenetrable barriers. The presentation will provide an overview of the PearlNet's current development and assessment status. Key topics include behavioural responses of harbour porpoises to the modified nets, efficiency of catch for targeted fish species, and considerations regarding material sustainability and recycling. Although a large-scale bycatch trial is slated for later this year, preliminary findings already indicate that the PearlNet could be a promising solution for reducing the bycatch of harbour porpoises and other odontocetes, without compromising the catch rates of targeted fish species.

Bottlenose dolphins adjust their signature whistles during fishery interactions: the influence of human activities on individual recognition and cooperation

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Signature whistles (SWs), i.e., tonal sounds characterised by a distinctive and stable stereotyped frequency modulation pattern (or contour), play an essential role in the acoustic communication and ecology of bottlenose dolphins (*Tursiops truncatus*, BD), allowing for individual recognition between conspecifics in different behavioural contexts. SWs may exhibit a high degree of plasticity in response to specific activities or conditions. However, the influence of different contexts is still poorly understood. Here the context-specific variability of SWs is investigated within the BD population inhabiting the Tiber River estuary area (Central Mediterranean Sea, Italy), with a particular focus on the interaction with different fishery running in the study area, i.e., trawling and small-scale gears. Acoustic data collected between 2019 and 2023 were modelled through an innovative Functional Data Analysis approach (FDA), with the aim of capturing SWs' dynamics in their entirety. Using FDA, the information of a SW (i.e., a vector of discrete observations of their frequency recorded at regular time intervals) is transformed into a continuous function, reproducing faithfully the SW frequency modulation and contour. A functional regression model with SWs' acoustic structure as the functional response was built using context-related factors as covariates. Estimated functional coefficients show that, among all, interaction with gillnets/pots seems to have the greatest influence, determining a clear increase in SWs frequency, while interaction with trawl nets appears to be non-significant. The different degrees of cooperation adopted by BDs in the two settings may explain such a finding, with artisanal fishery interactions requiring fine-scale organization and individual recognition between group members than trawling (BDs in the study area display a stereotyped and individual behaviour when interacting with trawlers). Our results show that SWs are effective communication tools through which feeding behaviour may be coordinated and controlled, and information may be distributed and acquired.

Shipping noise induces changes in fin whale songs

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Criterion 11.2 of the Marine Strategy Framework Directive addresses continuous noise, including shipping. Its implementation requires setting thresholds to describe favorable conditions of habitats. Hence, the level of onset of behavioral effects on indicator species must be determined. Fin whales are such candidates for thresholds on continuous noise. We analyzed 645 days of recordings (1999-2002) from the Ligurian Sea. The whole dataset was used to assess presence/absence of fin whale songs, while a subset was used for song analysis, selecting only files with high signal-to-noise ratio. One-hour recordings for each day were randomly selected, obtaining a final subset consisting of 134.5 hours. Our fin whale songs lasted 6 minutes on average (SD=246.83 s) and were separated from each other by rest periods (max duration= 948.80 s, mean=156.82 s, SD=125.98 s). Two types of pulses prevailed, respectively “classic” and “backbeat”. These were separated by stereotyped inter-pulse intervals (IPI, mean=16.33 s, SD=4.08 s). Novel findings included: a) the year-round presence of fin whales in the Ligurian Sea; b) acoustic presence is highest during autumn, when births of fin whale calves in the Mediterranean Sea peak, confirming the hypothesis that songs may have a role in reproduction; c) acoustic presence is lowest during summer coinciding with males spending most of their time feeding, in view of the reproductive season; d) shipping noise significantly affects songs with respect to the following parameters: IPI, rest, maximum- and minimum frequency, peak- and center frequency of the notes; e) Markov-chains and sequence analysis show that shipping noise affects the probability of transitioning from one type of note to another. Our findings are crucial to understand how fin whale songs may have changed over the years in response to increasing shipping noise. Changes usually come at higher energetic cost, likely reducing fitness.

Vocal compensation to anthropogenic noise in long-finned pilot whales

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Anthropogenic noise is considered a marine pollutant in the EU and can impact marine animals in a variety of ways. Prolonged noise that overlaps in time and frequency with animal communication signals can interfere with communication unless animals are able to compensate for increasing noise levels. Our study investigated Lombard response in long-finned pilot whales using high-resolution acoustic DTAGs in an area with high anthropogenic pressure, the Strait of Gibraltar. We tested if pilot whales increase their vocal amplitude in response to noise, and whether vocal compensation is signal- or context-specific. We analyzed 1416 calls from 18 individuals in small social groups of simultaneously tagged animals, allowing us to parse out which individual emitted which call and how the output level of that call depended on masking noise level. We found that noise level significantly influenced the apparent output level of calls, with an increase in noise correlating with a partial increase in call output level. Moreover, call type had a significant effect on call output level and on the degree of Lombard response: Low-frequency burst pulse calls exhibited a partial Lombard response magnitude of 0.29±0.06 dB increase in output level per 1 dB increase in noise level, short calls exhibited an amplitude increase of 0.33±0.08 dB per 1 dB increase in noise level, and high frequency calls did not show a significant Lombard response. Neither depth nor dive context influenced Lombard response magnitude. On top of the main intense continuous maritime traffic overlapping their distribution range, pilot whales are frequently targeted by whale watching industries and this can increase noise levels for prolonged periods of time. Our results indicate that pilot whales only compensate partially in response to increased noise levels and emphasize the need for understanding ecological consequences of communication disruptions to ensure sustainable management of these activities.

Underwater noise monitoring in Italian waters, a wide area dataset

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With the inclusion of underwater noise as a designated source of pollution under descriptor 11 in the Marine Strategy Framework Directive (MSFD), there has been a notable shift in governmental and regulatory focus. Guidelines and rules have been issued to adhere to the MSFD indications, particularly emphasizing the need for careful measurement and management of underwater noise, especially concerning marine mammals. This development has sparked a renewed institutional interest in the field of underwater acoustics. Governments are now requiring noise level assessments in the waters of each EU member state and incorporating these considerations into the permitting process for new industrial activities at sea. Over the past few years, our group has carried out many measurements in various commercial projects in the italian waters. This work presents several underwater noise baselines, accompanied by a detailed discussion of results, methodology, and challenges associated with the collection, analysis and measurement of actual calibrated noise levels together with their potential significance. The data we present is sourced, around the year, from sites in the Northern Adriatic Sea, Southern Adriatic Sea (both shallow and deep waters), the Tuscany Archipelago and the Ligurian Sea, showcasing the acoustic landscapes and their primary features through meticulously calibrated recordings over repeated observation periods.

We are presenting information on background noise levels (SPL, RMS re 1 μPa) and sound exposure levels (SEL re 1μPa2s), adhering to the main guidelines, with specific attention to anthropic sources that, while not yet regulated, are significantly present. In conclusion, we emphasize the importance of reporting and sharing knowledge derived from characterizing the soundscape of different locations and in different propagation conditions. The monitoring and mitigation actions related to commercial and industrial activities serve as valuable cues, aiding in a better understanding of the actual acoustic environment where underwater noise reduction is strongly needed. This facilitates more efficient planning of habitat protection.

ANATOMY & PHYSIOLOGY

Assessing biomarkers in common dolphin: Insights from blubber cortisol analysis

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Monitoring the health status of protected marine mammal species has become a focus in conservation research. Cortisol, a glucocorticoid hormone, plays a crucial role in the mammalian stress response, fat metabolism, and energy regulation. Its potential as a biomarker for physiological states has been widely recognized across species. Based on morphometric analysis, a decline in the nutritional health of common dolphins in the Celtic Seas ecoregion was reported. Detection however, using metabolic markers has not been undertaken to date. Here, we applied blubber cortisol analysis to further disentangle the multitude of stress factors affecting the species, using blubber samples. The samples originated from individuals stranded along the Irish coastline (2017-2019, n=84) with available necropsy data. Previous studies assessing blubber cortisol in marine mammals predominantly relied on a specific extraction methodology. In this study, we applied a simplified extraction method from blubber tissue, followed by a commercial enzyme-linked immunosorbent assay to quantify cortisol. Assay validations included intra and interspecific coefficients of variation, as well as tests for parallelism and accuracy. Using generalised linear models with the covariates cause of death, sex, sexual maturity status, total body length, nutritional status, season, ventral blubber thickness, and quartile of the year, cortisol concentrations were found to be negatively correlated with body length, and significantly higher in sexually immature individuals, suggesting physiological stress in younger animals during the current decline in nutritional health. The potential use of cortisol as a biomarker for nutritional health of the common dolphin was discussed. Although not fully refined, our results suggested avenues for improvement in blubber cortisol studies, allowing for optimization towards a faster and cheaper protocol. The cost-time-effectiveness of this novel extraction method was presented. In addition, further improvements of this method were proposed and caveats and feasibility of all methods were discussed.

The circulating milieu of bottlenose dolphins (*Tursiops truncatus*) may hold the key to preventing arterial aging

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Enhanced arterial function (high endothelial function and low aortic stiffness) is essential for the dive response and survival of cetaceans, given the demand to dive for feeding throughout their long lifespan. In humans, endothelial function is reduced with diving and aging, and large arteries stiffen with advanced age. Since reduced arterial health can limit health lifespan and cetaceans are long-lived, cetaceans may have preserved arterial health with advancing age. We tested if the circulating milieu (bioactive molecules in the serum) of young (n=16) and mid-life/older (ML/O; n=4) adult bottlenose dolphins would transfer the same arterial aging phenotypes as the serum of age-equivalent humans using an innovative technique. Excised arteries from young (5 mo) and old (25 mo) wildtype C57BL/6N mice were incubated ex vivo with 5% sex-matched adult human or bottlenose dolphin serum. Endothelial function was assessed as carotid artery endothelium-dependent dilation (EDD) to increasing doses of acetylcholine, and aortic stiffness as elastic modulus, a measure of intrinsic mechanical wall stiffness. Differences were assessed via 2-way ANOVAs; post hoc analyses were conducted between age groups within species. Peak EDD and aortic stiffness worsened in young mouse arteries following exposure to ML/O adult human serum ($P<0.001$ and $P=0.001$). These measures improved in old mouse arteries after exposure to young adult serum ($P=0.001$ and $P=0.044$). In contrast, old mouse arteries with old dolphin serum behaved like young mouse arteries with young dolphin serum for both, peak EDD (young v. ML/O serum donor in young arteries, $P=0.773$; in old mouse arteries, $P=0.942$) and aortic stiffness (young v. ML/O serum donor in young aortic rings, $P=0.974$; in old aortic rings $P=0.157$). These results suggest that the circulating milieu of bottlenose dolphins may be geroprotective. More research is needed to confirm these observations, elucidate the underlying mechanisms, and explore its potential applications for human medicine.

To click or to headbutt? Specific features of the melon in large bottlenose and Cuvier's beaked whales

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Anatomical investigations of large whale specimens have been limited compared to smaller delphinids, especially for offshore and deep diving species such as beaked whales. Here we report the findings of anatomical examinations of the heads of a male Northern bottlenose whale and a male Cuvier's beaked whale. Employing classic anatomical examination, and handheld 3D-scanning, we produced detailed 3D renditions of the heads to understand how male Northern bottlenose whales, with foreheads dominated by two large maxillary crests, produce echolocation sounds. In the bottlenose whale, the melon formed the ample bulbous forehead, and passed between the typically large maxillary crests. Caudally, the melon tapered nearly symmetrically between the maxillary crests in the center of the head into the large right phonic lip. This resembles an accentuation of the Cuvier's beaked whale rostrum, where the melon terminus clearly meanders to the right side. The asymmetry in cranial bones and soft structures of Hyperoodons suggests a potential link between increasing asymmetry and the alignment of the right phonic lip pair into a large melon for producing loud echolocation clicks. Behavioral data supports this, indicating that the right phonic lip pair produces clicks, while the left pair generates tonal whistles and burst pulse clicks in toothed whales. Regression analysis across various melon sizes suggests that larger melons are associated with higher source levels, but not in Hyperoodon, in which reported source levels are relatively low. Bulls likely use their bulbous head in headbutting behaviors, consistent with the size, structure, and position of the maxillary crest. Despite these cranial extremes and asymmetry, we find a symmetrical melon and hypertrophied right phonic lip pair. We conclude that the extreme anatomy of Hyperoodon heads is driven by functional duality of both headbutting for social interactions and sound production for echolocation.

Influenza A virus infection in grey and common seals in the UK

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Naturally occurring Influenza A virus (IAV) infection of both grey and harbour seals has occurred on the coasts of northern Europe during several outbreaks involving different strains of low pathogenicity avian influenza (LPAI) IAV, most recently H3N8 and H10N7, which are associated with respiratory tract infection, and sporadic increases in mortality. Since 2020, there have been reports of infection of harbour and common seals with HPAI H5Nx, which have been associated with lesions in the brain, both with and without visceral tissue involvement. This is a report of cases of naturally occurring infection with HPAI H5N1 influenza A virus, in both harbour (1) and grey (6) seals, from the UK coast (England and Scotland). Seals were either found dead or moribund and euthanased, or held within a treatment facility for a short period before death. Post mortem examination revealed IAV positive (RT-PCR) brain tissue in all seven animals and lung in one grey seal. Histological examination in all but one animal revealed variable patterns of meningitis and/or encephalitis, similar to previously reported cases of H5Nx infection in seals, namely lymphohistiocytic meningitis, perivascular cuffing, neuronal necrosis, gliosis of the cerebrum and/or cerebellum. One seal exhibited choroiditis and ventriculitis. Immunohistology for Influenza A virus revealed a variable pattern of viral antigen expression; in published reports of IAV antigen expression in the brain of H5Nx infected seals, viral antigen is restricted to neurons and glial cells. In the cases reported here, viral antigen was also detected in meninges, perivascular inflammatory cells, endothelial cells, choroid and ependyma cells. In addition, one harbour seal exhibited viral antigen in the lung and the adrenal gland, associated with lesions in these organs. This has both pathological and epidemiological implications for HPAIV detection and management in UK seal populations.

A new threat for the Med? Triazole-resistant *Aspergillus sydowii* in cetaceans from the Spanish Mediterranean

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Aspergillus sydowii has emerged as a critical marine pathogen causing widespread aspergillosis in tropical gorgonian coral communities. It has been associated to deep-seated infections especially in immunosuppressed humans and has only been reported once in the Mediterranean. This study aims to document the first isolation of azole-resistant A. sydowii in cetaceans from the Spanish Mediterranean Sea, exploring its ecological and public health implications.
Samples were collected from free-living and stranded small cetaceans along the Spanish Mediterranean coast. Respiratory secretions and other biological samples were obtained and cultured under various conditions to isolate A. sydowii. Identification was conducted through morphological assessment and MALDI-TOF. Temperature assays were performed to evaluate growth kinetics. Antifungal susceptibility was assessed using VIPcheckTM plates for triazole resistance.
Aspergillus sydowii was isolated from three healthy adult long-finned pilot whales (*Globicephala melas*) in a group of 8 individuals and one stranded striped dolphin (*Stenella coeruleoalba*) separated by 360 km. In one pilot whale, A. sydowii and Scopulariopsis brevicaulis were co-cultured, while in the other two pilot whales, A. sydowii demonstrated robust growth in isolation. Striped dolphin samples exhibited A. sydowii along with Exophiala spp. and S. brevicaulis. The isolates showed significant growth at 37°C but not at 40°C, with mean colony diameters greater at 24°C. All A. sydowii isolates were resistant to posaconazole concentrations of 0.5 mg/L.
Discussion:
The isolation of posaconazole-resistant A. sydowii from unrelated cetaceans, such as G. melas and *S. coeruleoalba*, underscores its potential as an active colonizer/pathogen in marine mammals. Its known role as a coral pathogen and its adaptability to warmer temperatures raises concerns about its broader ecological impact and potential contribution to the decline in marine biodiversity. The resistance to triazole and its ability to thrive in cetaceans suggest a possible increased threat to mediterranean marine ecosystems and both animal and human public health in the context of changing marine environments.

Pathological study of an open Patent Ductus Arteriosus (PDA) in a 20-year-old Killer Whale (*Orcinus orca*)

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The ductus arteriosus is an anatomical structure present in the fetal heart which closes during the first months of life, in the case of humans, to ensure the proper function of the cardiovascular system. In cetaceans, more specifically in bottlenose dolphins, this structure is open at time of birth, stays open for months in yearlings, and closes during the first years of life. Therefore, reported cases of a patent ductus arteriosus (PDA) in juveniles and/or adult cetaceans are extremely rare, either in wildlife or in captivity (under human care). Herewith we describe the diagnosis of a PDA in a 20-year-old female Killer Whale (*Orcinus orca*). A complete pathological study was carried out. Necropsy and histology showed that the animal suffered a cardiovascular anomaly from birth classified as congenital/development heart defect. She presented a large and open PDA associated with lesions consistent with severe chronic pulmonary hypertension connected with chronic heart lesions affecting systemically to other organs which ultimately led to heart failure and death. To our best knowledge, this is the first time where an open PDA and the associated chronic systemic pathology, in a 20-year-old Killer Whale (*Orcinus orca*) which was born in captivity, is reported.

Potential Acoustic and Environmental Predictors of Delphinid Mass Strandings

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Mitigation of cetacean mass stranding events (MSEs) is challenging as their causes remain poorly understood. Our aim is to carry out research to develop a MSE alert system that could aid responders and thereby reduce animal mortality. To this end, we are analysing data on MSEs of two delphinid species (common dolphins, *Delphinus delphis*, and Atlantic white-sided dolphins, Lagenorhynchus acutus) in Wellfleet Harbour, Massachusetts, USA, a global hotspot for MSEs. We are examining acoustic and temporal variables that might serve as predictors of these events. We recorded duty-cycled passive acoustic data in Wellfleet Harbour nearly continuously from 2014 to the present. Recordings from 34 days on which MSEs occurred (and 24 hours preceding each) were screened for whistles, as were recordings from 34 random non-stranding days from the same deployments (analysis is ongoing to increase our non-stranding acoustic sample). Whistle presence was both strongly associated with MSEs ($\chi 2(1, N = 68) = 11.4$, $p < 0.001$), and increased the odds of MSE presence by 8.4 times (95% CI: 2.6, 33.2, logistic regression, $N = 68$, $p < 0.001$). Across a larger dataset of 119 MSEs from 2000-2022, MSEs were most frequent in the spring (37.0%), and least frequent in the summer (11.7%). Thus, our results indicate that information on both whistle presence and seasonality could be used to predict MSEs. Research is ongoing to examine other variables such as water temperature, wind speed, and moon phase, to increase the predictive power of this model. The number of MSEs per year showed an increasing trend in Wellfleet from 2000-2022 (negative binomial GLM, $N = 23$, $p = 0.023$), demonstrating the need for predictive models that could assist in future responses to these events, which are a significant concern from an animal welfare perspective.

Acoustic Detection of Mediterranean Monk Seals (*Monachus monachus*) in the Inner Ionian Archipelago

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The Mediterranean monk seal (MMS; *Monachus monachus*) is one of the least populous marine mammal species in the world, with fewer than 800 individuals remaining. Having small population numbers distributed over a wide range in largely inaccessible habitat renders this species challenging to monitor. Population trends are primarily monitored via manual counts or autonomous cameras mounted within haul-out caves. Passive acoustic monitoring (PAM) has emerged as a promising complementary low-impact, resource-efficient method for tracking range-wide occupancy, population trends, and behavioural patterns. While there are relatively few studies of the vocal repertoire of the MMS, recordings of in-air vocalisations have been collected from a small number of animals, and recent analyses have begun to collect data on their underwater vocalisations. An understanding of the species' vocal behaviour is key to establishing the value of PAM for monitoring these animals, as well as quantifying the impacts of threats such as underwater noise and interactions with boat traffic. Reviewing large audio datasets to identify vocalisations can be incredibly time-consuming, hence automated detectors are increasingly being used to rapidly process large datasets. Here, we present a selection of calls recorded in monk seal habitat in the Inner Ionian Archipelago, and offer insights into the inception stages of development of an automated detector capable of identifying monk seal vocalisations in long-term underwater recordings. Out of ~3,500 potential MMS calls identified at a single site over the course of 16.5 days in 2021, ~1,370 high quality calls were analysed via principal components analysis, random forest classification, and density-based spatial clustering. Three call types were identified as ideal for targeting with a detector due to their distinct acoustic structures and high call rate. This research represents a promising step towards a long-term acoustic monitoring tool to safeguard the future of the Mediterranean monk seal.

Song notes and patterns of the Mediterranean fin whale in the Ionian Sea: towards effective monitoring for conservation

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The analysis of songs is recognized as a meaningful approach to investigate baleen whale populations' identities and to assess changes due to anthropogenic activities. Male fin whales (*Balenoptera physalus*) emit long and stereotyped 20-Hz songs for courtship purposes. Fin whales are also known to use irregular repetition calls at various frequencies to keep contact and convey information at distance. Still, our knowledge of the songs of the Mediterranean fin whale subpopulation is very limited. Here we present the first study of the songs recorded in the Ionian Sea. So far, songs were described in literature only in the Western Mediterranean Sea. Acoustic data were sampled continuously at 2 kHz by the cabled observatory NEMO-SN1 deployed at 2100 m depth, 25 km offshore Catania. The typical "classic" and "backbeat" fin whale 20-Hz calls were detected in 28 sequences spread over 7 of 10 months of recording. Noise levels were also measured and noise-induced changes in the modeled detection range were evaluated. The inter-note-intervals (INIs) and the alternation of note types were studied, and four main song patterns were identified. These patterns were found repeatedly over different months, showing a regular structure in detected songs. The INI-type distributions were consistent with those found in the Western Mediterranean Sea, revealing recurring features in the songs of this population. Significant differences were observed in the spectral characteristics of the classic notes between songs and irregular sequences. However, irregular sequences had significantly lower SNR. This could be due to the high levels of noise measured in the area from intense maritime traffic and airgun pulses. This work provides a reference to interpret Mediterranean fin whale songs. Also, it points out the potential interference of anthropogenic noise with song detection and study.

Shared non-signature whistles produced by bottlenose dolphins

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Individually distinctive signature whistles (SW) of bottlenose dolphins (*Tursiops truncatus*) have been well-described in the literature since the 1960s, and have been estimated to comprise approximately 50% of whistles produced by a resident community of approximately 160 free-ranging dolphins in waters near Sarasota Bay, Florida, USA. Surprisingly little is known about whistles other than signatures (non-signature whistles, NSW). By recording dolphins over several decades during brief catch-and-release health assessments (HAs) we have compiled a database of whistles, which includes SW of most members of the Sarasota community. Thus, we are in a unique position to study NSW, because we are able to differentiate between SW and NSW. In an analysis of whistles recorded both during HAs and on digital acoustic tags (DTAGs), we have found evidence of multiple stereotyped, shared NSW types. Preliminary analyses are focusing on two of the most distinctive and visually recognizable of these, called types A and B. NSWA consists of an unusual "up-down-up" sequence of short, steep whistle segments. NSWB consists of variable upsweep components followed by a distinctive flat portion. To date, we have found evidence for production of these whistle types by 23 and 34 different dolphins, respectively. Both whistle types are produced by males and females (NSWA: 55% F, 45%M; NSWB: 35% F, 65% M). Analysis of a subset of occurrences of NSWB found that 75% were made by a male associating with a female, and 66% were in response (within 1 sec) to another NSW. We are continuing to examine how contextual variables such as sex, age, presence of other animals, and occurrence of other whistles influence NSW production. Our results suggest that stereotypic non-signature whistles are likely of comparable importance to signature whistles in the dolphin communication system.

NEW TECHNOLOGIES

A wave glider for passive acoustic monitoring of cetaceans in the Mediterranean Sea

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Monitoring cetaceans in the vast ocean environment, particularly in remote and non-coastal areas, presents a significant challenge. Therefore, the global trend is toward autonomous observation systems capable of collecting huge amounts of data over large temporal and spatial scales. A wave glider is a surface and remotely operable oceanographic platform equipped with multi-parameter sensors, including a towed array hydrophone. Here, we tested the potential use of this autonomous vehicle to acquire high quality acoustic data and provide information on the spatial distribution of different cetacean species in the Mediterranean Sea, including elusive species such as deep-diving whales. The wave glider sailed crossing the southern Tyrrhenian Sea, the Strait of Sicily, the Ionian Sea and the Adriatic Sea for about 2,500 nautical miles. Acoustic data were acquired continuously from the 30th September to the 17th December 2022, and from 15th January 2023 to 3rd March 2023. Data collection was set at a sampling rate of 192 kHz, storing files of 460 sec in the flac format. A total of 19,115 recordings (about 2.2 TB) were acquired. A preliminary data analysis involved spectrogram visualization and audio listening of a subsample of the dataset, both broadband and low-frequency, to identify cetacean vocalizations and anthropogenic noise sources. Then, automatic techniques (signal processing and machine learning algorithms) were applied to the entire dataset. The acoustic signals of delphinids, sperm whales, fin whales and different anthropogenic noise sources were identified during the route traveled by this surface vehicle. Autonomous platforms are today's largest in situ ocean observation tool and provide an enormous amount of significant information on cetacean species, which are currently under severe pressure due to the negative effects of human activities and climate change.

GENETICS & EVOLUTION

Ecological and spatial correlates of population structuring in a metapopulation of North Atlantic killer whales

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Kinship dynamics can significantly shape population structure through interactions between genetics, social behaviour and ecology. Killer whales (*Orcinus orca*) are a highly social species living in kin-based social groups. In this study, 201 individuals were sampled across the North Atlantic from Western Greenland to Norway. Integrating multi-decadal sighting and predatory records, we investigate whether ecological and spatial factors contribute to large scale population structuring of the wide ranging North Atlantic killer whale. Combining an extensive dataset of samples and genome-wide SNP genotypes with methods that capture both historic and contemporary gene flow, we find evidence for a metapopulation connected by sporadic gene flow spanning the North Atlantic (aligned with previous research). However, we additionally identify spatio-temporal effects of varying prey distribution on mating patterns and discover kinship signatures of recent gene flow between locations, previously undocumented. Exclusive fish feeding killer whales did not genetically segregate from individuals known to adopt a mixed diet of fish and mammal prey. In fact, recent gene flow between individuals with different dietary preferences was found. This is a significant deviation within a species renowned for its stringent social structure and genetic differentiation among prey specialists coexisting in sympatry elsewhere. Our findings are of high importance for conservation efforts; increasing the understanding of population connectivity among North Atlantic killer whales. This metapopulation has historically been subject to large-scale exploitation from commercial whaling and ongoing subsistence hunting, culling to protect herring stocks, and faces further threats from contaminant loads, prey resource fluctuations and climatice change. This study emphasizes the necessity for coordinated management of this widespread migratory predator and its prey across national borders.

Environmental DNA reveals spatial and temporal variability of cetaceans and their prey species in a Scottish marine protected area

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Foraging grounds are acknowledged as high priority marine mammal habitats for marine protected area (MPA) designation, but may be temporally dynamic as prey species respond to seasonal variation and environmental change due to climate heating. Regular monitoring of prey availability and abundance is important to inform spatial planning decisions and area status, but limited prey data often hampers understanding of marine mammal habitat use. Environmental DNA (eDNA) metabarcoding could enhance knowledge of dynamics between marine mammals and their prey, but so far has rarely been utilised to explore marine mammal trophic interactions. In this study, we investigate spatiotemporal trends in the availability and abundance of key prey taxa for cetaceans in a newly established MPA in Northeast Scotland, employing eDNA metabarcoding. We recovered 105 operational taxonomic units (OTUs) from marine vertebrates using two primer sets targeting 12S and 16S rRNA genes, and 112 OTUs from a broader eukaryotic primer set targeting 18S rRNA. We detected clear spatial partitioning between coastal bottlenose dolphins and the more pelagic minke whales and harbour porpoises, aligned with the availability of their dominant prey species. Key forage fish species were the most abundant teleost fish detected, but their availability varied seasonally and with distance from shore, which could help interpret observed shifts in minke whale distributions and age-class partitioning. As well as resident cetaceans, we also detected rarer cetacean species such as Sowerby's beaked whales that were not sighted during sampling, along with threatened and invasive teleost species. This study demonstrates the utility of eDNA to detect spatiotemporal trends in the occurrence and abundance of cetaceans and their prey species, furthering understanding of fine-scale habitat use within MPAs. Future long-term monitoring of predator-prey dynamics with eDNA could improve our ability to predict climate-induced shifts in foraging grounds and enhance rapid responses with appropriate management actions.

Unveiling the enigmatic natural history of Mediterranean Common Dolphins: Ecological and evolutionary insights for conservation challenges

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The Mediterranean population of common dolphin (*Delphinus delphis*) presents an enigmatic natural history. Once widely prevalent, it faced a significant decline across most of the basin by the late 1960s (Bearzi et al., 2003). The precise reasons and mechanisms behind this decline remain largely unknown or poorly understood. However, a range of potential causes has been identified, encompassing deliberate culling, accidental deaths in fishing gear, reduced prey availability, and habitat degradation (Bearzi et al., 2008; Bearzi, Holcer, & Notarbartolo di Sciara, 2004; Piroddi et al., 2011). Present estimates derived from surveys and monitoring campaigns suggest either a complete absence or a near disappearance of common dolphins from areas historically known to harbor substantial populations. The International Union for Conservation of Nature has designated the Mediterranean population of common dolphins as Endangered (Bearzi et al., 2021). We reconstructed the little-known natural history of this population using Mediterranean museum skeletal specimens from the last two centuries. A multidisciplinary analytical approach, consisting of genetic analysis on ancient DNA, skull geometric morphometry, and collagen stable isotope analysis, in addition to data from strandings and historical documentation, has enabled a better understanding of the ecology of the historical Mediterranean common dolphin population. The main results are: i) the incorrect taxonomic attributions in museum collections and historical literature represent a low but significant bias in the identification of Mediterranean dolphin species and in the knowledge of their demographic and ecological history over the past decades and centuries; ii) 10% of museum specimens show a discrepancy between morphology and genetics and these could potentially represent evidence of interspecific hybridization events between the *Delphinus delphis* and other species more common in the basin, such as *Stenella coeruleoalba* and *Tursiops truncatus*; iii) the Mediterranean common dolphin population shows significant spatial heterogeneity in the ecological, trophic and distribution patterns.

ECOLOGY & HABITAT USE

Dynamic habitat suitability models of minke whales on the West coast of Scotland

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Minke whales are the most frequently encountered baleen whale species in Scottish waters, but despite regular sightings during summer months, there is a lack of understanding about their habitat usage and movements in western Scottish waters. In the current study, data were collected during visual random line transects conducted off the west coast of Scotland between 2003 and 2019 from the Hebridean Whale and Dolphin Trust's research vessel. Transects were divided into smaller segments, and binomial generalised additive models were used to ascertain the relative importance of a range of static and dynamic environmental variables on minke whale presence at a daily, weekly, and monthly scale. These models were then used to generate predictions of minke whale distribution and abundance for each day of the summer season.
The models showed a general movement from the south to north of the Scottish west coast and a general movement inshore as the season proceeded. The southwest of the study area appears to be particularly important for minke whales from May to August, whereas the northern region of the study area appears the most heavily used in September. Minke whales most commonly used the Sea of Hebrides Marine Protected Area in June and July but were largely absent from it in other months when they were using areas to the north of it.
This study extends our knowledge of minke whale distribution on the west coast of Scotland, using data collected on a considerably larger spatial and temporal scale than previously used. The results suggest that while the effectiveness of the designated MPA needs continuously revisiting to account for variations in the distribution of minke whales and anthropogenic threats (particularly entanglement), it will provide a concentrated area to investigate, understand, and mitigate risks.

Interannual and seasonal variations in abundance of small cetaceans in the NE Atlantic

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The need to transition towards the production of sustainable energy will lead to the construction of additional offshore wind farms in the NE Atlantic, ultimately resulting in an increase in activities that could potentially impact cetaceans. In this context, studies aimed at improving our knowledge of cetacean distribution and abundance are key. Aerial surveys are an efficient method to collect data on the presence and number of cetaceans in a short time, and are particularly well suited for extensive offshore areas. Five aerial surveys were carried out in the Irish EEZ in summer 2016, 2021 and 2022 and winter 2016 and 2022. In total 50,820 kilometres of line transects were surveyed on effort using a twin-engine, fixed-wing aircraft. Data on all cetaceans species were collected using distance sampling methodology and analysed for six species, harbour porpoise, bottlenose, common, Risso's, white-sided and white-beaked dolphins, for the different seasons using Mark-Recapture Distance Sampling. Preliminary analyses show that densities varied particularly between 2016 and the 2021-2022 period. Harbour porpoise (0.115 individuals/km2 in summer 2016) and bottlenose dolphins (0.252 - 0.583 individuals/km2 in summer and winter 2016 respectively) showed higher densities in 2016 than in 2021-2022 (from 0.005 to 0.01 individuals/km2 for harbour porpoise and from 0.022 to 0.027 individuals/km2 for bottlenose dolphins). In contrast, common dolphin showed higher densities in 2021-2022, ranging from 0.127 to 0.363 individuals/km2, than in 2016 (0.04 individuals/km2). Results highlight the importance of the Irish Sea for harbour porpoise and the continental shelf waters, particularly the Celtic Sea, for bottlenose and common dolphins. The study revealed interannual (particularly between 2016 and 2021-2022) and seasonal differences in species densities and distribution in the Irish EEZ, highlighting the need for more regular seasonal surveys. These results provide comprehensive information on cetacean abundance and distribution that can be used for informed management.

Bryde's whales population dynamics in Madeira archipelago: an indication of the species recent arrival to the area?

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Bryde's whales were only recently recorded in Macaronesia (Canary Islands – 1997; Madeira – 2001; and Azores – 2004) but it is unclear if the species presence in the region is recent or they went unnoticed previously. This study used the Bryde's whale photo-identification catalogue of Madeira archipelago, created and curated over 20 years (2001 – 2021) by the Madeira Whale Museum, integrating dorsal fin images collected by the institution in coastal scientific surveys, contributions from local whale-watching companies and opportunistic encounters. Analyses focussed on 2006-2021 and investigated the effect of uncertainty in species identification, distinctiveness, and matching. Annual apparent survival rates were estimated using Cormack-Jolly-Seber models. Annual abundance was estimated by fitting Robust Design (RD) models to the capture histories of non-calf Bryde's whales in the study area, and the "superpopulation" for the study period was estimated by fitting the POPAN parameterization of the Jolly-Seber (JS) model. The estimated survival rates were high (> 0.98) and both RD and POPAN abundance estimates showed a clear positive trend over the study period. The RD abundance estimate in 2006 and 2021 were 25 animals (95%CI: 10 – 63) and 213 animals (95%CI: 147 – 310), respectively. The superpopulation was estimated to be 519 animals (95%CI: 431 – 625). The very small abundance estimates (low tens) at the beginning of the study period (2006) and the upwards trend in abundance in the following years supports the recent arrival of Bryde's whales to Macaronesia. The back-projection of the population growth trend to years prior to the study period would reach zero less than 10 years in the past, which together with the recent first records of the species in all Macaronesia archipelagos, adds strength to this hypothesis.

Environmental drivers affecting the density of Southern Right Whales (*Eubalaena australis*) in the Brazilian calving ground

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In the context of climate change, understanding the drivers influencing migratory choices of animals for feeding and breeding grounds is crucial for conservation. The southern right whale, *Eubalaena australis* (Desmoulins, 1822), found throughout the southern hemisphere, utilizes the state of Santa Catarina as its primary calving ground and the largest occurrence area of the species in Brazil. Globally, the El Niño-Southern Oscillation (ENSO) has been recognized as a significant factor affecting the survival and reproductive success of whales. Here, we investigated the impact of ENSO, using the Oceanic Niño Index (ONI) and sea surface temperature, and the sampling year on the density of breeding whales in Brazil. We used data from systematic aerial surveys conducted between 2002 and 2023, covering 716.897 km² of coastal areas, from 27.907º to 29.367º. To investigate the potential relationship between the explanatory variables and whale density, we applied Generalized Linear Models (GLM) using R-4.3.2. According to the most parsimonious model, ONI with a lag of one year and sea surface temperature significantly influenced whale density. Therefore, there is a pronounced negative relationship between the number of whales visiting the area in years following high ONIs values, combined with a minor negative effect of increasing water temperature. These findings align with previous data that indicated adverse effects of high ONI on the whale survival and reproductive success. Given scenarios of increasingly intense and frequent climatic events, this knowledge is highly important for conservation and an initial step towards a better understanding of how global factors can influence the number of breeding whales in Brazil.

Oscillation of stable isotopes in fin whale baleen plates unveil behavioural responses to climate patterns

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Large marine vertebrates are considered sentinels of changes in ecosystem functioning because their diet and migration are often driven by climate variations. These changes can be inferred through the analysis of stable isotopes of nitrogen (δ15N) and carbon (δ13C), particularly when performed on metabolically inert tissues, such as baleen plates from mysticetes, which keep a fixed record of the isotopic values over time. We examined variation in δ15N and δ13C values along the baleen plate of 29 fin whales (*Balaenoptera physalus*) caught in the feeding grounds off western Iceland in 2013, 2015, 2018 and 2022 to investigate possible links with changes in climatic indices: the North Atlantic Oscillation (NAO), the Atlantic Multidecadal Oscillation (AMO) and the Atlantic Meridional Overturning Circulation (AMOC). We estimated the baleen growth rate at 16.03 ± 0.92 cm y−1 and, from the capture date of each whale, we retrospectively reconstructed a time series of its stable isotopic records. δ15N values were negatively correlated with the NAO index and positively correlated with the AMO index when lagged by 31-34 and 27-32 months, respectively. δ13C values were negatively correlated to the AMO index when lagged by 9-10 months. We discuss potential processes that explain the observed correlations and conclude that fin whales can modulate their diet and migratory behaviour to adapt to climate-induced shifts in prey availability or habitat suitability. Knowledge about the long-term behaviour of mysticetes is crucial in the current context of climate variability to better predict population resilience and implement efficient conservation measures.

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Mercury isotopes as useful chemical tracers to study ecological niche partitioning in cetaceans

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In ecological communities, it is anticipated that sympatric species will unevenly distribute themselves across various niche dimensions (n-hypervolume), thereby preventing competitive exclusion. In this context, the isotopic niche concept arose as a powerful approach to inform ecological niche questions. Stable isotopes of carbon (δ13C) and nitrogen (δ15N) are used as chemical tracers to inform about both scenopoetic (habitat use) and bionomic (trophic position) axes respectively. Recently, mercury isotopes have emerged as interesting tracers to study the vertical (water depth) segregation between marine pelagic organisms. Here, we analyse mercury isotopes (Δ199Hg and δ202Hg) in cetacean skin in combination with δ13C and δ15N to better understand the ecological niche segregation within cetacean communities. We sampled the most common cetacean species coexisting in the Alboran Sea, as well as striped and common dolphins in three different areas in southern Spain. The use of Δ199Hg led to a reduction in the trophic overlap estimates in contrast to those derived solely from δ13C/δ15N, highlighting the necessity of employing multiple isotope signatures for a precise trophic characterization of cetacean species. Additionally, we found a consistent vertical segregation between common and striped dolphins in the three studied areas. These results highlight that these species predominantly forage at distinct water depths and that resource partitioning is manifested along the vertical dimension within cetacean assemblages. In summary, this research provides new ecological insights into ecological segregation through the use of mercury isotopes in co-occurring high trophic level cetacean species. The precise characterization of ecological patterns is essential for comprehending and predicting the evolving dynamics between cetaceans and their ecosystem in a changing ocean.

Size, growth and age of Mediterranean male sperm whales

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Knowledge of life history and demographic parameters is essential to understand the status of a species and its vulnerability to stressors and to support informed management and conservation decisions. This is particularly true for threatened and long-lived taxa whose survival is affected by ever growing human activity and the effects of climate change. The Mediterranean sub-population of sperm whales includes less than 2,500 mature individuals and, given its inferred continuing decline due to the incidence of rising rates of ship strikes, is classified as Endangered according to IUCN Red list Criteria. In this context, we have analysed sperm whale photo-identification and acoustic data collected in the Ligurian Sea, north-western Mediterranean, between 2008 and 2023 to gain insight into males' body-length and growth, which were in turn used to derive the age of individual whales. Body-length was derived acoustically, and for those animals measured at least twice, more than six months apart, the body-growth was estimated. Finally, by using available information on age-at-length for the Mediterranean, we estimated the age for each measured whale. Our results show that male sperm whales occurring in the Ligurian Sea are consistently smaller than 15 meters (average 11.65 m), with an estimated maximum age between 35 and 40 years. The individual annual growth ranged between 0 and 25 cm, with larger animals growing at a slower rate than smaller ones. Furthermore, the analysis confirmed that the Ligurian Sea is home to sexually mature male sperm whales, showing a high-degree of site fidelity across the years, but, it also highlight that in recent times, the area has been used by smaller individuals occurring both as singletons and in loose aggregations. These findings provide an essential baseline to assess and monitor changes in the sperm whale population structure and to inform effective management and conservation measures.

ECOLOGICAL MODELLING

Estimating densities and total abundance of four small dolphin species in a significant portion of the North Atlantic

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Distribution and abundance models are important tools to understand habitat preferences, population trends and areas suitable to be protected. A major baseline for these goals is to know the overall abundance and distribution of a species in the area of interest. Several surveys have been conducted in the Atlantic Ocean to estimate the abundance of cetacean species, mainly in the Western North Atlantic and European waters. Here, we present the first abundance and spatial densities estimates for four dolphin species: common dolphin (*Delphinus delphis*), common bottlenose dolphin (*Tursiops truncatus*), Atlantic spotted dolphin (*Stenella frontalis*) and striped dolphin (*Stenella coeruleoalba*), in a portion of the North Atlantic spanning from the Iberian Peninsula to oceanic waters, going beyond the Azores and Madeira archipelagos. We analyzed transect sighting data from research vessel surveys, which occurred in 2004-2020. Geographic position, species, group size, and distance to the observer were recorded whenever cetaceans were detected. A total of 3329 cetacean sightings were recorded, with 1627 corresponding to common dolphins, 339 to bottlenose dolphins, 293 to the spotted, and 140 to striped dolphins. Detection functions were fitted to model the detection probability of each species as a function of distance to the observer, and later used to fit Density Surface Models. We used smooths of static environmental covariates and location to fit a Generalized Additive Model, with location and depth being selected variables in our final models for all species, and slope for the bottlenose and spotted dolphins. We are actively working on perfecting the models and on precision measures to go against the abundance estimates. These results will provide baseline values for managing these species within and beyond three Economic Exclusive Zones (mainland Portugal, Azores and Madeira), mainly in non-surveyed offshore waters.

Evaluating fin whale distribution in the Mediterranean Sea using Generalized Additive Models (GAMs) and Hurdle Models

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Understanding the habitat of highly migratory species requires spatial predictions such as species distribution models to inform conservation and management plans. While Generalized Additive Models (GAMs) are commonly used in ecology, and particularly the habitat modelling of marine mammals, there remains a debate between modelling habitat (presence / absence) versus density (# individuals). Our study assesses the performance and predictive capabilities of GAMs, used for modeling both fin whale density and habitat suitability, alongside Hurdle Models treating presence / absence and density as a two-stage process, more suitable to address the challenge of zero-inflated data. Fin whale data were collected from 2008 to 2022 along fixed transects crossing the NW Mediterranean Sea during the summer period. Data were analysed using traditional line transect methodology, obtaining the Effective Area monitored. Based on existing literature, we select various covariates, either static in nature, such as bathymetry and slope, or variable in time, e.g., SST, MLD, Chl concentration, EKE, and FSLE. We compared both the explanatory power and predictive power of the different modelling techniques. Our results show that all models performed well in distinguishing presences and absences but, while density and presence patterns for the fin whale exhibit similarities, their dependencies on environmental factors can vary significantly. Bathymetry was the most important variable in all models, followed by SST and the chlorophyll recorded two months before the sighting. This study underscores the pivotal role of SDMs in marine mammal conservation efforts and emphasizes the importance of selecting appropriate modeling techniques. It contributes valuable insights into the complex interplay between environmental variables and the distribution of fin whales, providing a solid foundation for informed decision-making and habitat management.

Long-Term Monitoring and Analysis of the Orca Population in the Strait of Gibraltar (1999-2023): Insights into Population Status and Network Dynamics

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This study presents a comprehensive analysis of the Iberian orca (*Orcinus orca*) population found in the waters of the Strait of Gibraltar, spanning a period of 25 years (from 1999 to 2023). The primary objective of this work was to evaluate the current status of the population, examining changes over time, with a particular focus on the evolution of social structures and potential connections to Atlantic bluefin tuna stocks. A thorough analysis of photographic data was conducted utilising photo-identification and mark-recapture tools. This allowed for the cataloguing of individual orcas and the analysis of population trends over time, including life parameters and social network dynamics. Throughout this study, 87 distinct individuals were identified from 43522 analysed photos, providing valuable insights into the population's characteristics. The implications of this type of research are significant, particularly considering the small size and critically endangered status of this orca subpopulation (IUCN 2019). Furthermore, the interactions with sailboats seen in recent years have brought increasing (and often negative) attention to this species making this type of study even more important. Continuous monitoring and protection efforts are, therefore, crucial for this small population of the Iberian waters. Looking forward, it is imperative to maintain consistent data collection on this population to understand its fluctuations, social structure alterations, and to anticipate potential declines. This ongoing research is vital for implementing effective conservation strategies and ensuring the long-term survival and well-being of the orcas in their home.

BEHAVIOUR

Diel foraging patterns of deep-diving offshore common bottlenose dolphins (*Tursiops truncatus*) tagged near Bermuda

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While common bottlenose dolphins in coastal ecosystems are frequently studied, we know relatively little about the offshore deep-diving bottlenose dolphin ecotype. They seem to have physiological adaptations for higher diving capacity, and satellite-linked tags have confirmed record-breaking deep dives. We hypothesize that dolphins exploit profitable prey patches on these deep dives to offset the physiological costs associated with diving. We tagged 3 offshore bottlenose dolphins near Bermuda with acoustic and movement recording digital tags (DTAGS) to study their diving and foraging behavior. All tag deployments lasted more than 17 hours and included entire nighttime periods. All three dolphins dove deeper than 300 m, up to 482 m, with deep dives starting near sunset and peaking shortly thereafter. Generalized additive models showed a significant effect of time of day on both dive depth and buzz rate (rapid echolocation sequences associated with foraging attempts). Foraging behavior also began at sunset but, unlike deep diving, continued throughout the night, with high levels of surface foraging occurring after the peak in deep diving. All dolphins foraged at high rates during nighttime hours, with limited foraging activity during the day. These offshore dolphins showed similar behavior patterns that indicate the importance of nighttime foraging, likely feeding on the vertically migrating deep scattering layer. Mesopelagic prey resources can be difficult to assess but are critically important for many offshore marine mammal species. As human industry ventures further from coastal areas, impacts from offshore wind, oil drilling, and mesopelagic fishing may present new threats for pelagic marine mammals, in addition to disruptions in oceanographic patterns from climate change. Our study addresses a critical data gap in the understanding of foraging behavior in a little-studied offshore bottlenose dolphin population and highlights the importance of mesopelagic prey resources even for bottlenose dolphins, which are better-known as a coastal species.

ABSTRACTS - SHORT TALKS

CONSERVATION

Empowering local communities: a marine mammal conservation and community science initiative in Chocó, Colombian Pacific

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This study details the implementation of a community-driven science program in Nuquí, Chocó, Colombia, aimed at marine mammal monitoring, sustainable tourism, and conservation. The primary objective is to cultivate local scientific engagement and facilitate knowledge exchange to advance sustainable marine conservation practices within local communities. The program involved the training of four local fishermen and certification of two whale-watching guides in various marine mammal data collection techniques. The training encompassed key aspects such as photo-ID, transects, and GPS handling, emphasizing the collection of data on marine mammal behaviors, group composition, whale-watching guidelines, and environmental conditions. Additionally, hydrophone usage was incorporated into the training. Results from three years of intermittent data collection (2020-2022), one year of monthly monitoring, and a dedicated whale-watching season (2023) revealed more than 112 sightings, comprising photo-ID and comprehensive data on GPS coordinates, group composition, behavior, and other relevant parameters. In addition, these participants were invited and actively participated in a national conference, presenting their work, and contributing to the empowerment and knowledge dissemination about marine mammals in their region. Beyond data collection, this initiative empowers the local community, fostering their involvement in the broader discourse on marine conservation and sustainable practices. Looking ahead, the success of the program calls for the expansion of these community-driven initiatives to reach more local communities, emphasizing the need for ongoing training to create a network of locally empowered individuals contributing to sustained marine conservation efforts. This approach underscores the potential scalability and effectiveness of community-centered programs in achieving broader goals of preserving marine ecosystems.

Are Marine Protected Areas spatially relevant for cetacean conservation? A case study of the Portuguese coast

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Cetaceans are vital indicators of ecosystem health, and currently face significant threats from human activities such as overfishing, habitat loss, and climate change. Conservation strategies include, among others, the spatial definition of Marine Protected Areas (MPAs), the biodiversity-preserving Natura 2000 network, and the Important Marine Mammal Areas (IMMAs) which spotlight key marine mammal habitats. Using a long-term dataset, from 2004 to 2020, this study investigates cetacean species distribution along the Portuguese coast to determine correlation with three MPAs that target, at least, one cetacean species: Maceda-Vieira, Arrábida/Espichel, and Costa Sudoeste. The research focuses on five cetacean species: bottlenose dolphin, common dolphin, Risso's dolphin, striped dolphin, and pilot whales. Generalized Additive Models (GAM) were employed to model group (sightings), individual encounter rates, and number of identified species, against extracted fixed variables, including habitat-based, geographical, and spatial-based (MPA-related) predictors. Overall, and taking into account the conducted survey effort, findings reveal a higher cetacean prevalence in Maceda-Vieira, followed by the prevalence in non-protected waters, and the Costa Sudoeste MPAs, with no sightings recorded in the Arrábida/Espichel MPA. For all species, the GAM models indicate that, in general, the encounter rates and species richness align more with habitat fixed variables than with the presence of a protected area. The research offers critical insights into the role of protected areas in cetacean conservation. Specifically, it underscores the need to delimit data-driven specific areas of special importance for cetacean communities, such as IMMAs. Moreover, it further emphasizes the need for long-term monitoring in mitigating human activities impacts on cetaceans.

Update on the common dolphin population status in Portuguese continental waters

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According to the most recent article 17 assessment (EU Habitats Directive), the common dolphin population in continental Portugal has an Unfavourable - Inadequate status. Also, the population is currently considered Near Threatened in the 2023 Portuguese Red Book of Mammals because of the high bycatch mortality, which is not expected to decrease in a foreseeable future. In 2023, an airplane census allowed estimating the common dolphin population in continental Portugal. On the other hand, in 2023 the number of common dolphins strandings remained high particularly in the northern coast of Portugal (172 individuals recorded in a 300 km coastline). Considering only fresh and moderately decomposed common dolphins, post-mortem exams revealed bycatch and probable bycatch rates of 79,6% and 8,7%, respectively. Also, bycatch evaluated from stranded individuals in the northern coast which could be used to determine cause of stranding produced an estimated minimum mortality from bycatch of 9244 common dolphins (CI: 6926-12339) for 2023. This value is 5-times higher than the Potential Biological Removal (1781 common dolphins [CI: 1335-2378], estimated for populations in good condition), and corresponds to a 10% removal of the population. If a 1.7% of the best population estimate is considered the threshold against which bycatch would be assessed, more than 1542 bycaught individuals would be considered unacceptable. Further studies on habitat suitability for the common dolphin in the Portuguese coast are ongoing. Apart from fisheries bycatch, cumulative effects of other threats arising from the emergent blue economy activities and offshore renewable energies should be considered in future transboundary conservation plans for the common dolphin in the northeast Atlantic.

Enhancing biodiversity conservation and public awareness through citizen science and whale watching with eDNA monitoring

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Promoting public awareness is crucial for effective conservation actions aimed at preserving biodiversity. The BIODIVERSA+ eWHALE project unites European researchers, industry partners, and the public to enhance marine biodiversity protection through a combination of environmental DNA (eDNA) sampling, whale watching, and citizen science. Specifically, the project focuses on a citizen science approach for eDNA sampling, carried out during whale watching tours, providing ecotourists with the opportunity to observe and receive information about the procedure. This study aimed to investigate the ecotourists' prior knowledge of biodiversity and eDNA in Italy, Portugal, and Iceland. Additionally, it analysed how this knowledge evolved after participants received specific information. To assess the impact of information dissemination, two sets of parallel closed-answer questionnaires were developed and distributed, one before and one after the citizen science experience, with 17 multiple-choice questions concerning respondents' knowledge of biodiversity and eDNA. Respondents' anonymity was guaranteed to encourage candid responses. A total of 176 responses were collected for the first set, and 107 for the second set. Multiple Correspondence Analysis (MCA) was employed to explore the association between respondents' origins, characteristics, and awareness of biodiversity and conservation. Additionally, a Wilcoxon paired test was conducted to evaluate the improvement in awareness following the field experience. The paired test results demonstrated a substantial enhancement in awareness, indicating a highly significant difference ($P < 0.01$) between knowledge levels before and after engaging in the citizen science program. This study highlights the great potential of citizen science in narrowing knowledge gaps and fostering heightened awareness. The whale watching experience, which involved eDNA sampling, highlighted the significant impact of citizen engagement on deepening comprehension and fostering appreciation for essential ecological concepts. This underscores the importance of continued citizen science initiatives for both environmental research and education.

HUMAN INTERACTIONS

Using multi-sensors devices to assess fin whales' behaviour and interactions with marine traffic in the Mediterranean Sea

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Ship-strikes are amongst the primary causes of direct mortality of large whales, with serious welfare implications and potential long-term population consequences. It is therefore essential to identify and develop mitigation measures to reduce the number and the risk of deadly collisions. Under the framework of project LIFE SeaDetect, aimed at reducing vessel collision risk with marine mammals and unidentified floating objects (UFO), an automated onboard detection system, a real-time passive acoustic monitoring network at sea and a real-time detection-sharing and alert system are being developed and tested. To aid the SeaDetect project goals, we deployed multi-sensors devices to assess fin whales behaviour and interactions with approaching maritime traffic. During June 2023, three SPOT-365 LIMPET satellite transmitters and 2 CATS multi-sensors devices were deployed on fin whales in the Gulf of Lion. CATS tags deployments lasted 2h20m and 6h45m, respectively, with whales spending consistent time near the surface. SPOT-365 deployment ranged between 35 and 48 days. From the tagging location, whales moved north-east and entered the Pelagos Sanctuary, where they engaged in feeding activities. A qualitative overlap with tracking and AIS data showed that feeding areas closely coincided with heavy traffic levels, increasing the risk of collision. Closest point of approach between the tagged whales and passing large vessels were also assessed across the entire area visited by the whales. Our analysis show that whales do not appear to avoid areas of heavy ship traffic and that their surface behaviour makes them susceptible to high risk of collision. While the small sample size did not allow to fully evaluate fin whales' response to oncoming vessels, our data provide a first step towards the assessment and implementation of the Associated Protective Measures of the recently established Particularly Sensitive Sea Area in the North-Western Mediterranean Sea.

Assessment of the Cuvier's beaked whale's (*Ziphius cavirostris*) exposition to maritime traffic in the Ligurian basin

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Eight Cuvier's beaked whale (*Ziphius cavirostris*) were tagged and monitored in the Pelagos Sanctuary (Ligurian Basin) during the summer 2021. This study analyzed the exposure of the whales to maritime traffic, using telemetry and AIS data. We created a database of exposure events by selecting ship positions within a 10 km buffer around the tagged animals. Each event was characterized by closest points of approach to the whale, exposure duration and vessel type and speed. Over three months, 2631 transits were recorded averaging 32 to 163 transits per week per whale. The less exposed whale spent 14% of the deployment period with at least 1 boat within the 10km range compared to the one with a maximum of exposure with 57% of the time. The most exposed whale was approached more than 40 times a day by transits coming close to less than 6 km. Statistical test concludes on significant differences of exposure among categories of vessels approaching the whales and between individuals. They were mostly impacted by yachts, passengers, and cargo boats, representing together 75% of the maritime traffic recorded around them. Over 80% of the vessels recorded were traveling at a speed over 7 knots. Ship speed and distance are parameters directly linked to the level of vessels noise received by the animal. Therefore, over 80% of the events are susceptible to reduce at least partially the communication space of Cuvier's beaked whales and so they might influence whale behavior. This study showed that Cuvier's beaked whales in the Pelagos Sanctuary are chronically exposed to high levels of shipping disturbance. In a scenario of increasing maritime traffic, our results should urge additional analysis to understand the short and long-term consequences of such a disturbance on this population, in order to implement an effective conservation policy.

Community science to understand AIS and non-AIS vessel activity, and their interactions and potential impacts on whales, dolphins and seals around coastal Scotland

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10. *UHI Shetland*
11. *NatureScot*
12. *Dolphin View Cottages Hillockhead*
13. *Shetland Webcams*
14. *Orkney Marine Mammal Research Initiative*
15. *Ardnamurchan Lighthouse*
16. *HebNet*
17. *Not declared*
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Understanding, and then subsequently monitoring and managing human activities in the marine environment is inherently challenging. Challenges include inadequate data, a limited understanding of environmental interactions within marine ecosystems, and the inherent complexities of managing mobile species and activities. This proves a great limitation to understanding the potential spatio-temporal overlap, and the associated potential for negative impacts, that human activities may pose to marine mammals. To begin to build a more holistic overview of vessel traffic, and the potential impacts this traffic poses to marine wildlife around coastal Scotland, we present the Scottish Vessel Project. This is a collaborative initiative utilising several data collection approaches to help build understanding, including collection of AIS (large vessel) data and collection of long-term land- and vessel-based data (in collaboration with WDC Shorewatch and the Hebridean Whale and Dolphin Trust). Our findings indicate that AIS data significantly underrepresents actual vessel traffic, particularly in summer months, with a number of non-AIS vessel types being those most commonly observed interacting with marine mammals, and/or most likely to exhibit erratic behaviour that may pose a particular risk to marine mammals (i.e. sharp changes in speed and/or

direction). Here, we will describe the results of data collected by a network of trained volunteers at multiple sites around Scotland. This work represents a significant and novel contribution to understanding the volume and type of vessels around coastal Scotland, and their potential associated impacts to marine mammals.

Winter distribution of cetaceans in the Irish and Celtic Seas and implications for assessment of anthropogenic impacts

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Within Europe, a target of 60GW of installed offshore wind farm (OWF) capacity by 2030 has been set as part of the EU'S Strategy for Offshore Renewable Energy. Many areas of the Irish and Celtic Seas (ICS) are leased for OWFs; there are 13 operational OWFs in the Irish Sea with those in concept and early planning reaching double figures. Digital Video Aerial Surveys (DAS) are routinely used to collect marine megafauna data to derive cetacean distribution and abundance to support OWF Environmental Impact Assessments (EIAs). To reliably determine potential interactions between cetaceans and OWFs, good understanding of year-round cetacean distribution is required. Currently, most data within the ICS are summer biased, with large-scale surveys such as SCANS and ObSERVE providing summer snapshot surveys on a roughly decadal scale; these data are often used as reference populations and may not be representative of year-round abundance. Here, we collate and describe winter cetacean DAS data collected in the ICS between 2018 and 2023 (restricted to October - March), to investigate whether summer reference data is appropriate to assess anthropogenic impacts to cetaceans. As the most abundant species recorded in DAS (6,069 and 2,747 total observations, respectively), common dolphin (CD; *Delphinus delphis*) and harbour porpoise (HP; *Phocoena phocoena*) were selected. HP had widespread distribution in the ICS and they were observed in all survey months; using summer reference data for this species may be appropriate. Winter DAS of CD suggest a more northerly distribution than presented in SCANS-III and SCANS-IV, reaching latitudes of ~53 degrees. In all years, winter CD observations peaked in January. For CD, the use of summer data for projects in the northern Irish Sea may not be appropriate; extension of large-scale surveys to include winter and use of site-specific data will likely be advantageous.

Response of harbor porpoises (*Phocoena phocoena*) to different types of acoustic harassment devices before the construction of offshore wind farms

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Pingers and acoustic harassment devices (AHDs) are used by industries (e.g., fisheries, aquaculture, offshore wind) worldwide to deter marine mammals such as the harbor porpoise (*Phocoena phocoena*) from areas where they might suffer injury. Before the construction of offshore wind farm foundations in Germany, seal scarers (usually SPL = 174-193 dB re 1 µPa (rms) @ 1m at 1-20 kHz depending on the device) were prescribed as AHDs until 2017. However, seal scarers resulted in lower detection rates of harbor porpoises at much greater distances than intended. Therefore, acoustic porpoise deterrent devices (APDs; e.g. FaunaGuard Porpoise Module; SPL = 172 dB re 1 µPa (rms) @ 1m at 60-150 kHz) have since been prescribed to keep the animals away from offshore construction sites without causing large-scale disturbance. Despite project-specific assessments suggesting that APDs are effective, this study represents the first cross-project analysis comparing APD effectiveness with previous piling operations where seal scarers were employed. In 2018 and 2019, harbor porpoises were monitored acoustically at four offshore wind farms with CPODs before, during and after piling at distances ranging up to 10 km from piling. APD operation led to a significant decrease in detection rates in the vicinity of the device, indicating displacement of animals from a small-scale area. Depending on the wind farm, detection rates decreased by 30% to 100% during APD operation at 750 m distance compared to 6 hours before APD operation. In addition, reduced detection rates during APD operation were only observed up to about 2.5 km, even when the APD was switched on for more than 40 minutes. As the extent of harbor porpoise disturbance is lower when using an APD compared to the seal scarer, we consider that preferential use of an APD is an improvement to mitigation strategies.

Harbour porpoise detections decline in response to a scientific seismic survey during site characterization of a tidal energy development: considerations for Environmental Impact Assessments

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Passive acoustic monitoring is a useful tool to assess and monitor potential anthropogenic impacts on cetaceans. In the current study, an array of seven acoustic recorders was deployed in summer 2017 to investigate harbour porpoise (*Phocoena phocoena*) distribution at a tidal energy development off Northwest Wales, to inform encounter probabilities and potential collision risk with tidal turbines, prior to turbine installation. During the deployment period, a five-day scientific 2D seismic survey, using a S-Boom Sub-Bottom Profiler (SBP) was conducted in the study area to survey the seabed to inform turbine installation. Information about the effects of SBPs on marine mammals is generally lacking; however, exploratory plots suggested there was a marked reduction in porpoise detection rates starting from the first day of the seismic survey until the end of the recording period, four days after seismic survey completion. A change point analysis was therefore conducted to investigate the effect of the seismic survey on porpoise presence. This showed that there was a significant change in mean daily porpoise detections that coincided with the day the seismic survey began. Further, a GEEGLM showed that daily porpoise occurrence was significantly different before and after the seismic survey, with a positive relationship between porpoise occurrence and day before the survey and a negative relationship between porpoise occurrence and day after the seismic survey began. This study has provided important insights into effects of SBP surveys, commonly used for academic research as well as site characterisation for marine renewable energy (MRE) developments. Environmental impact assessments typically review and monitor activities during installation, operation and decommissioning of MRE developments; however, this study has highlighted that on-site activities conducted years before installation may cause significant disturbance to porpoises. It is important to consider the effects of these additional activities when estimating the full impacts of developments.

ANATOMY & PHYSIOLOGY

Revisiting a case of anencephaly in a neonate Indo-Pacific bottlenose dolphin with virtopsy

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Anencephaly is a deadly type of cephalic axial skeletal-neural dysraphic disorders with a multifactorial aetiology which compromises the formation of the neural folds, basicranium, and neurocranium. The lack of mesoderm closure during formation of the embryonic skeletal-neural axis compromises skeletal formation and consequently affects both skeletal and neural formation. In cetaceans, this fetal abnormality has been first reported in an Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) kept in captivity in Ocean Park Hong Kong in late 1991, in utero using transabdominal ultrasound during the gestation, and physical and general radiographic examination as a term stillbirth1. Main results included kyphosis of the cervical and lordosis of the thoracic vertebrae, narrowed triangular base, thickening of an undersized maxilla, cranial vault defect and absence of the bones constituting the cranial cavity (frontal, intra-parietal and parietal bones). The fetus was then fixed in formalin for further research. Recently, we scanned the specimen with 3D surface scanning (3DSS) using Artec Leo (Artec 3D, Luxembourg) and computed tomography (CT) using Philips 16-slice Brilliance Big Bore CT scanner (Philips Healthcare, Amsterdam, Netherlands), and conducted virtopsy (virtual necropsy) for a detailed analysis. Virtopsy confirmed the previous findings but also revealed that the component bones of the cranial cavity were not entirely absent but greatly reduced. Additionally, virtopsy showed a large lack of fusion between the two frontal bones that was not previously observed. No other skeletal abnormalities were found. In summary, this report described a case of anencephaly on a fetus of Indo-Pacific bottlenose dolphin that was diagnosed using ultrasound, and later confirmed using 3DSS, CT and virtopsy. Although ultrasound has been essential for diagnosing fetal anomalies, virtopsy provided a more accurate characterization of the bone malformations. This example highlighted the importance of using virtopsy as a tool to understand the nature and characteristics of pathologies in cetaceans accurately.

Marine macro-litter ingestion by deep diving cetaceans stranded in North-western Iberian Peninsula

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Marine litter is globally considered a threat to marine habitats and wildlife, being already documented in the digestive tracts of 58.1% of cetacean species with rates up to 31% in some populations. Among odontocetes, beaked whales and sperm whales have been suggested to be especially vulnerable to marine litter ingestion probably as a result of their foraging strategy at great depths. Considering the importance of stranding networks as a source of marine litter data, we assessed marine macro-litter ingestion and mortality (due to ingestion) rates of deep diving cetaceans of the Ziphiidae, Physeteridae and Kogiidae families, stranded in the north-western Iberian Peninsula. Of the 168 stranded individuals (Ziphiidae: 87; Physeteridae: 38; Kogiidae: 43), 58 (34.52%) were fully or partially necropsied and 27 (F.O%=46.55%) had ingested macro-litter mostly composed of plastics and fishing gear items, corresponding to a high overall ingestion rate for these deep diving cetacean species. In addition, of all the individuals ingesting macro-litter, 7.40% had lethal consequences, 74.07% sublethal and 18.52% minor consequences, suggesting litter ingestion as a significant cause of death for species that feed on or near the seafloor. Specifically, this study revealed macro-litter ingestion as a significant threat to Cuvier's beaked whales, sperm whales and pygmy sperm whales with high ingestion rates of 59.09% (n=13), 55.56% (n=5) and 27.78% (n=5), respectively. In this study period, only sperm whales presented lethal cases of marine litter ingestion (2 out of 5 analysed individuals), raising concerns about population-level impacts of this threat on this vulnerable species. More recently, lethal cases of marine litter ingestion were also detected in Galicia in a Cuvier's beaked whale. A continued monitoring of deep diving stranded cetaceans is essential to assess and better understand the threats to which these species are subjected, also contributing to the scientific requirements of international legal frameworks.

PCB, pesticides, PBDE and HBCDD in harbor porpoises from Swedish waters 2005-2019

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Blubber from 47 porpoises from Swedish waters collected between 2005 and 2019 were analyzed for 7 polychlorinated biphenyl congeners (PCBs), dichlorodiphenyltrichloroethane (DDT) and its metabolites, polybrominated diphenyl ethers (PBDEs) and hexabromocyclododecane (HBCDD). Twenty-three juveniles, thirteen adult males (4-19 years old) and eleven adult females (3-16 years old) were included in the study. The concentrations of 7CB were between 1 and 39 ppm lw. The results were compared with suggested threshold levels for adverse effect in marine mammals (9 ppm lw based on 25CBs). Even though only the predominant 7 CB congeners were analyzed within this study, eight of the adult males and three juveniles were at this level or above. All adult females had concentrations below 9 ppm lw (1-7 ppm lw). This can be explained by the fact that they were reproductively active. Most of them were pregnant and/or lactating and had the possibility to offload CBs to their calves. Similarly, this likely explains why three juveniles had concentrations above the threshold level and that the two porpoises with the highest concentrations of 7CBs (24 and 39 ppm lw) were older males (15-16 and 19 years old, respectively). Concentrations of sDDT (DDE+DDD+DDT) were between 0,6-13 ppm lw. DDT was found in all porpoises except one (0,07-2 ppm lw).

HBCDD and five brominated flame retardants were analyzed in blubber (BDE-47, -99, -100, -153 and -154). HBCDD was the most dominating compound (35-525 ppb lw), followed by BDE-47 (20-315 ppb lw). Compared to CBs and DDTs, the concentrations are very low. Approximately 96% of the sum sDDT+7CB+PBDEs+HBCD consisted of 7CBs and sDDT (62 and 34% respectively, based on mean values).

Despite banning of PCBs over 50 years ago, juvenile porpoises and adult males still have levels above the threshold and investigation of contaminant effects on health and reproduction are highly warranted.

Perfluoroalkyl substances in NW Mediterranean striped dolphins: Unveiling biomagnification and temporal shifts (1990–2021)

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Poly- and Perfluoroalkyl Substances (PFAS) represent a widely recognized class of environmental contaminants characterized by their toxicity, persistence, and capacity for biomagnification. The primary objective of this investigation is to ascertain the biomagnification rates of PFAS and to evaluate temporal trends in PFAS concentrations within sexually mature striped dolphins over the last three decades (1990–2021) within the North-Western Mediterranean Sea. Out of the 19 targeted PFAS, 13 and 17 were detected, respectively, in the digestive content and liver of the sampled dolphins. Concentrations in these tissues ranged from 43 to 1609 ng/g wet weight in digestive content and 254 to 7010 ng/g wet weight in liver. Notably, linear perfluorooctanesulfonic acid (n-PFOS) and perfluorooctanesulfonamide (FOSA) emerged as the most prevalent compounds in both sample types, consistently present across all specimens. Following these, perfluoroundecanoic acid (PFUnDA), perfluorotridecanoic acid (PFTrDA), and perfluorononanoic acid (PFNA) were also identified. Long-chain PFAS (i.e., PFCAs with a carbon chain length ≥ 7 and PFSAs with a carbon chain length ≥ 6) biomagnified more than short-chain PFAS, indicating a potential impact on the health of striped dolphins. Concentrations exceeding the Environmental Quality Standards established by the European Union in 2014 were observed in half of the digestive content samples, indicating potential health risks associated with the consumption of contaminated prey by striped dolphins. Temporal analyses revealed an increase in concentrations of most long-chain PFAS from 1990 to 2004–2009, followed by stabilization during 2014–2021. This stabilization phase may be attributed to compliance with national regulations and industrial initiatives implemented during this period. The persistent presence of prohibited PFAS observed in this study underscores the relevance of ongoing ecological risk assessments and the necessity to develop management strategies aimed at mitigating PFAS pollution within marine ecosystems.

Spatiotemporal Trends Spanning Three Decades Show Toxic Levels of Chemical Contaminants in Marine Mammals

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Despite their ban and restriction under the 2001 Stockholm Convention, persistent organic pollutants (POPs), are still widespread and pervasive in the environment. Releases of these toxic and bioaccumulative chemicals are ongoing and their contribution to population declines of marine mammals is of global concern. To safeguard their survival, it is of paramount importance to understand the effectiveness of mitigation measures. Using one of the world's largest marine mammals strandings datasets, we combine published and unpublished data to examine pollutant concentrations in eleven species that stranded along the coast of Great Britain to quantify spatiotemporal trends over three decades and identify species and regions where pollutants pose the greatest threat. We find that although levels of pollutants have decreased overall, there is significant spatial and taxonomic heterogeneity, such that pollutants remain a threat to biodiversity in several species and regions. Of individuals sampled within the most recent five years (2014-2018), 48% of individuals exhibited a concentration known to exceed toxic thresholds. Notably, pollutant concentrations are highest in long-lived, apex odontocetes (e.g., killer whales (*Orcinus orca*), bottlenose dolphins (*Tursiops truncatus*) and white-beaked dolphins (*Lagenorhynchus albirostris*) and were significantly higher in animals that stranded on more industrialised coastlines. At present concentrations, POPs are likely to be significantly impacting marine mammal health. We conclude that more effective international elimination and mitigation strategies are urgently needed to address this critical issue for global ocean health.

Bridging the gaps in the life-cycle of *Anisakis* spp. infecting oceanic cetaceans in the western Mediterranean

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Anisakis spp. are trophically-trasmitted nematodes that reproduce in cetaceans worldwide. Although their general life cycle is well-known, substantial gaps remain concerning the identity of hosts in the oceanic realm. In this study we condense data on *Anisakis* spp. in 6 oceanic cetaceans, and some of their key prey (lanternfish, Myctophidae), from waters off the central Spanish Mediterranean coast, based on surveys carried out by our research team from 1985 to date. Among stranded delphinids, anisakis were detected in 7 of 47 striped dolphins (Prevalence: 14.9%), *Stenella coeruleoalba*, but not in 17 Risso's dolphins, *Grampus griseus*, 6 common dolphins, *Delphinus delphis*, and 5 long-finned pilot whales, *Globicephala melas*. Furthermore, two stranded Cuvier's beaked whales, *Ziphius cavirostris*, harboured Type II larvae (P: 100%). Molecular identification of anisakis infecting striped dolphins rendered a single species, i.e., *A. pegreffii*. DNA metabarcoding from faeces of 9 sperm whales, *Physeter macrocephalus*, using ITS primers specific for nematodes detected anisakis in two of them (P: 22.2%), one being identified as A. physeteris. In lanternfish, anisakis were found in 18 of 221 *Notoscopelus elongatus* (P: 8.1%) and 3 of 122 *Lampanyctus crocodilus* (P: 2.5%), but in none of 26 *Benthosema glaciale*. Both *A. pegreffii* and *A. physeteris* were identified in lanternfish. Remarkably, the prevalence of *Anisakis* spp. observed in the study area is lower than that found for the same hosts in other areas, probably due to a lower density of cetaceans. This is the first investigation of the oceanic life-cycle of Anisakis spp. taking into account both paratenic and definitive hosts from the same study area. Our results suggest that lanternfish play an important role in the transmission of *A. pegreffii* to striped dolphins, and probably of *A. physeteris* to sperm whales through cephalopods.

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Parasitofauna of bottlenose dolphin (*Tursiops truncatus*) in North-Western Adriatic Sea

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The common bottlenose dolphin (*Tursiops truncatus*) is a coastal species regularly present in Adriatic Sea. Since cetaceans represent definitive hosts for numerous heteroxenous parasites, they are good indicators for the food chain stability and, more generally, the health of the marine environment. We report on the parasitofauna of 44 bottlenose dolphins from the North-Western Adriatic Sea, stranded in the period 2006-2023. The animals were submitted to necropsy followed by complete parasitological examination. Tissue samples (41/44) were extracted and analysed by real-time PCR to research *Toxoplasma gondii* DNA. Samples that tested positive for T. gondii were submitted to a genotyping analysis using 15 microsatellite. Overall, 9 different helminth taxa were identified, including nematodes (n=4), digeneans (n=3), cestodes (n=1) and acanthocephalans (n=1). The greatest diversity was found at gastrointestinal level, in which the digeneans *Pholeter gastrophilus*, and *Synthesium tursionis* had the highest prevalence (P) and abundance (A) (P=52.3%, A=65; P=50% A=31,3 respectively), followed by Braunina cordiformis (P=38,6% A=17,3). In few specimens, *Anisakis pegreffi* (Anisakidae) (2/44), *Diphyllobothrium stemmacephalum* (Diphyllobothriidae) (1/44) and *Corynosoma* sp. (Polymorphidae) (1/44) were recorded. The lungworms *Halocercus delphini* and *Stenurus ovatus* (Pseudaliidae) were detected with P=52,4% and 19,0% respectively (4 animals with mixed infections). *Crassicauda* sp. (Spirurida) was isolated from subcutaneous tissues in one specimen. The richness of the intestinal helminth fauna is lower than observed in the Western Mediterranean in the same host species. Lower diversity in cetacean species may account for part of this disparity, as helminth exchange rate, for generalist species, may be lower in the area compared with Western Mediterranean. Two T. gondii strains (2/3) have been successfully genotyped and correspond to European Type II lineage, confirming the predominance of this in the Mediterranean. Monitoring of parasitofauna in neritic and pelagic cetacean species can provide useful information on the parasitic diversity and the marine environment health.

Screening of Cetacean Morbillivirus, Avian Influenza Virus and Herpesvirus in the exhaled breath of humpback whales (*Megaptera novaeangliae*) along their North Atlantic migratory route

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Pathogen surveillance programs are vital to monitor wildlife health and to enable the early detection of novel pathogens. Despite this, baseline data is lacking regarding the pathogens that live free-ranging cetaceans are exposed to in the North Atlantic, and how their combined effects with other stressors, such as pollutants, may impact their health. Knowledge on their current health status is critical to understand how these species will respond to progressively higher anthropogenic pressures in the future. In this study, we will explore the use of non-invasive techniques to sample one of the most charismatic species occurring in northern Norway - the humpback whale (*Megaptera novaeangliae*) - with the aim of establishing the basis for the creation of a long term non-invasive health surveillance program in cetaceans in this region. Cetacean Morbillivirus (CeMV), Avian Influenza Virus (AIV) and herpesvirus (HV) are important pathogens currently deleteriously affecting marine mammal populations worldwide. These pathogens have been linked with known cases of debilitating neurological disease, mortality and mass strandings in cetaceans and other marine mammals. Using an uncrewed aerial vehicle (UAV), 60 humpback whale exhaled breath samples were collected along their North Atlantic migratory route, including: 1) the feeding grounds in Husavik (Iceland) during summer 2022 (n= 19), 2) the stopover feeding grounds in Skjervøy, Norway, during the winters of 2021, 2022 and 2023 (n= 32); and 3) the breeding grounds in Sal Rei, Cape Verde, during spring 2023 (n= 9). These samples will be screened for CeMV, AIV and HV, via PCR.

TB or not TB? A case of suspected *Mycobacterium avium paratuberculosis* (MAP) in a Risso's dolphin (*Grampus griseus*)

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There are few reports of *Mycobacterium* sp. infections in marine mammals, and most are from pinnipeds, both captive and free ranging, from Europe, Australasia and South America. Most infections were due to *M. pinnipedii*, but single cases of *M. bovis* and *M. avium* subsp. *avium* infections occurred in the UK. Mycobacterium sp. infections in cetaceans are very rare and involve *M. marinum*, *M. chelonae* or *M. abscessus* causing respiratory or skin infections. This is the first report of a Mycobacterial infection in a free ranging Risso's dolphin (*Grampus griseus*). Histologically, similar to cattle with Johne's Disease due to *Mycobacterium avium paratuberculosis* (MAP) infection, very large numbers of macrophages with abundant cytoplasm were present within the lamina propria of the intestine of this juvenile male Risso's dolphin, and exceptionally large numbers of Ziehl Neelsen stain-positive coccobacilli were present within the cytoplasm of these macrophages. The animal was in poor nutritional condition similar to the clinical signs seen in in cattle. DNA extracted from formalin-fixed, paraffin-wax embedded intestinal tissue tested positive, by qPCR, for the Mycobacterium avium complex (IS1311) and for two MAP-specific targets (IS900 and F57). Further sequencing is planned for species confirmation. This represents a unique case, involving a fastidious slow growing organism that requires specialist media for culture and is not possible to recover during routine bacterial examination as diagnosis relies on specific molecular techniques. This is likely one reason for this organism not being reported from cetaceans previously. Intestine is not routinely sampled as part of the standard PM protocol in Europe. This report shows that intestine should be collected and *Mycobacterium avium paratuberculosis* (MAP) infection should be considered a differential diagnosis in cases of chronic emaciation. More research is necessary to determine how this organism is transmitted in cetaceans, perhaps the faecal-oral route as in cattle?

Acoustic characterization of long-finned pilot whales' (*Globicephala melas*) pulsed calls from the North-western Mediterranean Sea

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The long-finned pilot whale is a highly social species, with an extremely complex and structurally flexible vocal repertoire, which includes variable call repetitions and combinations. To better describe the structure of the pilot whale's vocal repertoire in the Mediterranean Sea, we focused on 2120 pulsed calls (PC) (i.e., rapidly produced impulsive sounds, with distinct tonal properties due to the high pulse repetition rates), identified in 34 recordings collected between 2011 and 2022 in the north-western portion of the Pelagos Sanctuary. High-quality pulsed calls were analysed with Raven-Pro software by extracting maximum and minimum frequency, frequency range and duration. The number of segments, and the number and type (overall shape) of elements composing the sound, were used for PC classification and cataloguing. The PC emission rates per type were calculated as the number of calls over the total duration of the recordings. A first-order Markov chain was used to investigate the probability of transition between different calls. PC minimum and maximum frequency averaged 1±8 KHz and 18.5±8 KHz, respectively, with a frequency range of 17±8 KHz, and a duration of 0.9±0.4 seconds. The number of elements and segments averaged 3 (max 12) and 1 (max 6), respectively. The PC emission rate averaged 1.5 per minute. Seven PC element types were identified, yielding a catalogue of 33 discrete calls, with both simple (<2 element types) and complex (>2 element types) structures. Although different combinations of PC types were observed, the transition matrix revealed that calls of the same type are most frequently emitted in sequence. Literature suggests that repetitions could serve to maintain contact and cohesion, but a closer investigation of their function is still ongoing. This study provides a baseline for further investigations, contributing to increase the knowledge on the acoustic repertoire of this endangered subpopulation, which is still poorly known.

Look Who's Talking": new insights into bottlenose dolphins' sociality gained from signature whistles

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Individual recognition through signature whistles (SWs) plays a crucial role in the functioning of large "fission-fusion" bottlenose dolphin (*Tursiops truncatus*, BD) societies. As SWs are thought to be the result of social learning and adaptive processes, acoustic similarities/variations, and associations between SWs, may reflect differentiation patterns at between-individual, population and species levels. With the aim of filling knowledge gaps on BD social complexity, this work investigates BD visual and acoustic associations patterns in a Mediterranean population (Central Tyrrhenian Sea, Italy), comparing photo-ID catalogue and SWs data collected between 2017 and 2023. The half-weight index of dyadic associations, network modularity and metrics were measured in SOCPROG, and sociograms displaying network relationships were built in Gephi. SWs were attributed to known individuals in the photo-ID catalogue through a custom R code developed on capture-recapture histories, then using this information to measure social bond strength and acoustic similarities between matched individuals/SWs. The SWs-based network successfully reconstructs a well-connected BD society, exhibiting both fluid and stable associations (HWIave=0.08±0.03; HWImax=0.42±0.16), also highlighting the presence of two SWs with high eigenvector centrality scores, belonging to the presumed "decision-makers" and/or "leaders" in the population. SWs are found most likely to be exchanged and share similar frequency modulation patterns when belonging to strongly connected individuals. Network modularity (Q=0.34) also indicates the population might be divided into clusters of individuals based on affiliations between their SWs. Such evidences definitely support SWs as key drivers of BD social bonding and population structuring, suggesting them as proxies for identifying conservation units. In addition, SWs usage in mark-recapture studies appears a promising perspective, to estimate population density and pinpoint alterations caused by the increasing anthropogenic pressures on the marine environment.

Bottlenose dolphin mothers modify signature whistles in the presence of their own calves

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Adult humans communicating with children often modify their speech to include higher pitches and wider pitch ranges, a phenomenon known as child-directed communication (CDC) or "motherese." Although CDC occurs across diverse human cultures, evidence in nonhuman species is scarce. Like humans, bottlenose dolphins (*Tursiops truncatus*) have long-term mother–offspring bonds and are capable of vocal production learning, both of which are likely important for CDC. In addition, individually distinctive signature whistles provide an opportunity to quantify changes in the same vocalizations produced in the presence or absence of calves, which is aligned with how CDC occurs in humans (i.e., using the same words but with modifications when talking to children). We explored whether bottlenose dolphins in the long-term resident Sarasota Bay, USA, community use CDC, by comparing whistles produced by 19 females both with and without calves in different years. Dolphins were recorded during brief catch-and-release health assessments between 1984 and 2018. By measuring parameters of 20 randomly selected signature whistles from each female with and without a calf, we discovered that dolphin females modify their signature whistles to include higher maximum frequencies and wider frequency ranges when recorded with their dependent calves. These changes are similar to those in human caregivers communicating with children. Our results provide the first evidence in a nonhuman mammal for changes in the same vocalizations when produced in the presence vs. absence of offspring, and thus are suggestive of convergent evolution of CDC in humans and bottlenose dolphins. If similar selective pressures led to vocal modifications in both species, CDC in dolphins may play a role in enhancing attention, bonding, and vocal learning, as it does in humans. Our results contribute to the expanding body of evidence affirming dolphins as a relevant animal model for investigating the evolution of vocal learning and language.

Can you hear me? Playback experiment highlights porpoise detection range differences between commonly used PAM devices: C-POD, F-POD, and SoundTrap

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Passive acoustic monitoring (PAM) is a valuable tool for monitoring acoustically active small cetaceans such as the harbour porpoise (*Phocoena phocoena*), with a range of devices used across studies. However, there is a need to compare detection probability and effective detection radius/area (EDR/EDA) for devices to ensure comparability of findings between studies. Using playback experiments, we determine detection probability and EDR/EDA for co-deployed C-PODs (Cetacean POrpoise Detectors), F-PODs (Full waveform capture POD) and SoundTraps. We conducted playbacks of harbour porpoise vocalisations at a range of distances from moored PAM devices. While the effect of distance to device was consistent across all devices, other variables that influenced the detection probability of playbacks differed between the devices. Source level was found to influence the detection probability of playbacks for SoundTrap and C-POD, and there was also a significant difference between transects for the C-POD, potentially due to different ambient noise conditions. The maximum detection distance of the playbacks for the SoundTrap and the F-POD was between 400 - 500m, and EDR was estimated at 314m (EDA 0.311 km2) and 284m (EDA 0.181 km2), respectively. The maximum detection distance for the C-POD was lower, at 300 - 400m, and an EDR of 218m (EDA 0.150 km2). A lower EDR was calculated for buzzes compared to clicks across devices, suggesting that time spent foraging may be underestimated in some PAM studies. The results of this study highlight how detection ranges may differ across commonly used PAM devices. EDR/EDA is an important prerequisite for PAM-derived density and abundance estimates. As such, understanding how devices differ is essential for comparing studies and appropriate planning of acoustic monitoring projects, particularly where estimates of abundance are a key goal.

IPI distribution as a tool for passive acoustic monitoring of well-known sperm whale units

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Sperm whales (*Physeter macrocephalus*) use broadband echolocation clicks to navigate and forage in the dark, deep oceans. The clicks are characterized by a multi-pulse structure with an intense first pulse followed by additional pulses of decaying amplitude. The inter-pulse interval (IPI) between the first pulse and the following one is correlated with the size of the spermaceti organ and thereby allometrically related to body size. In some circumstances, the IPI has been used to distinguish between well-known individuals. In the units studied off Dominica, the group composition is relatively stable and consists of females of various ages and sizes who usually have different IPIs that can distinguish between them. Accordingly, the IPI distributions of females in a specific unit may be characteristic and allow for discrimination between well-studied units. Photo-identified individuals from known units were recorded during the beginning of their dives (on-axis, high-quality clicks) along the west coast of Dominica in 2023. Individual IPIs were extracted from these recordings to produce ground-truthed unit-level distributions of IPIs. Additionally, photo-identified units were recorded systematically using far-field PAM recordings for comparison. Both types were achieved while only the unit of interest was in the detection range. Four units were recorded, resulting in 118 recordings (30727 clicks) of individual identified whales and 93 systematic recordings (45460 clicks) of identified units. Comparison between distributions from the two types of recordings using Kullback-Leibler divergence reveals that IPI distributions within the same sperm whale units exhibit an average KL Divergence of 0.24, suggesting a moderate level of dissimilarity. In contrast, the KL Divergence between IPI distributions from different units is notably higher at 0.54, which suggests a larger distinction between units than within. Thus supporting the idea that IPI distributions can be used as a passive acoustic tool to distinguish between sperm whale social units.

Quantitative within-individual signature whistle variation in bottlenose dolphins

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With growing human activities and their potential negative impacts on marine ecosystems, there is a pressing need to monitor wildlife populations to ensure sustainable marine development. New innovations in deep learning can open up new opportunities for acoustic monitoring, such as detecting individual-specific acoustic signals. However, deep learning often is data-limited and benefits from augmentation techniques that subtly change data to reflect real life conditions. But this process is challenging without knowledge of the inherent biological variability of signals. To close this knowledge gap, we aimed to quantify within-animal variation and test for contextual differences in the individually distinctive signature whistles of common bottlenose dolphins (*Tursiops truncatus*). We recorded signature whistles from members of a long-term resident community of dolphins in waters near Sarasota Bay, Florida, USA during catch-and-release health assessment sessions, and with sound-recording tags after release. We extracted individual time-frequency contours and used a generalized mixed-effects framework to investigate the effects of state (temporarily restrained or free-ranging), age class (calf or adult), and sex (male or female) on contour parameters, including fundamental frequency and duration of discrete elements called “loops”. Within-individual variation for 15 dolphins was lower for contour frequency (+15 % symmetric variation, 95% interpercentile range) compared to loop duration (+44 % symmetric variation, 95% interpercentile range). We did not find any differences in contour frequency parameters or duration between contexts, but both mean and maximum inter-loop intervals were shorter when dolphins were temporarily restrained. Our results indicate that fundamental frequency contour parameters of bottlenose dolphin signature whistles are fairly stable across contexts, making these signals highly suitable for individual-based acoustic monitoring. By improving our understanding of biological variation in call parameters, this research can inform data augmentation techniques that enable individual-based bottlenose dolphin acoustic monitoring using signature whistles, including remote tracking where listening station networks exist.

NEW TECHNOLOGIES

KM3NeT as an underwater acoustic monitoring infrastructure

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The KM3NeT deep-sea neutrino telescope, currently in the construction phase is already collecting data, deploys an array of optical sensors installed aboard cabled mooring lines anchored at the sea bed (Detection Units, DUs) in two different cabled infrastructures sites in the Mediterranean sea: ARCA, situated 90 km off the coast of Capo Passero at a depth of 3500 m (equipped today with 28 DUs out of 230), and ORCA, located 40 km off the coast of Toulon at a depth of 2500 m (equipped today with 18 DUs out of 115). To monitor the position of optical sensors installed in these DUs, moving under the effect of ocean currents, a novel acoustic positioning system has been developed. This system uses a phased array of large-frequency-band (10 Hz-70 kHz) digital hydrophones in each DU base. The raw acoustic data is transmitted via optic-fiber cables to on-shore computing farms for analysis, allowing real-time data acquisition and study. The potential of KM3NeT hydrophones to function as Passive Acoustic Monitoring sensors represents a significant milestone, indicating its possible application as a multidisciplinary marine science laboratory. This study supports utilizing KM3NeT acoustic receivers for such purposes, given the extensive hydrophone array network in the depths of the Mediterranean Sea, enabling real-time tracking of detected sources, such as cetaceans. This work introduces KM3NeT as a unique underwater acoustic monitoring infrastructure and proposes relevant practices for marine mammal monitoring and the evaluation of environmental noise levels. The utilization of KM3NeT in this capacity is of considerable interest to the scientific community and it could be used to evaluate the indicators for underwater noise established by the European Marine Strategy Framework Directive.

Playing hide and seek with harbour porpoises: evaluating theodolites and drones as land-based visual observation methods

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Monitoring cetaceans in their natural habitat can be challenging, as they spend large amounts of their time under the water and can present unpredictable movement patterns. This applies particularly to the harbour porpoises, among the smallest cetaceans, that tend to stay near the coast, surfacing briefly to breathe and having a low silhouette. While their observation range is small and limited to the immediate vicinity, land-based observation stations are a popular method as they allow continuous monitoring of an area at relatively low cost. Theodolites and drones are both benign approaches which are especially attractive in behavioural work as they do not directly interfere with the animals and do not alter their behaviour when used properly. In this study, we used these two visual observation methods simultaneously and compared them to detect their shortages and compatibilities while studying the elusive harbour porpoise (*Phocoena phocoena*) in the western Baltic Sea. Geographical coordinates of harbour porpoise sightings and routings can be obtained with both methods, but on different resolution scales, as drones allow following the animals under the water, while theodolites solely allow collecting data of the animals at the surface. The theodolite is a weather resistant tool, with an extended battery life and allows fast processing of the data. It is nevertheless limited to surface observations and requires a high vantage point. Conversely, drones allow a broader range and at the same time more detailed behaviour observation but are weather-sensitive and constrained by battery capacity, requiring a charging infrastructure, especially for longer lasting observations. Analyzing drone footage is further time-consuming, affecting data processing efficiency. Furthermore, the success of finding harbour porpoises with the drones, limits the amount of effective data to work with. In summary, both methods show advantages and disadvantages and should be selected based on the specific research questions.

To track or not to track – CetTrack: a new open-source tool to track animals using cheap drone footage

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Affordable drones are becoming increasingly available to researchers as well as to the general public and present a huge potential for remote areas and specifically targeted research questions. Currently, these drones are used for descriptive analysis, including general behavioural studies and blow sampling are known use scenarios. However, there are many studies for which knowing the location of the observed animal(s) is of extreme importance. Examples are controlled exposure experiments and bycatch prevention studies where animals react to a certain anthropogenic impact. Moreover, accurate position or a relative position to another animal are necessary for studies on close associations between animals, for instance in mating behaviour and mother-calf relationships. Here, we present the open-source software "CetTrack" developed specifically to estimate the location of the target animals from footage collected with affordable drones. It was developed in Matlab 2023a and compiled for use on any Windows PC as a standalone tool that does not require a Matlab licence. CetTrack reads in the flightlog data generated from AirData (www.airdata.com) for DJI drones including Mini2, Air2s and Mavic3 Classic. The flightlog is synchronised to the video frames, and, through gimbal angle and flight altitude, it calculates the coordinates of the point the user selects in the video footage, e.g., the head of an animal. Preliminary results indicate an accuracy of +/- 2 m in absolute location and up to +/- 3 cm in relative location (comparing one object in the frame to another). The analysed and presented footage includes mating, nursing and several reactions to nets of harbour porpoises. Future applications include energetics costs for certain types of behaviours, feeding techniques, group interactions, and relative size of individuals within a group. We believe CetTrack will provide researchers a robust tool to further the knowledge of their study species.

Optimizing environmental DNA field sampling and laboratory protocols across a multinational initiative to detect and quantify the presence of whales in the North-East Atlantic and Mediterranean Sea

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Environmental DNA (eDNA) - trace genomic material shed by organisms into their environment - offers a non-invasive approach for monitoring marine biodiversity. However, large-scale eDNA-based research still faces challenges including unrefined sampling protocols as well as ensuring consistent, high-quality molecular analyses across laboratories. The eWHALE initiative, a multinational Biodiversa+ project, aims to address these challenges by optimizing field sampling and laboratory protocols for cetacean monitoring efforts. In summer 2023, eWHALE partners collected water samples throughout the North-East Atlantic and Mediterranean near *Physeter macrocephalus*, *Megaptera novaeangliae*, *Balaenoptera physalus*, and *Balaenoptera acutorostrata*. During the course of the season, various sampling parameters were systematically modified: a) collection point (flukeprint or breach site), b) timing of post-whale presence, c) eDNA filter type, d) sampled water volume. Prior to subsequent analyses, a ring test was conducted to identify the comparability of laboratory protocols among the four international partners. After independent extraction of a subset of samples by each laboratory, total DNA concentrations were measured via Qubit fluorometry and then target DNA quantification was carried out via species-specific qPCR. Subsequently, all field-collected samples were analyzed. Results from the ring test indicated comparable performance among laboratories and no bias towards lysis and extraction methods. Regarding field sampling optimization, similar quantities of target species DNA were obtained from

samples collected at both the flukeprint and breach site. Higher volumes of filtered water significantly increased eDNA quantities although there was a trade-off between filter pore size and water volume. Also, higher quantities of cetacean DNA were detected in samples collected immediately after a whale's presence although traces were still detectable 5 minutes later. These insights will guide future eDNA-based cetacean monitoring efforts and advance eDNA-based research such as identifying the intraspecific genetic diversity and feeding ecology of marine megafauna; a pivotal step towards advancing global cetacean research and conservation.

ECOLOGY & HABITAT USE

Beyond borders: investigating Cuvier's beaked whale (*Ziphius cavirostris*) distribution and habitat suitability at the Southeastern Edge of the Pelagos Sanctuary

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Cuvier's beaked whale (*Ziphius cavirostris*) stands as the sole member of the Ziphiidae family regularly sighted in the Mediterranean Sea. Despite various studies confirming the species' regular

presence in this region, the precise boundaries of its distribution within the basin remain undefined. This elusive species holds significant interest within the Research and Citizen Science project "Le Vele del Panda" (WWF Italy). Between 2020 and 2023, a total of 90 whale watching research cruises (431 days of effort) were conducted in the Tyrrhenian and Ligurian Sea. The data collected during these surveys has been analysed in this study to investigate the presence and distribution of Cuvier's beaked whales. Throughout these surveys, photographs and GPS locations were documented for each sighting, along with observations of surface behavior and group size. The analysis encompassed a total of 22 sightings of Cuvier's beaked whales (46 individuals, with photo-ID data available for 23). The majority of these sightings (n=16, involving 37 individuals) were recorded along the northern edges of the Tyrrhennian canyon system, approximately 7 nautical miles southwest of Giglio Island. In order to assess the interplay between sighting distribution, environmental traits, and human impact, a generalised additive model (GAM) was used to determine the current habitat suitability for *Ziphius cavirostris* within the study area. The results reveal a previously unstudied key hotspot area for the species situated along the southern border of the Pelagos Sanctuary, filling a critical knowledge gap concerning the current distribution of Cuvier's beaked whales. This study underscores the potential role of Citizen Science projects in the long-term monitoring of such an elusive cetacean species in the Mediterranean Sea to promote its protection and conservation.

Foraging habitats of six species of odontocetes inferred through stable isotopes analysis

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Research on cetaceans' trophic ecology has historically relied on stomach contents analysis of either hunted, by-caught, or stranded individuals. However, this analysis presents disadvantages due to the differential digestibility rates in prey items, the assessment of diet over a short timescale, or the sampling of sick or debilitated individuals. Therefore, stable isotopes have been used to investigate the trophic ecology of cetaceans. In this study, the foraging habitats of six species of odontocetes were investigated in the Madeira Archipelago, comparing their δ13C and δ15N values with those of their potential prey. A total of 165 biopsy samples were collected from short-beaked common dolphins *Delphinus delphis*, Atlantic spotted dolphins *Stenella frontalis*, common bottlenose dolphins *Tursiops truncatus*, short-finned pilot whales *Globicephala macrorhynchus*, false killer whales *Pseudorca crassidens*, and sperm whales *Physeter macrocephalus*, between 2017 and 2019. After adjustment of the trophic level, the isotopic values of each cetacean species were plotted with the prey groups to potentially infer the predator's foraging habitats. The common dolphin demonstrates a close relationship with epipelagic and benthopelagic small fishes and demersal and mesopelagic squids, with some individuals feeding in more 15N-enriched habitats. The foraging habitats of spotted and bottlenose dolphins were similar to those of demersal and mesopelagic squids and small pelagic fishes. The false killer, pilot, and sperm whales presented similar foraging habitats to tuna fishes, with pilot whales also showing proximity to mesopelagic squids. Since the observation of feeding events is, in many cases, not possible (as in deep-diving species) or challenging (as in oceanic species), the use of stable isotopes in predators and their potential prey provides a valuable evaluation of the trophic ecology of cetaceans. This information is essential to detect anthropogenic impacts, such as interactions with fisheries and contaminants, and establish preventive conservation measures.

Geographical distribution of two fin whale (*Balaenoptera physalus*) populations across the Weddell Sea

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Fin whales (*Balaenoptera physalus*) are currently classified as an endangered species and knowledge on this species is scarce in the Southern Ocean. Passive acoustic monitoring presents an opportunity to investigate their vocal activity and behavior, providing insights into their distribution, abundance and population structure. Fin whales are known to produce 20Hz-pulses, characterized as low-frequency, high-intensity pulses, generated as both single vocalizations and as structured song sequences. These typical fin whale 20Hz-pulses are often accompanied by a simultaneous higher frequency (HF) component. This can be centered around different frequencies, likely representing population specific frequency shifts. Within the Southern Ocean, six distinct HF components have been identified so far, with two present in the Atlantic Sector of the Southern Ocean (ASSO) which are centered around 86Hz and 99Hz. This study aims to describe the acoustic presence and distribution of (at least) two fin whale populations by automatically analyzing passive acoustic data, from 2013 of 10 recording positions throughout the ASSO. While the overall low frequency (20Hz) chorus presence shows a seasonal pattern with an increase in chorus presence starting in March and a continuous presence extending until the end of October, show both high frequency choruses (86 and 99Hz) a shorter seasonal pattern from April to July. Our recordings reveal that the 86Hz HF component is only recorded in the west of the ASSO, centred around the Western Antarctic Peninsula, while the 99Hz HF component was recorded at eight recording positions throughout the ASSO with highest occurrence in recordings along the Greenwich Meridian. While our preliminary findings indicate geographical separation of populations, as well as possible important key habitats, additional analyses such as sound propagation modelling are planned to gain a comprehensive understanding of the acoustic distribution, population boundaries and possible migratory patterns of the two fin whale populations in the ASSO.

ECOLOGICAL MODELLING

A matter of scale: identifying the best spatial and temporal scales of environmental variables to model the distribution of harbour porpoise

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The importance of scale when investigating ecological patterns and processes is recognised across many species. In marine ecosystems, the processes that drive species distribution have a hierarchical structure over multiple nested spatial and temporal scales. Hence, multi-scale approaches should be considered when developing accurate distribution models to identify key habitats, particularly for populations of conservation concern. Here, we propose a modelling procedure to identify the best spatial and temporal scale for each modelled and remotely sensed oceanographic variable to model harbour porpoise (*Phocoena phocoena*) distribution within the Irish EEZ. Harbour porpoise sightings were recorded during dedicated line-transect aerial surveys conducted in the summer of 2016, 2021 and 2022. Binary generalised additive models were used to assess the relationships between porpoise presence and oceanographic variables at different spatial (5-40 km) and temporal (daily, monthly and across survey period) scales. Selected variables included sea surface temperature, thermal fronts, chlorophyll-a, sea surface height, mixed layer depth and salinity. A total of 30,514 km was covered on-effort with 216 harbour porpoise sightings recorded. Overall, the best spatial scale corresponded to the coarsest resolution considered in this study (40 km), while porpoise presence showed stronger association with oceanographic variables summarised at a longer temporal scale. Habitat models including covariates at coarse spatial and temporal scales may better reflect the processes driving availability and abundance of resources at these large scales. These findings support the hypothesis that a multi-scale approach should be applied when investigating species distribution. Identifying suitable spatial and temporal scale would improve the functional interpretation of the underlying relationships, particularly when studying how a small marine predator interacts with its environment and responds to climate and ecosystem changes.

Seasonal dynamics and environmental preferences of Cetacean behaviours in the Gulf of Taranto (Northen Ionian Sea) for informed management strategies

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The Gulf of Taranto (Northern Ionian Sea) is a complex yet threatened environmental context in the Central-eastern Mediterranean Sea. It serves as a biodiversity hotspot for cetaceans, demonstrating its relevance for the conservation of these priority species. Particularly, over the past 15 years, this area has been described to be strategic for safeguarding cetaceans, hosting several critical habitats. However, the Gulf of Taranto is threatened by various human activities such as overfishing, pollution and global warming, posing risks to the long-term survival of here living dolphins and whales. Effectively managing vulnerable cetacean populations requires a deep understanding of seasonal variability in species distribution, behaviour, habitat utilization and environmental preferences. Dolphins, for instance, often exhibit shifts in distribution patterns in response to seasonal variations in oceanographic conditions. This study aims to enhance comprehension of the seasonality of behavioural patterns and the relationship between group behaviours and the bio-geo-chemical environment of vulnerable cetacean populations in the study area. To achieve this, the study utilizes a dataset comprising group behavioural observations of three cetacean species (*Grampus griseus*, *Stenella coeruleoalba*, *Tursiops truncatus*) collected between 2016 and 2023 during standardized surveys. The dataset also includes group size, together with twenty environmental variables from Copernicus and EMODnet-bathymetry dataset. The research employs a Chi-squared test to investigate whether seasonality influences the frequency of the four cetacean group behaviours for each species. The Dunn's test is then used to assess potential differences in behaviours related to environmental and social variables. Thereby, the influence of seasonality on the major characterizing variables of a specific behaviour (e.g., feeding in Risso's dolphin) is tested using the Dunn's test. This study seeks to give a contribution to the implementation of seasonal-targeted management of marine resources, aiming to enhance cetacean conservation and transition towards improved sustainable conditions.

BEHAVIOUR

Foraging behavior of Chilean blue whales (*Balaenoptera musculus chilensis*) in the Chiloense Ecoregion

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This study was conducted to investigate the underwater feeding behavior of Chilean blue whale (*Balaenoptera musculus chilensis*) in the northern Chilean Patagonia region, which is a key feeding ground and a nursery area for this subspecies. Until 10 years ago, the feeding ecology of this subspecies has been studied by visual monitoring and through anatomical dissections, limiting direct behavioral analyses and the study of interaction with their prey. During six separate research cruises (2014-2019) we deployed 28 sound and movement recording tags (DTAGs) on Chilean blue whales, attached by suction cups, to measure their fine-scale feeding behavior. In addition, from 2016 to 2019, prey density and distribution were simultaneously recorded with tag data utilizing a scientific echosounder. Hundreds of feeding events were detected from movement sensing data throughout day and night hours (duration of more than 190h). Chilean blue whales exhibited both shallow and deep foraging events utilizing different strategies in response to changing conditions of light and prey distribution/density, with foraging dives recorded continuously for the whole duration of the deployments. However, whales showed a higher feeding rate during nighttime on shallow and dispersed krill, but a higher rate of foraging events per dive during deep dives on dense krill patches. The results also showed less energetically costly maneuvers when foraging near the surface, with lower values of pitch and speed. Both strategies adopted by the whales confirm the optimal foraging theory by minimizing costs associated with feeding while simultaneously maximizing benefits. These results provide valuable insights into the behavioral ecology of Chilean blue whales to promote specific conservation plans in the Chiloense Ecoregion. This area is facing an increase of marine traffic, putting whales at higher risk of ship collision especially during nighttime.

Marine mammal feeding strategies in a warming Arctic

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The current warming trajectory of the Arctic points at important physical and structural ecosystem changes in the North Polar Basin and adjacent waters. Even if a seasonally ice-free Arctic Ocean has yet to be observed, the qualitative and quantitative degradation of sea ice is unequivocal. The Atlantic inflow increases, and the pelagic ecosystem is shifting towards a Boreal regime, a phenomenon otherwise known as Atlantification. The modified spatial and temporal availability, quantity and quality of potential prey items, coupled with changes in the geographical extent and physical propertied of sea ice have effects on the foraging possibilities of Arctic marine mammals. We reviewed the literature on foraging ecology and behavior of selected Arctic marine mammals, changes in prey distribution and abundance and reported observations indicating climate-related changes in feeding strategies. The most striking alternative prey and capture behavior has been observed in polar bears targeting swimming reindeer in a Svalbard fjord. Although only inferred by the unexpected location of few observations, walruses and bearded seals in the deep Amundsen Basin must target other prey than benthic invertebrates. We did not find any reported observations on changes in feeding strategies for other pinniped or cetacean species. Evolutionary history of some species such as beluga whales and narwhals indicate that warmer periods during past climate fluctuations have resulted with population declines. It is thus likely that the present warming will have similar effects. It is also likely that the projected ice-free summers in the Arctic Ocean, and the consequent increased accessibility of the area, will result in unusual observations for typical Arctic but also other marine mammal species.

Movement patterns and connectivity of the rough-toothed dolphin, *Steno bredanensis*, in the northeast Atlantic

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Understanding the ecological drivers of a species' movement patterns can provide insight into the environmental factors influencing their behavior and population dynamics. The rough-toothed dolphin (*Steno bredanensis*) inhabits a range of environments from shallow coastal waters to deep pelagic habitats, demonstrating varied site fidelity and dispersal patterns across their range. Previous satellite tracking has revealed a degree of site fidelity in the species, challenging the prevailing belief of their strictly pelagic nature. This study utilized satellite telemetry and photo-ID to investigate whether *S. bredanensis* located near oceanic islands in the northeast Atlantic constitute separate, resident populations or are part of larger, nomadic groups. From 2021 to 2023, five individuals were tagged off Madeira Island, Portugal. Tag retention varied significantly, ranging from 14 to 201 days (mean duration: 73.4 days), with individuals covering distances from 1,639 km to 16,135 km. The total data transmission duration for all five individuals was 367 days. A southward winter migration to the coastal waters of Western Sahara and Mauritania, and transient summer movements towards the Azores were observed. Photo-ID analysis revealed 14 matches between Madeira Island and Canary Islands catalogues, and 13 intra-archipelago matches within the Canary Islands. No matches were found between the Azores and other archipelagos. Overall, our results, while preliminary, suggest that each tagged *S. bredanensis* displayed similar seasonal movement trends, yet exhibited more intricate spatial movements potentially influenced by oceanic topography and other environmental parameters. Given the species' IUCN classification as 'Near Threatened', this research provides critical insights into the residency and migratory behavior of *S. bredanensis*, contributing to the conservation and management strategies for this species in the face of increasing anthropogenic threats.

Small odontocetes behavioural response to vessel traffic in the Northern Ionian Sea (Central eastern Mediterranean Sea)

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The Northern Ionian Sea (Central eastern Mediterranean Sea) is characterized by an intense merchant and passenger transport, the presence of a Navy harbour as well as fishing and recreational activities. Nevertheless, it hosts several cetaceans' species, and it has been demonstrated as a critical habitat for *Stenella coeruleoalba*, *Tursiops truncatus* and *Grampus griseus*. However, the effects of the vessel traffic on these populations are still poor understood. This study analysed small odontocetes behavioural response to the presence of different vessel categories (fishing, research and touristic). When multiple vessel types were present simultaneously, the category was labelled as "more vessel". Eleven types of events were used to classify odontocetes behavioural response in positive (the group stops its activity to approach the vessel), negative (the group changes its activity, moving away from the vessel) and indifference (the group continues its activity without notable change). Specifically, 2 events characterize the positive response (bowride, surf boat-wake), 8 negative (change direction, pass underwater, less-compact formation, more-compact formation, leave speed, leave calm, dive, aggressive behaviour) and 1 indifference (no change). Moreover, data on the predominant behaviour of focal-group (feeding, resting, socializing, travelling) and on the type of vessel approaching the group, within 200 m radius, were recorded in 3-minute-long lasting samples. A total of 239 samples were collected during 71 daily-surveys carried out in spring-summer 2023. A descriptive statistical analysis was conducted to evaluate odontocetes behavioural response considering each vessel category, each predominant behaviour and each observed species. Moreover, the percentage of occurrence of each event characterizing the observed behavioural response was calculated. Preliminary results stressed the importance of improving the data collection related to this field of research in order to implement proper mitigation measures, reduce impacts and avoid long term effects on cetacean populations in the area.

ABSTRACTS – POSTERS
(Alphabetical order)

9.5 kg ambergris coprolite linked to a lethal septicemia in a stranded male Sperm Whale in La Palma (Canary Islands)

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On the 21st of May 2023, a dead adult male sperm whale (*Physeter macrocephalus*) of around 13m in length and around 18 tons (Lockyer C, 1976) was reportedly stranded at Playa Los Nogales, La Palma, Canary Islands, Spain. The animal showed no external injuries and a very fresh condition. Necropsy was done 48hpm later. The most visible gross pathological findings were identified in the left side of the ventricular heart cavity, where marked multifocal hemorrhagic areas could be easily distinguished from the non-hemorrhagic tissue. These hemorrhagic areas extended locally from the epicardial surface deep into the myocardial muscles. These findings were especially notable in the papillary muscles of the left ventricle, and not so evident by gross examination in the myocardium of the right ventricle. The gastric content was not abundant, with some squid beaks and fish lenses as part of the collected content. A 5 cm metal fishing hook was also found among the gastric content. There was a light brown creamy content in the duodenum. The colon was extremely dilated. This area was estimated to be located 1 to 2 meters cranial to the anus. In its lumen and close to the rectum, a 9.5 Kg solid coprolite with irregular external morphology, putrid smell, and around 50 cm of diameter was found, partially or entirely obstructing the intestinal lumen. Microbiological analysis identified the presence of *Edwardsiella tarda* in isolates from heart, blood, lungs, liver, and muscle cultures. *Hathewaya limosa* was also identified in blood, lungs, muscle, and liver samples; and *Clostridium perfringens* was identified in both the heart and blood. It was concluded a final diagnosis of a lethal septicemia from intestinal origin linked to a partial colonic obstruction caused by a 9.5 Kg coprolite (ambergris stone).

A bottom up fisher led approach to tackling by-catch and entanglement in inshore fisheries

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For many species of cetacean by-catch and entanglement is a significant cause of non-natural mortality. Conflicting agendas of fisheries managers and cetacean conservationists to reduce this threat often leads to polarisation and entrenched positions which in some cases has resulted in extensive fisheries closures, which threaten the livelihoods of whole fishing communities, or failure to reduce mortality to within safe biological limits. In Scotland, a proposal initially aimed at restricting trawl fishing led to the creation of the Scottish Entanglement Alliance (SEA), a collaborative multidisciplinary partnership between the fishing industry, researchers, government advisors and marine conservation charities to assess the nature and scale of entanglements in Scotland's small-scale creel fisheries. Utilising in person interviews, approximately 11% of Scotland's creel fishers responded to a series of questions regarding their own experiences of entanglement, including species and gear type involved, fishing depth and location. Minke whales and basking sharks were the most frequently reported species, followed by humpback whales. In more than 80% of incidents involving minke whales and basking sharks, and 50% of those involving humpback whales, these animals were caught in the creel groundlines. During interviews fishers were also invited to propose and become involved in appropriate entanglement mitigations. Proposals included a transition to sinking groundline, shortened endlines, and reduced fishing effort. A localised pilot of sinking groundline is currently underway, with a view to expand this nationally in 2024. There are concerted local and global movements to restrict damaging trawl fishing, particularly where these fisheries displace small-scale fishers (SSF). By providing a platform for creel fishers, the SEA project has demonstrated that a collaborative, bottom-up approach to addressing entanglement at a local scale, and building trust with SSF, may offer a model for progressing entanglement mitigation elsewhere.

A conspicuously white common dolphin sighted in the Istanbul Strait and Black Sea, Türkiye

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Atypically pigmented individuals have been reported for many cetacean species in the world, including harbour porpoises, bottlenose and common dolphins in the Black Sea. Anomalously white individuals are often presumed to be true albinos. Albinism is, however, differentiated from piebaldism (body pigmentation missing in only some areas) and leucism (dark-eyed anomalously white animals). On 29 May 2022, a group of 30-40 common dolphins *Delphinus delphis* were sighted during a dolphin watch cruise in the Istanbul Strait, Türkiye. One individual was bright white, which made it very conspicuous in that group. It was the size of an adult and showing normal behaviour with other dolphins. Close examination of the photographs revealed that the animal had some dark patches on the head and the right side of the body, but the rest of the upper part of the body was almost completely white, including the tail flukes. Usual color patterns peculiar to this species, such as a dark cape below the dorsal fin and a grey patch on the tail stock, were completely missing. Based on the above classification, it is assumed that this individual had developed such coloration due to piebaldism. There was another report of a white dolphin in the lower part of the Istanbul Strait two days later, which is presumably the same individual. Moreover, it was found that the same individual was sighted off Sile, Black Sea coast of Türkiye, in April 2021 and once again in November 2022. However, in spite of this distinct coloration, it had never been spotted previously throughout our long-term monitoring in the Istanbul Strait for more than 20 years. This is the first report of anomalously pigmented common dolphin sighted in the Turkish waters.

A deep learning classification model for multiple baleen whale species using ANIMAL-SPOT

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1. Seiche Ltd.

A classification model for multiple baleen whale species has been developed using Animal-Spot, a deep learning software framework that addresses multi-class species and call-type identification. The model is based on the ResNet18 convolutional neural network architecture and is trained to classify several baleen whale species based on their stereotypical call-types. The model has been successfully integrated into Pamguard, an open-source passive acoustic monitoring software widely used in industry and research for real-time detection, classification, and localisation of marine mammals. At present, the model is trained to classify the vocalisations of several baleen whale species including North Atlantic right whale, fin whale, Antarctic blue whale and Antarctic minke whale. Future models are to be developed to provide a series of regional classifiers of additional species and vocalisation types as training data becomes more widely available. The aim of the model is to provide high performance automation of baleen whale species classification for use in real-time monitoring and mitigation. Potential user scenarios include offshore industrial noise mitigation and real-time telemetry alert systems for onshore monitoring of offshore acoustic receivers.

A literary deep dive: assessing the reporting rates of cetacean availability bias for estimating abundance from digital aerial surveys

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Accurate cetacean density estimates are a fundamental element in undertaking meaningful impact assessments for offshore development. Digital aerial transect surveys are a standard approach for offshore wind developers in the UK and Europe to acquire site-specific cetacean density estimates. However, a key limitation of this method is that cetaceans are only visible when surfacing above water. To overcome this "availability bias", correction factors can be applied to these relative estimates based on species-specific diving information. However, appropriate parameters from which corrections can be derived in the literature is currently limited. We undertook a systematic literature review using ISI Web of Knowledge of journals relating to marine mammals and seabirds visiting UK waters, using a range of search terms including "diving", "duration", "availability bias" and "cetacean" etc. From ~1,500 journals, we identified less than 200 articles containing data directly relating to diving or surfacing duration of the relevant species. Of these, less than 60 papers related to cetaceans, covering 9 species. Despite the high-quality tracking and observational cetacean studies reported, preliminary results suggest less than 30% provided metrics from which availability bias could be calculated; each with their own limitations and caveats, including geographical suitability and varying threshold depths at which diving behaviour is defined. Here we analyse the rejected papers to identify what useful metrics were provided and, most importantly, we identify which metrics were missing in order to estimate availability bias. We report the results of availability bias rates found, including white-beaked dolphin (*Lagenorhynchus albirostris*) and Risso's dolphin (*Grampus griseus*). Knowledge sharing is essential if we are to protect cetaceans whilst achieving sustainable energy development. We provide feedback for cetacean tracking and diving studies on useful metrics to include in future publications to improve density estimation from digital aerial survey data.

A review of noise abatement systems and their applicability to English and Welsh waters

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The construction of offshore structures often involves pile driving operations using hydraulic hammers to install foundations into the substrate. Pile driving introduces significant amounts of underwater sound, which has the potential to cause auditory and behavioral impacts in marine mammals. Mitigation measures to reduce the risks include avoiding sensitive habitats and times, ensuring no mammals are present within impact zones and setting noise-thresholds. Sound reduction measures to meet specific acoustic thresholds have been implemented in several countries including Germany. Here the use of acoustic mitigation measures, described as primary and secondary mitigation, is a standard requirement at offshore construction sites. Primary mitigation aims to reduce the sound emissions at source by reducing the source power, using alternative low-noise foundations, or using alternative hammers (vibratory hammers, BLUE piling technology). Secondary mitigation aims to reduce the sound propagated through the water column and is achieved by Noise Abatement Systems (NAS). As part of a feasibility study into implementing a threshold limit to pile driving activities in English and Welsh waters, a comprehensive review of NAS was undertaken. This included an assessment of the potential effectiveness of NAS in modelled piling scenario areas based on water depth and current speed. To explore the effect of NAS on modelled received sound levels, the frequency dependent (third-octave band) insertion loss of mitigation options was used. Modelling was limited to NAS or combinations of NAS where there was sufficient robust test data to provide a robust estimate of sound reduction. Results indicate that for combined NAS a received Sound Exposure Level of 170 dB re 1 µPa2s is likely to be achievable for even the worst-case design assumptions used in the modelling. Options for a decibel limit in English and Welsh waters are presented, and their advantages and disadvantages discussed.

A review on *Toxoplasma gondii* infection in Mediterranean cetaceans

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The authors present a review on Cetacean infection by *Toxoplasma gondii* in the Mediterranean region. *Toxoplasma gondii*, a globally pervasive protozoan parasite with a high zoonotic potential, thrives due to the widespread expansion of cat populations worldwide. Domestic cats notably contribute to the dissemination of oocysts in the environment compared to their wild felid counterparts. This parasite has emerged as a pathogen affecting all aquatic mammals. The Mediterranean basin presents a strategic area for studying T. gondii oocysts' transportation from land to seawater. The region's geographic traits, dense coastal human populations, and high cat concentrations in cities foster high T. gondii seroprevalence in Mediterranean domestic cats. Investigations conducted in the field reveal across Mediterranean countries, such as in Egypt and Algeria with 79.63 and 53.46% seropositive cats, respectively, resulting in significant soil and water contamination. The Mediterranean Sea is a biodiversity hotspot and harbors nine resident cetacean species: *Stenella coeruleoalba*, *Tursiops truncatus*, *Delphinus delphis*, *Grampus griseus*, *Globicephala melas*, *Steno bredanensis*, *Ziphius cavirostris*, *Physeter macrocephalus* are sighted odontocetes, and *Balaenoptera physalus* is the common mysticete. Several of these cetacean species are classified as vulnerable or endangered by the IUCN. The infections of cetaceans by T. gondii were suspected to occur through consumption of filtering molluscs or oocyst-carrying fish. *Toxoplasma gondii*-infected cetaceans develop meningoencephalitis, visceral abscesses, and myositis due to acute tachyzoite infections or bradyzoite encystment. Investigations in Spain, Italy, and Israel reported an overall prevalence of 35.5% in cetacean species. Cetaceans, as significant marine predators, serve as sentinels of environmental health. *Toxoplasma gondii* parasite negatively impacts already weakened cetacean populations. They also raise awareness of potential marine exposure risks for human populations. Further investigations are needed to better understand the actual impact of *Toxoplasma gondii* on cetaceans and to identify feasible control options.

A silent threat: heavily contaminated common dolphins (*Delphinus delphis*) with evidence of impacts and health deterioration in the Northwest coast of Mainland Portugal

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Cetaceans exposed to pollution, overfishing, vessel collision, and pressures from tourism, may experience a general deterioration in body and health condition. Bioaccumulation of toxic concentrations of polychlorinated biphenyls (PCBs) is among the most concerning impacts on populations. Identification of early-warning signals of these impacts (e.g. contaminants in the tissues, external deformities) are essential to efficiently manage cetacean populations and mitigate ecological consequences. We collected tissue samples through biopsy darting, and photographic records of individuals of common dolphins (*Delphinus delphis*) on the Northwest coast of Mainland Portugal (NW-PT). By analysing concentrations of PCBs in the blubber, we encountered some of the highest concentrations ever reported for common dolphins around the world. In females, concentrations (mean: 23.76±14.26 µg g− 1 lipid weight) are similar to those found in females from other regions of the Iberia (Galicia and Mediterranean coast). However, for the males, the PCBs concentrations (mean: 64.83±36.61 µg g− 1 lipid weight) surpassed their counterparts from the Iberia Peninsula, with values higher than the highest PCB toxicity threshold published for marine mammals. Evaluation of external deformities revealed an overall prevalence of 0.36 (excluding notches) in the population (out of the distinctively marked individuals catalogued). Skin lesions were

observed in 13% of the individuals, including dark and tattoo-like lesions often indicative of pathogen infection. Moreover, the presence of characteristic scars and other physical impact lesions, such as an amputated dorsal fin, revealed evidence of interaction with marine traffic and fishing activities. Additionally, we also encountered emaciated individuals with apparent difficulty in breathing, indicating an overall poor body and health condition. The results presented here raise important implications regarding health condition of common dolphins in the NW-PT, suggesting exposure of the population to extreme anthropogenic pressures, and calling for an urgent concerted action from the scientific community and decision-making entities.

A strategy for ocean literacy: joining marine science and art in undergraduate university curriculum

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Addressing environmental changes is a global matter requiring people who can understand complex issues and find solutions employing a range of strategies and thought processes. Expanding and overlapping the domain of university science and humanistic majors can contribute to advance innovative thinking and consequential impact. As a case study we designed a book project to test this idea. Students taking an introductory printmaking class to fulfill a university arts requirement were divided into teams to research gray, harbor, harp, and hooded seals whose range includes the coastal Maine campus location. In consultation with marine biologists, students received fact sheets on morphology, diet, habitat threats and disease. The teams used a shared drive, which helped them collaborate and feel more comfortable with new material. Teams discussed how to translate science into visual form, chose their book's theme, sourced imagery, and strengthened emotional content to transfer information and resonate with the public. Using relief carving, learning printmaking skills, and arranging individual prints and text into a coherent narrative, students produced a numbered edition of artists' books about each seal. We found that Art synthesizing scientific perspectives is a powerful expressive tool, more than art only representing science. This artist book format, when exhibited, opens in a long horizontal accordion presenting the joined prints and text as a single work of art, inviting viewers of all experience levels into the science through beauty. Students were motivated by the books' potential as a communication instrument for impactful public education, effective for display in scientific (universities, conferences) and artistic (galleries, museums) contexts. The results we obtained demonstrate that expanding skills and being able to overlap different disciplines advances the authors' knowledge to a higher level through collaboration and provides opportunities for increasing public awareness through their union.

A study focused on the effectiveness of the acoustic deterrent DiD-01 in trammel nets in Salina Island (Aeolian archipelago, Italy)

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1. Filicudi Wildlife Conservation

The Life Delfi project aims to mitigate negative interactions between *Tursiops truncatus* (Montagu, 1821) and artisanal fishing activities in different Mediterranean areas. Within the project, this study tested the effectiveness of DiD-01, a new "Dolphin interactive Deterrent" to be applied to trammel nets. Twenty-three tests were conducted in the waters around Salina (Aeolian archipelago, Italy) between June-September 2023. The pinger was positioned at the beginning of a 1200m-long trammel net, deployed at an average depth of 25.4 m (SD = ± 2.3 m) and kept in the water for an average time of 35.32 h (SD = ± 3.41 h). Since the operating range of the DiD-01 is 600m, the first half of the net was considered as the test net, and the second half as the control net. The effectiveness of test was evaluated by comparing the catch in the two parts of the net. During the study period 1790 organisms (913 in the pinger test net and 877 in the control net) were analyzed and no significant differences were observed in terms of total catch type, weight, and length between pinger and control nets. However, no sightings of bottlenose dolphins near the net during fishing operations, no holes in the net or fish damaged by dolphins were recorded. Further studies during season of higher interaction might help to evaluate the actual effectiveness of DiD-01. It is also recommended to test the DiD-01 integrating a hydrophone into the fishing net to also assess the presence/absence of dolphins.

A two-step photogrammetry method for use with fast-moving whales

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Drone-borne photogrammetry has expanded as an accurate means to non-invasively determine the length, body condition and reproductive state of cetaceans globally. However, photogrammetry methods are all limited by the quality of the images captured, which can depend on the lighting, the sea state, and the behaviour of the animals. Such was the case when LIDAR-equipped drones were deployed to conduct photogrammetry on North Atlantic right whales in the Gulf of St. Lawrence, Canada, where the ocean was typical not calm, and the animals were moving relatively quickly while foraging, creating white-water along their edges. To maximise the use of these data, a 2-step photogrammetry method was developed. Firstly, the length was established for an animal positioned relatively flat at the surface, where the visibility of edges was not a consideration. Secondly, the length obtained was then traced over a different image of the same animal, where all the sides were visible, but where the tail was dropped downwards, or obscured. The user traced the spine of the animal as far back as they could, and the software extended the body length line beyond this to obtain the length calculated in the previous step. This allowed the generation of locations needed for width measurements are accurate 5% length increments.
For calibrated images, single-image photogrammetry was undertaken for comparison. Between-user length differences were around 0.3% for traditional single images and 0.5% for paired images. Errors for body area calculated between 15 and 85% length increments were 0.4% and 0.6% respectively. When single images were possible for whales, differences were around 0.9%, compared to 2.3% for pairs, with the errors being 4.4% and 10.0% for body area. Extending our dataset to include paired images more than doubled the results, proving that this method has the potential to be very useful if further refined.

Abundance and distribution of cetaceans in the western English Channel, and their exposure to key threats

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The English Channel, one of the world's busiest shipping lanes, is heavily impacted by industries including fisheries, offshore wind and recreational boating. These waters are also habitat for multiple cetacean species. Despite this, cetacean abundance and distribution in the western English Channel are poorly understood, with few scientific and no long-term surveys. With anthropogenic pressures increasing, knowledge of distribution and exposure to key threats such as noise pollution and bycatch is vital for conservation efforts and policymakers. Data from the University of Plymouth's ongoing visual and passive acoustic surveys (conducted in the summer months of 2017-23 over 47 days), provides novel insights into the distributions of cetaceans in the coastal region (<6nm from shore) from Plymouth to the Isles of Scilly. Common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) were most abundant with an average of 0.79 and 0.43 seen per hour, respectively. Minke whales (*Balaenoptera acutorostrata*), bottlenose (*Tursiops truncatus*), Risso's (*Grampus griseus*) and white-beaked (*Lagenorhynchus albirostris*) dolphins were less common. The towed hydrophone doubled the detection rates of harbour porpoises compared to visual sightings alone, especially in higher sea states. Distance sampling of *P. phocoena* acoustic data indicated higher densities in late summer compared to early summer and a higher likelihood of presence in shallower near-coastal areas, and around the Scilly Isles. Supplementary to boat surveys, continuous passive acoustic monitoring since 2017 at the mouth of Plymouth Sound, a busy port and military base, has highlighted the overlap of cetacean vocalisations with vessel noise and enabled year-round detection of cetacean vocalisations. Winter detections of both harbour porpoises and common dolphins were higher than in summer, with increased echolocation rates at night. Outcomes are expected to provide a valuable resource for conservation management and planning decisions, contributing to positive conservation outcomes for coastal cetaceans in highly impacted areas.

Abundance and distribution of marine mammals in north-eastern Sicily, Ionian Sea

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Marine mammal abundance and distribution in Sicilian waters are not well known due to the lack of dedicated national monitoring programs. This study provides the first seasonal abundance and density estimates for marine mammal species in north-eastern Sicily, Ionian Sea, based on boat-based surveys conducted year-round by the Marecamp Association under the "Dolphin watching and Conservation in the Gulf of Catania" programme. Effort covered over 6.000 NM in the marine region between Messina and Brucoli from 2015 through 2022. Ten cetacean species and one phocid species were observed: bottlenose dolphin (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*), Cuvier's beaked whale (*Ziphius cavirostris*), sperm whale (*Physeter macrocephalus*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), fin whale (*Balaenoptera physalus*), killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), rough-toothed dolphin (*Steno bredanensis*), and Mediterranean monk seal (*Monachus monachus*). Results indicate seasonal distribution patterns and abundance trends: bottlenose dolphin, striped dolphin, and sperm whale were sighted during all seasons; fin whale is more common in the study area during migration in summer; since 2018, there has been an increase in the sightings frequency and the striped dolphin herds composition in the central zone while bottlenose dolphin population decreased, and the total disappearance of the Risso's dolphin from the entire study area; common dolphin is more frequent in the south-central zone while Cuvier's beaked whale in the northern one during almost the whole year with fewer sightings. Punctual data concerns single individuals of rough-toothed dolphin and Mediterranean monk seal, and a large pod of false killer whales in the southern region; and a small pod of killer whales in the North. Our findings hold significant importance in enhancing understanding of species conservation status over time in relation to anthropogenic and environmental factors. This knowledge is crucial for informed conservation efforts in Sicilian nearshore waters.

Abundance of common bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Trieste and adjacent waters of the northern Adriatic Sea

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Abundance is a key parameter relevant to assessing the conservation status of animal populations. Such information can be particularly informative in areas highly impacted by a multitude of anthropogenic stressors, as it can shed light on how populations cope with such stressors. The Gulf of Trieste in the northern Adriatic Sea is one of the most heavily human-impacted areas in the Mediterranean Sea and is also home to a population of common bottlenose dolphins (*Tursiops truncatus*) that has been continuously studied since 2002. Mark-recapture models using Pollock's Robust Design were applied to long-term (2013-2022) data on photo-identified individuals, collected from boat-based focal follows. Estimates from the most supported models suggest that between 155 (95% CI = 131–183, CV = 0.09) and 224 (95% CI = 202–249, CV = 0.05) bottlenose dolphins used this area annually during the study period. No trend in abundance was detected. This study provides a robust baseline for future monitoring and assessments and provides a context for other studies of this population.

Accidental interaction between cetaceans and the surface longline by the Spanish fleet from Atlantic Ocean

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Surface longlining is one of the most common fishing gears to capture swordfish (*Xiphias gladius*) and blue shark (*Prionace glauca*) in the Atlantic Ocean. Many Atlantic coastal countries (e.g. Spain, Portugal, Brazil, United States, Uruguay), as well as others from distant regions (e.g. Japan, China, Taiwan, Korea), fish in the Atlantic using this technique. Although it is a selective gear that does not usually interact with cetaceans, sometimes they do. In this work, the information from the Spanish On-Board Observer Program is analyzed, versus the data from an Electronic Monitoring System (EMS). During the period 2018-2022, a total of 3,246 fishing sets were analyzed, corresponding to 3.6 million hooks. Incidental catches of marine mammals are very low with a frequency of approximately one individual every 300,000 hooks. Dolphins emerge as the most frequent group, with 8 interactions involving at least 5 different species, with bottlenose dolphin (*Tursiops truncatus* 3 interactions) and false killer whale (*Pseudorca crassidens*; 2 interactions) being the most frequent. Furthermore, there were documented four entanglements of humpback whales (*Megaptera novaeangliae*) specimens. The number of entanglements observed in the EMS was smaller than those observed by onboard observers, which could suggest that the EMS tends to underestimate the fishing interactions of cetaceans in the open sea. This finding highlights a discrepancy that requires further investigation and evaluation, shedding light on potential limitations or biases inherent to the electronic monitoring system.

Acoustic behaviour of different clusters of common dolphin (*Delphinus delphis*) in the South of Samos Island, Greece

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The social and cooperative nature of dolphins is well documented, while little is reported on the behavioural and ecological factors driving group dynamics within subpopulations. Common dolphins (*Delphinus delphis*) are highly vocal animals, producing click trains, burst pulses and whistles. Previous studies have identified the importance of whistles for communication, but there is a lack of research on the ways group dynamics affect common dolphin vocalisations. This study investigates the different acoustic behaviour of the common dolphin subpopulation inhabiting the Southern waters of Samos Island in the Central Aegean Sea (Eastern Mediterranean Sea). This subpopulation of 51 individuals was divided using association analysis by gregariousness in SOCPROG. Results indicated 6 different clusters (modularity = 0.419) that could be differentiated within the subpopulation. The clusters ranged in size from 5 to 11 individuals. As per the acoustic data, a total of 2,010 whistles were analysed and classified into different whistle types (Upsweep, Downsweep, Flat, Convex, Concave & Multiloop). A Chi-Square Test was used to identify the most common whistle type in each cluster. The most significant ($p < 0.05$) whistle types were Flat for Clusters 1 and 3, Upsweep for Clusters 2 and 4 and Downsweep for Clusters 5 and 6, indicating that different cluster formations impact the type of whistle produced. This may be linked with the strong fission-fusion bonds dolphins create for improved foraging, breeding, offspring protection and defence of territory and warrants further research. These preliminary results represent a baseline for further studies researching the correlation between social network structures and habitat use in this study area. The subpopulation studied is one of the remaining strongholds for this endangered population and as such this research is extremely useful for cetacean management actions in the Aegean Sea.

Acoustic chain, DB and data analysis within the “Italian Integrated Environmental Research Infrastructures System (ITINERIS)” project

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The aim of the Italian Integrated Environmental Research Infrastructures System (ITINERIS) project is to establish the Italian Hub of Research Infrastructures within the environmental scientific domain. ITINERIS seeks to facilitate the observation and investigation of environmental processes across the atmosphere, marine domain, terrestrial biosphere, and geosphere. The project also endeavors to promote sustainable, cross-disciplinary research by leveraging existing data and services, emphasizing accessibility for users. The cornerstone of this initiative is the creation of the ITINERIS HUB, designed to provide users with seamless access to data and services. Notably, ITINERIS opts for the optimization and harmonization of existing data centers rather than creating new ones. The project will fortify these centers through various activities, with a particular focus on enhancing the FAIR (Findable, Accessible, Interoperable, and Reusable) principles across all participating entities. This contribution highlights the role of INFN – Laboratori Nazionali del Sud (LNS) in the project. LNS is coordinating the production, integration, and testing of a new subsea Junction Box to be installed at the 3500 m deep LNS infrastructure of Capo Passero – Italy, that will ensure power and high-speed data connection from shire to seafloor. An overview will be provided on the acoustic data acquisition chain and storage, with a particular insight into the use of high-sensitivity and large band-width hydrophones installed on the Junction Box for real-time and long-term data capture. Hydrophones’ data are continuously transmitted to shore and analyzed. A selection of raw data and sound pressure levels in octave bands are calculated and stored to study the soundscape at the site. Status of the project and preliminary results on marine noise analysis will be presented.

Acoustic monitoring reveals variations in habitat use of the Amazonian manatee in relation to climatic events

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Extreme heat and drought induced by the El Niño-Southern Oscillation (ENSO) are currently impacting the Amazon basin. For the manatees that use the plant-rich floodplains at high water levels as a feeding area before migrating to deeper lakes at low water season, this habitat alteration can lead to changes in migration routes and influence their survival rate. As part of Project Providence, acoustic recordings were obtained from an autonomous recorder deployed at a floodplain lake in the Mamirauá reserve for 3 consecutive high water seasons to compare manatee presence in 2021, 2022 and 2023 (ENSO year). A convolutional neural network classification model was used to detect manatee vocalizations in the datasets. Similar classification performance in terms of precision (range 0.90-0.93) and recall (range 0.97-1.00) was achieved for each year. In 2021, from mid-May to mid-July, 98% of days showed manatee presence compared to 70% in 2023 during the same period. Daily number of hours with positive detections was approximately 4 times smaller in 2023 (3.9 h in 2021 vs 1.1 h in 2023). A similar decreasing trend in manatee detections was observed between two weeks in May 2022 and 2023 (2.06 h vs 1.31 h respectively). One hypothesis for the reduction in acoustic presence is related to the migration routes between habitats that incorporate shallower sections (“bottleneck”), which can dry out completely at low waters. Drought is directly amplifying this phenomenon, thus reducing temporal access to a crucial habitat, in addition to the habitat’s spatial reduction and alteration. The research is ongoing in 2024, where drought is expected to last until July 2024, to monitor the evolution of manatee presence in Mamirauá lake and to better understand the consequences of extreme climatic events on manatee movements and habitat availability.

Acoustic tracking of sperm whales in the Gulf of Catania

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In the present study, we present results of a research conducted on sperm whales passing through the Gulf of Catania using Passive Acoustic Monitoring and the development of a custom software tool for their localization using acoustic data provided by the NEMO-OvDE (Ocean Noise Detection Experiment) underwater phased-array. The results obtained from the tracking provide new information about the sperm whales population off the eastern coast of Sicily.
The OvDE acoustic station was deployed in 2005 as part of the NEMO-KM3NeT experiment, aimed at building a submarine Cherenkov telescope for high-energy neutrino detection. The purpose of the acoustic station was long-term monitoring of deep-sea acoustic noise, but the data collected from it proved to be of great interest in the field of biology as well. It was located approximately 2000 meters deep in the sea, about 25 km off shore from the port of Catania and consists of four high-depth piezoelectric hydrophones anchored to a frame, forming the vertices of a tetrahedron. This geometry enables the reconstruction of the position of the sperm whale at the time of emission of the acoustic signals by analyzing the differences in arrival times at the four hydrophones, calculated through cross-correlation of the signals. We developed a software capable of recognizing the acoustic signals produced by sperm whales and using them to locate and track the animal over time. From the acoustic tracking of the animals we estimated typical routes, depth, average cruising speed, and the diving and ascent speeds of the animal to the surface. Furthermore, we studied the interaction between sperm whales and motorized vessels.

Alzheimer-Like β-Amyloid plaques in the brain of an aged stenella

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The main reason Alzheimer's disease (AD) is thought to be a human illness is the lack of reliable animal models for spontaneous disease. The complexity and comparability of the brain, along with age-related problems, present challenges for experimental animal models. Recently, Amyloid-β (Aβ) plaques (APs) and phosphorylated tau (ptau) changes in neurons and neuropil were observed in different mammal species, with very few descriptions in cetaceans, which have an Aβ aminoacidic sequence similar to that of humans. This study describes Aβ deposition in the brain tissue of a female striped dolphin (*Stenella coeruleoalba*) stranded in the Ligurian coast of the Pelagos Sanctuary in 2015 (DCC 2). The 18-year-old dolphin, submitted for complete postmortem investigations, in the brain presented a moderate pyogranulomatous encephalitis, with diffuse gliosis and multiple nodules of microglia. Four different areas of cerebral and cerebellar cortex, considered target areas for AD pathology according to the "ABC" criteria defined by the National Institute on Aging and Alzheimer's Association, underwent immunohistochemical analysis. The immunolocalization of Aβ was tested using a rabbit monoclonal antibody (Ab) [mOC64] (ab201060, Abcam), while pTau was detected through 2 Abs: AT180 (MN1040, ThermoFisher) and AT8 (MN1020, ThermoFisher). Brain tissues from (1) human patients with AD and/or only APs and (2) an Atlantic spotted dolphin (S. frontalis) stranded in the Canary Islands (Sacchini et al., 2020), served as positive control sections. Extracellular and intracellular Aβ deposition, forming APs, was observed in the frontal cortex, while labelling of pTau tested through AT8 Ab, was present in the parietal cortex of the studied animal. No labelling was detected by AT180 Ab.Our initial results support the hypothesis that cetaceans, in particular toothed whales, might spontaneously exhibit AD-like pathology, possibly serving as unique natural models for AD. However, assessing clinical signs essential for an AD diagnosis proves challenging.

An autonomous surface vehicle to investigate presence, distribution, and acoustic behavior of delphinids in the Central Mediterranean Sea

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Passive Acoustic Monitoring is a method now widely used to study cetaceans and fills the gaps of the traditional visual method. With the use of autonomous platforms, such as a wave glider powered by green energy, it is now possible to characterize not only the distribution of cetaceans, but also their abundance and acoustic behavior over large spatial and temporal scales. To this end, a wave glider equipped with a single-towed hydrophone was deployed in the central Mediterranean Sea from 30th September 2022 to 17th December 2022, and from 15th January 2023 to 3rd March 2023. This autonomous vehicle sailed crossing the southern Tyrrhenian Sea, the Strait of Sicily, the Ionian Sea and the Adriatic Sea for about 2,500 nautical miles. The continuous recording setting yielded a total of 19,115 files of 460s (2.2 TB), a third of which was kept for spectrogram visualization and audio listening (manual analysis). Then, automatic techniques (signal processing and machine learning algorithms) were applied to identify delphinids' signals within the dataset. These analyses revealed that almost half of recordings contained sounds from delphinids. Whistles were the most-common type of signal recorded, followed by echolocation clicks and pulsed sounds. The temporal distribution of the detected signals revealed the existence of daily cycles in delphinids, which use their biosonar mainly during nighttime. Moreover, the results showed that the southern Tyrrhenian Sea and the western Ionian Sea were the two areas with the most detections of delphinids, but also where the majority of anthropogenic noise sources were recorded. Shipping noise was present almost continuously, and different types of sonars and low-frequency pulses have been recorded. The number of anthropogenic sounds detected during the glider's route highlighted the extensive impact of human activities in the central Mediterranean Sea.

An overview of marine mammals stranding in Sicily: a focus on Marecamp recordings

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Strandings can result from various natural and human-induced causes and are often complex and multifactorial. Some common factors are natural events due to predation, diseases, and parasites; environmental factors such as climate change, storms, and weather events; anthropogenic factors such as entanglement, collisions with vessels, pollution, and noise pollution; biotoxins; social and group dynamics. Consulting the GeoCetus database of Centro Studi Cetacei, the Italian stranding network, about 200 strandings are officially reported along the Italian coast yearly. Marecamp recorded 53 strandings in Sicily in the last five years, with a high incidence along the eastern and south-western coast. Among these, 85% of stranding notifications were received from private citizens and 15% from the Coast Guard. The striped dolphin was the most stranded species, with an incidence of 47% recorded events, followed by the bottlenose dolphin (15%), the common dolphin (8%), the sperm whale (6%), the rough-toothed dolphin (4%), and several unidentified specimens (17%).
In 23% of total cases, the hypothesized cause of death was the interaction with activities linked to fishing or accidents with boats. However, in some cases, the specimens may have preexisting pathologies that can predispose them to come into contact with humans and their gears. Furthermore, among the most recent events recorded, a special reflection goes to the recorded strandings of the common dolphin and the bottlenose dolphin calves, which account for 100% and 63% of the total events for species, respectively. Understanding the interplay of all the other factors is crucial for developing effective conservation and stranding response strategies to mitigate the impact of marine mammal strandings. Furthermore, strengthening local collaborations between scientists, conservationists, the public, and stakeholders is essential in addressing these complex challenges.

Analyses of sperm whales trumpet vocalization emitted in the Balearic feeding ground

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Sperm whale (*Physeter macrocephalus*) is a highly vocal marine mammal that spends most of its time foraging at depth. Although clicks comprise the large majority of its vocalizations, sperm whale also emits tonal sounds, like trumpets. Trumpets have been analyzed only recently and their function is still a matter of debate. Here, we investigated the trumpets acoustic structure to evaluate if the signal could convey information regarding the individual and the context of emission in the Balearic Archipelago during foraging events. Data were collected in 2018-2021, using a dual-elements hydrophone towed from a sailing vessel. Group size and composition were recorded, and photo-identification and animal size acoustic estimation were carried out to identify the emitter. From 27 hours of acoustic recordings, 46 trumpets were found. Four acoustic parameters were measured regarding the entire sound, while six parameters were extracted from the units composing the trumpet. In total, 21 individuals were identified with a mean length ranging from 10.78 m to 12.76 m, corresponding to sub-adult and adult males. Furthermore, trumpets were emitted at the beginning of a dive and combined both with slow clicks, long-range male vocalizations, and rapid clicks, commonly emitted during feeding events. Trumpets fundamental frequencies were statistically significant in relation to the identified individuals and to its size, suggesting that they are strictly related to the emitter, while, units parameters showed a higher variability in relation to social factors. These outcomes suggest that the acoustic structure of the trumpet might encode information about the characteristics of the male emitter during foraging events, and that the information content may vary mostly in the units composing the trumpet. These findings are in agreement with the previous studies and show a progress in the knowledge of this under studied sound.

Analysis of the presence of *Balaenoptera physalus*, *Physeter macrocephalus* and *Ziphius cavirostris* in the Gulf of Genoa: is anything changing?

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Since 2007, Fondazione Acquario di Genova, in collaboration with Golfo Paradiso Whale Watching, has been carried out a research activity on cetacean presence and distribution in the Pelagos area off the coast of Genova, characterized by the presence of two deep submarine canyons, furrowing the seabed in continuity with the Bisagno and Polcevera streams. The aim of this study is to analyze the presence and distribution of fin whale (*Balaenoptera physalus*), sperm whale (*Physeter macrocephalus*) and Cuvier's beaked whale (*Ziphius cavirostris*) in relation to static (presence of canyons, depth, slope, distance from the coast) and dynamic (primary production, water temperature) environmental parameters, also in relation to ongoing climate change. Data were collected during daily surveys on board the whale watching boats of the company "Golfo Paradiso Whale Watching". Sampling tracks and sighting points of the target species were recorded by means of a GPS device. Species identification, group size and the possible presence of calves were also recorded during the sightings. From May to October 2023, 35 daily surveys were carried out, totaling 2677.87 km of sampling effort. We spotted the Cuvier's beaked whale 14 times, the sperm whale 2 times and the fin whale 31 times. The fin whale sightings recorded in 2023 were much more numerous than those recorded in previous sampling years (49 sightings in total, over a 16-year period from 2007 to 2022). This exceptional occurrence could be due to variations in dynamic environmental parameters, possibly related to climate change.

Anisakis spp. (Nematoda: Anisakidae) diversity in dwarf sperm whale, *Kogia breviceps* (Cetacea: Kogiidae) stranded at the edge of its distribution range

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Anisakid nematodes are a ubiquitous taxon of marine mammal parasites with a worldwide distribution. They are characterized by complex life cycles, with adult stage developing in marine mammals, mainly cetaceans, while planktonic or semi-planktonic crustaceans act as first intermediate hosts, and fish and molluscs represent intermediate/paratenic hosts. Among the several cetacean species hosting adult stages of anisakid nematodes, kogiid whales represent a peculiar group, hosting an assemblage of anisakid species. So far, 3 species among Anisakidae family are considered specific for these hosts, i.e., *Anisakis brevispiculata*, *A. paggiae*, and a poorly studied species, *Pseudoterranova ceticola*. The aim of this study was to investigate the species diversity of a sample of anisakid nematodes obtained from a pygmy sperm whale individual stranded at the northern boundary of its Northeast Atlantic distribution range, the North of Scotland, in 2013. A total of 95 nematode specimens were studied by morphology and sequence analysis of the mtDNA *cox*2 and the rDNA ITS genes. According to the sequences obtained, four species were identified: *A. brevispiculata, A. paggiae*, *P. ceticola* and *A. simplex* (s.s.). *A. brevispiculata* resulted the most prevalent species with mostly adult female and male individuals. *A. simplex* (s.s.) relative frequency was high (37%), but most of the nematodes were at preadult stage. The pygmy sperm whale has been seldomly recorded in Scottish waters, and its occurrence in the area could be interpreted as an expansion of its range, most likely associated to global warming. The presence of *A. brevispiculata*, *A. paggiae*, and *P. ceticola* in this whale species in this area could indicate that the whole host community involved in these parasites life cycle is shifting in these northern waters, although it is possible they were acquired if the animal was feeding in more southern regions in recent times.

Anthropic pressure on cetaceans stranded along the Ligurian coast within the Pelagos Sanctuary

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Marine mammals are extremely sensitive to the disturbance of ecosystems due to human activities. In this study, data collected by the Italian National Reference Center for Diagnosis of stranded Marine Mammals over a 3-year period (2020 – 2022), were considered to assess the anthropic pressure on cetaceans living in the Ligurian sea. Out of a total of 37 stranded cetaceans within the concerned period and area, a complete post-mortem examination was performed on 23 cases. Of these, 14 were further selected considering at least one of these conditions: confirmed or probable interaction with fishing activities through the application of a standardized diagnostic framework (7/14=50%); toxicological stress through the evaluation of organochlorine compounds (OCs) hazardous levels (PCBs, HCBs, DDTs) (13/14=93%) and terrestrial pathogens-associated disease (systemic infection and/or associated lesions) (7/14=50%). Based on gross and microscopic pathology and ancillary testing, hypotheses on the cause of death were formulated for 9/14 animals. In 6/14 cases the cause of death was associated with natural origin, specifically represented by infectious diseases due to terrestrial pathogens in 4/5 cases. In 3/14 cases the cause of death was categorized as anthropic due to fishery interaction, specifically represented by bycatch with active fishing gear as a consequence of underlying pathologies, related to terrestrial pathogens in 2/3 cases. The cause of death was not determined in 5/14 cases. Among them, 2/5 cases showed evidence of suspected fishing interaction (bycatch with not determined fishing gear) and 1/5 showed *Toxoplasma gondii* and *Erysipelothrix rhusiopathiae* systemic infection together with fishing gear agglomerate ingestion. Furthermore, marine debris ingestion was assessed through a standardized method, confirming the presence of macro, meso and microplastics in 6/14 cases. These data are important evidence of the anthropogenic pressure to which cetaceans in the Pelagos Sanctuary are subjected to, which is affecting both individuals health and population conservation status.

Anthropogenic impacts on cetacean populations in the Strait of Sicily

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Several anthropogenic pressures affect the cetaceans inhabiting the Mediterranean Sea. Heavy naval traffic mainly produces underwater noise and causes collisions with large cetaceans; excessive fishing activities reduce fish resources and increase indirect by-catch; and marine litter can mostly cause entanglement and ingestion. To evaluate the effects of these anthropic factors on cetaceans, several surveys were carried out by the Marecamp Association for more than a year, February 2022 – March 2023, along two fixed routes: Catania-Malta and Porto Empedocle-Lampedusa. On board passenger ferries and cargo ships used as observation platforms of opportunity, in the framework of the Fixed Line Transect Mediterranean Monitoring Network (FLT Med Net), data about the presence of different species of cetaceans and anthropogenic activities were collected. Large commercial vessels and recreational boats were considered for maritime traffic, while fishing boats and fishing devices were counted as fishing activities. Material, sector of use and size data were recorded for floating marine litter. The results show that cetaceans avoid heavily trafficked areas, especially the transit areas of large commercial ships along the Strait of Sicily. This is particularly evident in the Catania-Malta route, where the largest number of cargo ships was recorded, and only rare cetacean sightings were registered in these areas. The greatest cetacean presence occurred along the Sicilian coasts, corresponding with an area with heightened fishing activity. Near Lampedusa Island, most sightings overlap areas with a higher density of marine litter, fishing activities, and ship traffic, represented particularly by recreational boats.
This research shows the significant presence of anthropogenic pressures on marine mammals in the study area and how differently they respond to them, offering new thoughts for the implementation of strategies suited for inshore and offshore marine environments.

Arteriosclerosis in Baltic Seals over two decades

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Since the 1970s, there has been an ongoing research project in Sweden aimed at monitoring the health of Baltic seals and their most common pathological changes. Nowadays, about 250 seals are sent in for analysis every year, by fishermen, hunters and the general public. The presence of arteriosclerosis in these seals has been described together with the Baltic Seal Disease Complex (BSDC) in 1999. All three species, grey seals (*Halichoerus grypus*), ringed seals (Pusa hispida) and harbour seals (*Phoca vitulina*), have presented vascular lesions, mainly focused on the abdominal section of the descending aorta and around its ramifications. These lesions are classified macroscopically by the presence and extension in size and distribution of raised whitish spots or streaks along the intima of the major arteries, with varying degrees of thickening of the vessel wall. In some cases, lipid deposits are present histologically, while in others there are calcified plaques. No associated inflammation has been noted. The prevalence of arteriosclerosis over the past two decades has remained somewhat constant. From 2001 to 2022 this prevalence was 15.8%, 15,5% and 12,6% for grey seals (n=815), ringed seals (n=284) and Baltic harbour seals (n=103) respectively. A clear relation to age was established, in accordance to numerous studies in several other species. Still, it is present, although in low severity, in a small number of young individuals, including juveniles as young as one-year-old. Arteriosclerosis is mostly a subclinical post mortem finding. However, the implications of loss of elasticity of major vessels in diving mammals, who necessitate perfect control of systemic arterial pressure, warrants further investigation, especially considering its presence in such young animals.

Assessing environmental variability in large-scale surveys for distribution and abundance of highly mobile species

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Synoptic surveys, designed for large-scale species abundance assessments, typically operate with temporal resolutions ranging from days to weeks, while highly mobile species may respond to dynamic oceanographic processes, spanning seconds to decades. A clearer comprehension of how environmental variability may impact species distribution is essential to interpret data obtained from synoptic surveys. This study, conducted within the framework of the ABIOMMED project, investigates the correlation between long-term cetacean distribution patterns and environmental variability. A temporal trend analysis was performed over an area of approximately 30,000 km2 within the Pelagos Sanctuary in the Northwestern Mediterranean Sea. The dataset spans 32 years of ship-based surveys conducted between May and October from 1990 to 2021. It focuses on sightings of the most prevalent species in the area: *Balaenoptera physalus* (n=1036) *Stenella coereluoalba* (n=4458); their temporal and spatial distributions were correlated with some key environmental predictors, such as sea surface temperature (SST) and chlorophyll-a levels. Environmental covariates were found to influence the spatial distribution of both species (Kruskal-Wallis: $P<0.01$), indicating a potential influence of changing chlorophyll-a spatial patterns over time. Specifically, the spatial distribution of the two species were observed as more clustered in years with lower chlorophyll-a and higher SST. Conversely, in years with higher chlorophyll-a concentrations, the spatial distribution was more dispersed, displaying a more heterogeneous pattern. This effect should be particularly considered when planning synoptic surveys to estimate the abundance of species with low population density, as low area coverage may result in a reduced number of detections and, consequently, less accurate abundance estimates. Notably, a discernible decline in primary productivity has been noted in the Pelagos Sanctuary region over the past decade, potentially leading to a more aggregated distribution of the two predominant species. This effect could be particularly relevant concerning fin whale, demanding increased spatial coverage for accurate assessment.

Assessing morphometric, allometric and body condition parameters of short-finned pilot whales (*Globicephala macrorhynchus*) through aerial photogrammetry

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Aerial photogrammetry is an innovative tool for the non-invasive study of wild cetaceans that can be used to provide valuable information about their health status, ontogenetic development, or adaptations to the environment. Here, we conducted morphometric, allometric and body condition measurements of wild short-finned pilot whales (*Globicephala macrorhynchus*) off Tenerife, Canary Islands. Data were collected using unmanned aerial vehicles (UAV). The body length (BL) and width (BW), the fluke width (FW) and the rostrum-blowhole distance ratio (RB) were measured from dorsal aerial photographs using a custom-made script in R. Individuals were sexed using one of the following methods: a photo-identification catalogue, the total body length, or the association with calves. A total of 123 whales were measured between 2021 and 2023, including 36 calves (BL 2.17±0.22 m; RB 0.28±0.05 ; FW 0.54±0.06 m), 28 juveniles (2.78±0.19 m; 0.32±0.05; 0.70±0.07 m), 22 adult females (3.51±0.23 m; 0.38±0.05; 0.89±0.09 m), 15 adult males (4.34±0.19 m; 0.44±0.05; 1.14±0.11 m) and 22 indeterminates (3.51±0.24 m; 0.37±0.07; 0.89±0.09 m). The body shape was similar among reproductive classes and gender, with the widest point being anterior of the dorsal fin (at 35% BL) corresponding to the 15-19% of BW. Allometries in the RB and the BW were found relative to the absolute BL. Younger animals showed less streamlined bodies and relatively larger rostrums than adults, leading to potential ontogenetic differences of diving capabilities, energetic balance, and anatomy of acoustic structures. FW grew isometrically with BL both in males and females, suggesting high-power fluke stroke requirements are shared among both sexes in this species. This study contributes to the long-term monitoring of the health status of the short-finned pilot whale resident population off Tenerife and expands current knowledge of the population life-history and ontogeny of this deep-diving species globally.

Assessing the effectiveness of acoustic deterrent devices to reduce common bottlenose dolphin depredation on small-scale fishery in Sardinia

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The common bottlenose dolphin (*Tursiops truncatus*) is considered the most frequent depredator of static net fisheries in the Mediterranean Sea. Depredation occurs when animals 'steal' fish from the gear, causing economic damage to fishers and leading to fisher-dolphin conflict. To reduce depredation attempts several strategies have been employed worldwide, acoustic deterrent devices (ADDs) being one of the mostly used although results related to their effectiveness are quite controversial. This study aimed at testing the efficiency of new acoustic deterrent devices (DiD01) to reduce depredation effects on two types of net (gillnet and trammel net), in terms of catch amount and composition. Between September and October 2023, during 138 commercial fishing activities (69 with ADDs displaced on the net and 69 without ADDs), depredation attempts were recorded, and data related to the weight of each fish caught, the depth of the fishing site and the features of the fishing net were collected. Based on a correlative modeling approach, the total catch amount (expressed as Catch per Unit Effort) was lower in case of dolphin depredation and was associated to the net type, while it was not influenced by the presence of ADDs. The number of species caught (species richness) was only influenced by the presence of dolphins, while no association was found with ADDs, net type and depth. These preliminary results indicated that catch amount and composition were driven by several factors which should be considered when ADD effectiveness is evaluated and that the use of ADDs was not able to reduce depredation, at least in this short-term evaluation.

Assessing the role of a small Marine Protected Area in coastal dolphin conservation

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Marine protected areas (MPAs) play a crucial role in safeguarding the delicate ecosystems and diverse marine life. It is generally thought that larger is better – the efficacy of MPAs increases with MPA size. This may be especially true for highly mobile species such as cetaceans. However, in practice, many MPAs, particularly in Europe and the Mediterranean, are very small and therefore unlikely to confer much protection to highly mobile cetaceans. We assessed the relevance of a small MPA for a local population of bottlenose dolphins in the northern Adriatic Sea over a 16-year period, combining visual and acoustic monitoring. The animals were observed within the MPA more frequently than expected for such a small area, suggesting high relevance of the MPA for the local dolphins. However, the vast majority of sightings were actually recorded just outside the protected area. This suggests that a) the wider area of the MPA is important to the animals, and b) that the MPA itself fails to confer any protection to the animals. This, combined with the fact that several threats – such as underwater noise and chemical pollution – do not stop at the MPA borders, means that the current extent of the MPA offers limited benefits to the conservation of bottlenose dolphins in this area. Our results suggest that expanding the MPA boundaries to encompass the surrounding waters would likely enhance dolphin conservation efforts, which would likely also contribute to the overall health and resilience of the marine ecosystem in this area. Our study provides a useful insight into the relevance of MPAs to mobile marine species.

Assessing the welfare challenges posed by climate change to European marine mammals, with a focus on seals

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The marine wildlife rescue and rehabilitation community around Europe and beyond is increasingly raising concerns about changes that they are seeing, and which are reported to be putting their facilities under increasing strain. There is particular concern about the incidence of storms and the effects of storm surges and increasingly rough weather on seal pups when they are on shore before and after they are weaned. Pups at this time are small with limited, if any, ability to swim and, for the first three weeks of their lives, are dependent on their mothers for food and defence. Strong waves and higher than usual sea levels can create conditions that cause pups to be washed away, separating them from their mothers and sometimes wounding them when they are washed onto rocks or other hard substrate. Many are drowned and those that survive require specialist care for weeks and, in some cases, months. In this presentation we will review some of the available evidence and consider its implications. The swiftly growing scientific literature that predicts and reports on the significance of climate change for marine mammals predominantly does this in the context of conservation. Much less attention has been given to the consequences of climate change-driven processes on the welfare of marine mammals. Other climate change-driven factors that may be negatively impacting the welfare of marine wildlife include prey loss and associated prey stress, changes in foraging and pupping locations and other geographical distribution and temporal shifts (including movement into higher latitudes), the expenditure of extra energy to maintain body temperature and the loss of habitat for ice-dependent species. Habitat destruction, pollution and the spread of disease and noise have already been identified as causes for welfare concern, and it is argued that climate change will further exacerbate these and other issues.

Assessing *Tursiops truncatus* population dynamics through its signature whistles in Ibiza and Formentera islands (western Mediterranean)

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The Pitiüses Islands (Ibiza and Formentera) in Spain stand out as a prominent nautical tourism destination in the western Mediterranean, particularly during the summer months. The continental shelf surrounding these islands is home of the bottlenose dolphin (*T. truncatus*), being the sole marine mammal species inhabiting this area. Genetic and stable isotope studies have indicated a subtle differentiation with the ones that range around Mallorca-Menorca or along the eastern Iberian peninsula, suggesting potential geographic closure of the population within the continental shelf area of the archipelago. This study aims to quantify the impact of anthropic pressure upon the species in the coastal area where boat traffic is particularly concentrated. From May 2020 to May 2022, a network of seven hydrophones was deployed at 30 meters depht. Using the SIGnature IDentification method, we individually identified 123 bottlenose dolphins based on their signature whistles, creating a capture-recapture matrix. Assuming both geographic and population closure, we estimated an overall population of 141 individuals (95% CI 131-162). The encounter rate was notably higher during colder months (December to April) compared to warmer ones (May to November). Performing a Robust Design approach, we confirmed those changes in abundance across seasons. Site Fidelity Indexes revealed 39% of the population as core residents, 45% as residents, and 16% as occasionals. Our results underscore the efficacy of passive acoustics and sonoidentification in assessing bottlenose dolphin population dynamics, serving as an indicator of environmental health in the Marine Strategy Framework Directive. They represent a technically viable alternative to traditional photo-identification techniques, especially in relatively small coastal areas, such as the Natura 2000 sites of the Pitiüses Islands.

Assessment of contamination by organic UV filters in two deep-diving cetacean species in NE Atlantic

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Understanding the occurrence and impact of emergent pollutants, such as organic UV filters, on marine mammals requires further investigation. Nonetheless, this knowledge is crucial for conservation efforts and assessing ecosystem health. This is mainly because they have been described as endocrine disruptors that affect normal development in the first stages of growth of different species, causing problems in reproduction, as they are potentially bioaccumulated and biomagnified. Considering the role of cetaceans as top predators in numerous trophic chains and their significance as umbrella species, this study provides preliminary results on the presence of eleven oUV-F in two free-ranging deep-diving species of cetaceans: short-finned pilot whales (*Globicephala macrorhynchus*) and sperm whales (*Physeter macrocephalus*) in Madeira archipelago. Results from fifteen biopsy samples showed that three of the covered oUV-F were detected in sperm whales: Homosalate (HMS, 4.1-9.3 µg/L), Octrocrylene (OC, 1.8-3.4 µg/L), and Methylene bis-benzotriazolyl (UV360, 2.9-11.7 µg/L); while five were detected in the short-finned pilot whale: Benzophenone-3 (BP3, 0.2-0.7 µg/L), HMS (7.9-16.1 µg/L), OC (3.3-5.2 µg/L), UV360 (2.4-9.5 µg/L) and 2-ethylhexyl salicytate (EHS, 18.4-35.2 µg/L). The observed differences in the type and concentration of oUV-F found can be attributed to variations in blubber composition between the two cetacean species. Sperm whales are known to have a higher concentration of wax in their outer blubber layers, whereas pilot whales possess more triglycerides. This difference may affect the deposition of the contaminants as oUV filters in the blubber. Additionally, differences in diet may also play a role in biomagnification, as each species may have different prey. These findings mark the first reported results concerning this type of contaminant in deep-diving cetacean species.

Atlantic Whale Deal Project: mitigating ship strikes and enhancing carbon sequestration in the Atlantic

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The Atlantic Ocean faces multiple pressures, resulting in biodiversity loss and associated loss of carbon sequestration. As ecosystem engineers, cetaceans play a crucial role in preserving and regulating ocean conditions. They provide essential ecosystem services, contributing to element and nutrient cycles by enhancing phytoplankton nutrition, as well as supporting cultural activities such as whale watching. Whales occur across coastal and open sea areas and despite their major environmental role, are greatly affected by human-induced hazards such as ship strikes. Increasing shipping activity leads to a higher risk of whale-ship collisions, posing dangers to both the animals and the vessels involved. The ATLANTIC WHALE DEAL is a 36-month project started on December 2023 and co-funded by the EU Interreg Atlantic Area for a total of 3.5M€, that will test innovative technologies to mitigate ship strikes and prevent biodiversity loss while putting forward transnational cooperation between multiple stakeholders. The project will work to produce

(acoustic, visual, and thermal) detection and localization techniques, create maps of collision risk and acoustic contamination integrated into interactive tools, as well as evaluating the ecosystem services provided by whales, and inform a long-term sustainable plan. Physicists, engineers, biologists, statisticians, designers, and socio-economists from four countries of the Atlantic Area (Portugal, France, Spain, and Ireland) will join efforts towards effective solutions to benefit society through governmental, non-governmental, academic, and commercial bodies. By safeguarding whale populations, the project aims to enhance the ecosystem services provided by these iconic creatures, strengthen natural solutions to carbon sequestration, and improve the health and long-term use of resources in the Atlantic, thus benefiting society towards global sustainability.

Automated recognition of bottlenose dolphins based on individually distinct signature whistles

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Bottlenose dolphins and other delphinids inhabit many coastal and offshore areas where human activities are accelerating. Human activity, particularly anthropogenic noise, can have a wide range of impacts on nearby cetacean populations, thus monitoring populations effectively is key to ensuring sustainable development. Acoustic monitoring could potentially leverage the individually distinct signature whistles that bottlenose dolphins, and likely many other small delphinids, use to identify each other. Here we present an automated approach for detecting and recognizing individual dolphins throughout an established listening network of >12 acoustic recording stations in Sarasota Bay, Florida, USA. Sarasota Bay, with its small, long-term resident community of common bottlenose dolphins, represents an ideal natural laboratory for developing and validating such techniques. Over the last >35 years, we collected an extensive database of whistles from known individuals recorded with suction cup hydrophones during brief catch-and-release health assessments, providing a unique benchmarking dataset for AI development. We trained and validated a deep learning classification model based on a curated subset of signature whistles from 70 different known bottlenose dolphins. We integrated an open-source dataset of ambient noise recordings from seven different field sites into a data augmentation workflow to ensure that algorithms perform well under highly varying noise conditions. Using a MobileNetV2 model, we achieved a classification performance of 94.5% correct classification for whistles from suction cup hydrophones, and 92.6% correct classification under more realistic low signal-to-noise ratio conditions. These initial results suggest that automatic signature whistle classification techniques could enable remote acoustic monitoring of movements and habitat use of individual bottlenose dolphins at scale and thus provide a cost-effective tool for delphinid monitoring during the ongoing large-scale transition to renewable energies.

Automated tracking algorithm for groups of common dolphins (*Delphinus delphis*)

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Obtaining fine-scale movement data for highly mobile cetacean species is inherently challenging. While telemetry tags can be used for large- to medium-sized cetaceans, they are invasive and not easily deployable on small, fast-swimming delphinids. Moreover, tags do not allow to obtain movement data for all the individuals present in a group. Drones can be used to record aerial videos and extract movement data on large aggregations of animals, provided that individuals can be tracked through the videos for extended periods. Annotation of georeferenced images is fundamental for the recording of the precise Geographical location of each animal within the frame. However, current methods involve annotating each individual manually, which is extremely time-consuming, especially for species living in large groups. In this study, a small off-the-shelf drone was flown at 60 m altitude over common dolphins (*Delphinus delphis*) off São Miguel Island, Azores, Portugal. The drone operator continuously tracked the dolphins even while the dolphins were submerged by slightly changing the gimbal angle to reduce glare. A machine learning model (Yolov5) was trained to analyze the videos at 10 frames per second. The model automatically classified 90.6% of common dolphin individuals correctly, 8.8% as false positive, and successfully discriminated other objects in the frames such as birds flying (0.4% confused with dolphin). Afterward, an algorithm developed for group-living ungulates was adapted to extract the track of each dolphin in the frames for video sequences lasting up to ten minutes. This method allowed for the exact Geographical positions of each dolphin in the pod which is essential to calculate the distance between individuals, swim speed, and diving time. Automating the quantification of these parameters will reduce the time and cost associated with the collection and analysis of movement data for dolphin species living in large aggregations.

Automated whistle extraction for precise scaled annotations

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Whistles produced by odontocete species can be used as indicators of species, density or individual identification, as well as for communication studies. These vocalisations in spectrogram representations vary in a wide range of time-frequency shapes. Their annotation is a challenge that is often time-consuming and labour-intensive. Existing automated contour extraction solutions are improving, but still struggle to be accurate in the context of overlapping vocalisations, which is common when studying groups of free-ranging small cetaceans. To address this problem, we developed a 2-step method in Python for detecting and extracting whistles within an audio recording. This method requires a relatively small number of manual annotations (< 2500) and was tested on recordings of free-ranging common dolphins (*Delphinus delphis*) in the Northwest Atlantic. For whistle detection, we selected the YOLOv8 model (a popular state-of-the-art object detection model) to predict bounding boxes around whistles in spectrograms. YOLOv8 is designed to detect complex objects in landscape images. It therefore performs well on simple spectrogram images, even in noisy situations. YOLOv8 has been trained to detect and classify between two categories: isolated whistles and overlapping whistles. Bounding boxes containing overlaps are given to the user for manual contour extraction using a custom-made annotation tool. Bounding boxes containing isolated whistles are fed into a deep learning regression model that uses the isolated image of each whistle to predict the contours. The performance of the regression depends heavily on the quality of the manual annotations, but it can generalise from them to predict any whistle shape. Overall, this method achieves a satisfactory compromise between annotation speed and prediction accuracy: simple whistles are extracted automatically and only the most complex annotations (i.e. overlapping whistles) are handled by the user.

Automatic detection of marine mammal whistles in spectrograms using yolo-v8

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In recent years, marine conservation studies have leveraged advancements in Passive Acoustic Monitoring Systems (PAMS) technology, facilitating non-invasive surveys of marine species and quantification of anthropogenic noise. However, the substantial volume of data generated by PAMS poses challenges in terms of processing time, human effort, and computational resources. This research explores the application of You-Only-Look-Once v8 (YOLOv8), a state-of-the-art deep learning model for real-time object detection, in automating the identification of marine mammal whistles within spectrograms. The initial experiment involves analyzing a dataset continuously collected over three hours by a hydrophone installed at a marine station not originally intended for this purpose, forming the basis for neural network training and experimental design. In addition to marine mammal whistles, low-intensity impulsive and repetitive noises—potentially arising from communication between marine sensors—are recorded and included in the study. The research assesses the effectiveness of YOLOv8 in automatically detecting marine mammal whistles, with manual identification revealing 1461 whistles and 5561 impulsive noises among 5955 analyzed frames. The impact of manually labeling both whistles and noise is investigated, showing minimal contribution to false positive reduction in whistle detection and limited improvement in the model's accuracy. Finally, a trained model with an accuracy of 0.78 and a recall of 0.81 was obtained. The study also examines the impact of different mAPs, indicating that, for this type of study, accepting mAP(25) is preferable to the default mAP(50) used by YOLO. This study sheds light on automated whistle detection in large amounts of acoustic data using the artificial intelligence provided by the YOLO tool

Avoiding the data-gap trap: using sparse data on threats to explore conservation status of poorly studied species

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1. Oceans Initiative

IUCN Red List is a global standard for assessing conservation status and extinction risk and serves to prioritize conservation action and associated resources to address declining species and populations. However, the IUCN Red list faces challenges of assessing status with large variability in the quantity and quality of information available, information being out of date (e.g. >10 years), underfunding leading to sparse data. A high proportion of cetacean species are considered Data Deficient with little chance of moving out of this designation. Oceanic dolphins pose a particular challenge due to the low statistical power to detect declines, patchy distribution, and large variability in group sizes. Population viability analyses (PVA) were used to model the dynamics of four oceanic dolphin populations in the northeastern Pacific Ocean: long-beaked common dolphins (*Delphinus delphis capensis*), short-beaked common dolphins (*D. delphis delphis*), Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), and "offshore" common bottlenose dolphins (*Tursiops truncatus*). We calibrated the PVA with life-history tables, studies on proxy species, and opportunistic information on injury, mortality, and other anthropogenic threats taken from stock assessment reports and the scientific literature. We found the most serious projected declines in long-beaked common dolphins, which showed the lowest birth rate. Most threat scenarios resulted in declines that would not be detected by existing monitoring programs in the United States, which are among the most data-rich surveys of their kind. The cumulative effects of the three sublethal stressors exceeded the effect of the one lethal stressor (fisheries bycatch). To implement proactive management and monitoring programs, anticipating which cetaceans are more at risk and which anthropogenic threats could cause declines is paramount. Our study highlights the value of model testing with PVA when monitoring data are poor, thereby identifying priorities for future research, monitoring, and management.

Beaked whales' distribution in the Azores based on whale watching and stranding data

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The Azores steep topography and deep waters create an ideal environment for a variety of cetaceans, including beaked whales, which due to their oceanic distribution and elusive behavior are still poorly understood. Therefore, it is extremely important to broaden the existing data about them, for instance, by using platforms of opportunity like whale-watching vessels and strandings. Sightings data from 2009 to 2020 provided by the MONICET database and stranding data from Rede de Arrojamentos de Cetáceos dos Açores - RACA (1994 to 2023) was analyzed, focusing on the five registered beaked whale species in the Azores. *Mesoplodon bidens* (Mb) species topped the list with 156 sightings, followed by Hyperoodon ampullatus (Ha) with 51 sightings (usually registered in deeper waters than the other beaked whale species), *Ziphius cavirostris* (Zc) with 40 sightings, *Mesoplodon densirostris* (Md) with 29 sightings, and Mesoplodon mirus (Mm) with 6 sightings. Mb and Ha were predominantly observed during the summer season, while Zc and Md were seen throughout the year. Notably, all species except Ha were registered stranded, with Mb having a much higher number of stranding events than the other species (Mb - 30, Zc - 12, Md - 5, and Mm - 1-). Although strandings occur throughout the year, it is remarkable the significant increase in summer, particularly of Mb strandings in July. This rise in Mb strandings, prompts a closer examination into the potential factors contributing to this event. This study highlights the important role of opportunistic data in conducting continuous research, enabling a broader understanding of beaked whales in the Azores and identifying potential topics of interest for further development.

Behavior and adaptive strategies of Bottlenose dolphin (*Tursiops truncatus ponticus*) to anthropogenic factors in the Black Sea

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The in the Black Sea Bottlenose dolphin is a unique subspecies. It occurs year-round in the Bulgarian Black Sea water area, being the most numerous during the spring-summer season. It is found both in the open sea and in coastal waters, where it actively interacts with human activities and, above all, with fisheries. The present work describes various forms of behavior and strategies of the species in relation to anthropogenic impacts. Along the coast, the dolphins use dalyan-type fishing gears, where they often enter to feed. It can be said that the ratio of benefits and constrains of this behavior is in favor of dolphins, since they are generally not given victims in this type of fishing gear. Another strategy is to follow the trawlers. After sorting the caught fish by fishermen, those that have no commercial value are thrown back into the sea. Bottlenose dolphin can also feed on dead fish and, benefit from this resource. Because of the continuous increase in the number of trawlers, it can be assumed that a significant part of the coastal population of the bottlenose dolphin feeds in this way. The benefit-to-constrain ratio seems to favor dolphins as they don't take casualties with this strategy and almost never get caught. But the possible loss of hunting habits should also be taken into account. Another strategy has been observed when dolphins approach bathing people or people jumping from rocks into the water, possibly taking advantage of the frightened fish that they catch more easily. In the past, a case has been observed where the fish were driven to sandy beaches and caught on land in the surf zone. Other, less commonly observed forms of behavior have also been described.

Beyond the waves: a closer look at the aerial behaviour of bottlenose dolphins (*Tursiops truncatus*) in the Strait of Sicily

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The reason behind the aerial behaviour displayed by cetaceans has not been fully understood yet, but it is inferred that they are useful for non-vocal communication between individuals. This study aims at analysing the aerial behaviours of a sub-population of bottlenose dolphins (*Tursiops truncatus*) in Agrigento waters (Strait of Sicily) between 2018 and 2020. A total of 680 aerial events (680 minutes) were recorded during the 72 bottlenose dolphin sightings (3654 minutes), consisting by 87.5% of jumps, 8% of tail slaps, and a remaining 4% of other behaviours. An aerial event rate (AER) was calculated as the ratio between the number of aerial events and the observation time (mins). This was further analysed in relation to the behavioural state of the group, the size and age-composition of the pods, and the interaction with fishing boats. The dolphins displayed more aerial behaviours when socialising (2), followed by carousel feeding (0.21), travelling (0.19), feeding (0.15) and, lastly, resting (0.03). The AER was higher for pods composed of 6-10 individuals, and for pods that included calves or newborns. Finally, a lower AER (0.15) was found when the pods where interacting with fishing boats, than when no interaction was occurring (0.22). All these differences were significant according to the variance analysis (p-values < 0.05). No aerial behaviours were recorded during sightings of only one individual, which consolidates their importance as a short-distance communication tool. Furthermore, most of the aerial behaviours were performed by pods of various ages and when the animals were socialising. This underlies their importance during play, which is of fundamental importance to the development of motor, communicative and social skills. Moreover, playing helps juveniles in learning and adapting to new situations, which improves their fitness.

Bottlenose dolphin vocal behaviour during a lethal bycatch event in the Gulf of Catania, Ionian Sea

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Cetacean bycatch is increasing worldwide and poses a significant threat to the conservation of delphinids. In particular, the bottlenose dolphin (*Tursiops truncatus*, Montagu 1821) is highly susceptible to the risk of remaining entangled in fishing nets during depredation events and that depends on its coastal distribution and opportunistic behaviour. A way of describing what happens during entanglement events is through cetaceans' vocal behaviour, which is, at this moment, a largely unexplored topic during death-related events. During acoustic monitoring carried out by the Marecamp Association for the "Mitigating dolphin depredation in Mediterranean fisheries – Joining efforts for strengthening cetacean conservation and sustainable fisheries'' project, also known as "Depredation-2", we reported the entangling and subsequent death of a sub-adult male bottlenose dolphin in a fishing net in the Gulf of Catania (Ionian Sea) and quantified the emission of signature whistle and burst pulses. An analysis of the vocal behaviour of the pod of bottlenose dolphins during the event is provided here. We collected 138 min of audio recordings and identified a total of 720 vocalisations, including 436 signature whistles, 51 non-signature whistles, and 233 burst pulses. In Particular, we recorded high vocal activity, with a peak characterised by emission rates of 36 signature whistles per minute and 70 burst pulses per minute. Although it is clear the need for further investigation, our study could be the starting point for understanding how passive acoustic monitoring (PAM) protocols are able to better estimate the impact of bycatch events during fishing activities. Developing tools for automatically detecting the peaks of these sound types could help recognize these events and, consequently, permit better quantification of the impact of professional fishing on small cetaceans.

Bottlenose dolphins (*Tursiops truncatus*) and trawler interactions in the Central Adriatic Sea

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Bottlenose dolphins regularly adapt their foraging techniques to enhance prey capture efficiency. This includes engaging in depredation on fishing gear, including interacting with trawlers, purse seines or set-nets. These interactions raise concerns for the long-term impact on dolphin communities due to their habituation to anthropogenic food sources and bycatch. As part of a boat-based study, data on trawler associated dolphin sightings (TADS) have been recorded since 2007 in Central Adriatic Sea, including within Natura 2000 (N2K) site Viški akvatorij for bottlenose dolphins. Over this 16-year period, a total of 1099 sightings of bottlenose dolphins were recorded. More than one quarter of these sightings (N=297; 27,02%) were TADS. Of the 481 dolphins considered to regularly utilise this area, only 44 animals (9,15%) were consistently seen in a TADS, whilst 139 animals (28,9%) were never encountered in a TADS. Of those 44 animals, only six are confirmed female (13,64%), while 38 (86,36%) are either known male or of unknown gender (but without previous association with offsprings). This percentage is rather low considering 32,64% of individuals in the entire community are confirmed females. Although dolphin bycatch in trawling nets has never been reported in this area, the implications of this feeding strategy are crucial considering the imminent implementation of the EU Action Plan for Protecting and Restoring Marine Ecosystems for Sustainable and Resilient Fisheries. This Plan requires Member States to adopt measures to prohibit mobile bottom fishing in marine N2K by 2030. Considering that 47,14% of TADS are located inside Viški akvatorij N2K site, this study provides a baseline regarding how the displacement of trawling may affect bottlenose dolphin communities. These measures could undermine N2K designation by encouraging dolphins to move outside designated sites following the trawlers. Conversely, fish stock recovery within the N2K may improve the sustainability of bottlenose dolphin community.

Bottlenose dolphins and small-scale fisheries in the Pelagos Sanctuary: searching new mitigation strategies to the conflict – TursioNet Project

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The common bottlenose dolphin (*Tursiops truncatus*) is a widespread species regularly found in the waters of the Pelagos Sanctuary. It exhibits remarkable behavioural plasticity and quickly learns to exploit the gears and the methods used for fishing to supplement its diet. This behaviour can trigger conflicts with fishermen and, despite being a cause for concern in many areas of the Mediterranean, the true extent of the problem remains poorly known. TursioNet is a project supported by the Pelagos Initiative hosted by the Prince Albert II of Monaco Foundation that aims to develop an automatic system, using acoustic devices placed on fishing nets, to map and monitor in real-time the interactions between bottlenose dolphins and small-scale fisheries in the Pelagos Sanctuary area. To identify the areas characterized by greater interaction rates, 68 questionnaires in Liguria and 15 in Corse were submitted to fishermen, re-elaborated and selected to place underwater acoustic recorders on fishing nets. To date, 90 days of recordings, covering the study area, have been collected and analysed. Wideband recordings have been chunked in 15' slots for processing, 5166 spectrograms were obtained, and 93 positive interactions were detected. The next steps include training of the automated device, its validation and the application of the new detection and reporting system on test gillnets. In parallel, signs of fishery interaction are assessed on the carcasses of stranded bottlenose dolphins through the application of specific diagnostic frameworks on both retrospective data and animals that died during the project. The results of TursioNet will allow to estimate the impact of bottlenose dolphins on small-scale fisheries and, conversely, the impact of gillnets (bycatch, accidental ingestion of nets, other) on the bottlenose dolphins residing in the Pelagos SPAMI with the goal of identifying possible conflict mitigation strategies and improving the management and conservation of this species.

Bottom trawling: characterization of acoustic noise and interaction with cetaceans in the central Mediterranean Sea

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Acoustic pollution is now a serious concern, and the EU Marine Strategy Framework Directive (MSFD) specifically mentions underwater noise as an emerging marine pollutant in Descriptor 11. Among anthropogenic noise sources, bottom trawling has recently been brought to the attention of the European Commission since information on its acoustic impact is scarce. Therefore, this fishing activity poses a serious threat to marine species not only because of its negative impact on benthic communities, but also due to the associated acoustic noise. Here, a single passive acoustic recorder (SoundTrap ST600) was deployed in offshore waters of western Sicilian coast (Strait of Sicily) to characterize the sound of trawling and to study the interaction with cetacean species. Acoustic data were acquired from 18 th February to 27 th April 2022, at 192 kHz sample rate and with 50% duty cycle (5 min every 10 min). A total of 9,473 recordings (about 1 TB) were acquired. Customized algorithms in MATLAB have been used to estimate ambient noise levels, analyzing sound pressure levels (SPLs) and frequency-based measurements, such us power spectral density (PSD) within the 1/3 octave bands of 63 and 125 Hz. Fishing vessels that were performing trawling activities have been identified using Automatic Identification System (AIS) data. Preliminary results showed that bottom trawling has a specific acoustic signature compared with ambient noise and sound from fishing boat transit alone. This is a source of acoustic pollution that can adversely affect cetaceans and marine ecosystems, consequently several considerations and regulations are needed to reduce its impact on vulnerable species.

Bright Extinction: warning signs of the looming extinction of an extremely well studied killer whale population

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1. Oceans Initiative

Wildlife species and populations are being driven to extinction in response to historic (e.g., overexploitation and habitat loss) and emerging (e.g., climate change, fisheries bycatch and contaminants) stressors, placing us in the midst of the planet's sixth mass extinction event and the first to be driven by humans. The invisible loss of biodiversity before species have even been discovered and described in the scientific literature has been termed, memorably, "dark extinction". We use the endangered southern resident killer whale (SRKW) (*Orcinus orca*) population of 75 individuals to illustrate its contrast, which we term "bright" extinction, namely the well-documented decline of a data-rich population toward extinction. A population viability analysis was used to test the sensitivity of SRKWs to variability in age structure, survival rates, and prey-demography functional relationships. Prey limitation and noise-mediated effects on foraging no longer influence SRKW population dynamics as they did 15 years ago; now, inbreeding, disease, and stochastic events are taking over in importance. As populations shrink to critically low numbers, so too does our power to elucidate statistically significant effects of ecological drivers. This complicates efforts to ensure that mitigation is tackling the stressors that will generate the greatest conservation gain at least cost to other ocean user communities. Even without worsening threats, the SRKW population shows signs of 1-2 more generations of persistence and slow decline, followed by an acceleration into an extinction vortex. Slowing, or even preventing extinction is still possible but will require larger sacrifices on regional urban development, agricultural practices, and maritime use than would have been the case had threats been fully mitigated when the science first became available. Knowledge, coupled with prompt and bold action on knowledge, are needed to protect biodiversity in the face of a changing world.

Cause of death and evidence of human interaction in cetaceans stranded along the Italian coastline between 2015 – 2020

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Cetacean strandings provide insights into the health and conservation status of free-ranging animals, including the impact of human activities. A retrospective study has been conducted on 6 annual reports elaborated by the Italian stranding network. Post-mortem investigations were performed according to national and international standardized protocols. Based on the collected evidence, the likely cause of death (COD) was hypothesized and subsequently categorized as natural or anthropic (Human Induced Mortality – HIM). Any evidence of interaction with human activities was also reported when not directly identified as HIM. From 2015 to 2020, the Italian stranding network responded to 1236 single-stranding events of 10 different species. The carcass decomposition code at necropsy, logistics, and functionality of regional stranding networks limited the post-mortem examination to 586 individuals. The COD was hypothesized in 53.07% of examined animals (311/586), while for the remaining 46.93% (275/586) it was not determined. 38.05% of the animals (223/586) died from natural conditions, with histopathological changes associated with infectious diseases in 28.67% of cases (166/586), age-related causes in 6.31% (37/586), and other conditions. Evidence of HIM was reported in 15.02% of the examined animals (88/586). In detail: 10.41% of animals (61/586) likely died from interaction with fishing activities, while in 4.61% of cases (25/586) traumatic injuries were caused by collisions with vessels. 25.43% of the cases (148/586) showed evidence of interaction with human activities. 104 cases showed evidence of fishery interaction, 29 evidence of a collision with vessels, and 16 marine litter ingestion. Among the identified COD, infectious diseases are the most represented, while interaction with fishing activities is the most represented HIM and the main finding reported during post-mortem investigations. The monitoring of sentinel species represents a strategic method to assess mortality patterns, emerging and reemerging pathogens, and environmental changes from a multidisciplinary One Health perspective.

Cause of death of harbor seal (*Phoca vitulina*) and grey seal (*Halichoerus grypus*) stranded on northern France coastline (1995-2021)

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Since 1995, a significant increase in strandings of gray seals (*Halichoerus grypus*) and common seals (*Phoca vitulina*) has been observed in the southern part of the North sea. The aim of this study is to highlight the primary lesions and predominant causes of death for pinnipeds stranded on the northern part of France between 1995 and 2021. Necropsies and sample collection were conducted following a standardized protocol. Common observations included pulmonary congestion and edema, subcutaneous and intramuscular hematomas, respiratory tract parasitism and parasitosis, and emaciation. The primary mortality causes were due to traumatic origin (46%), due to accidental entanglement in fishing nets (66.1%). Infectious processes (31%) were predominantly represented by pneumonia associated with severe emaciation and pulmonary parasitic infestation. Emaciation without infection processes (12%) emerged as a third ranking cause of mortality. The increase in strandings over the past decades is primarily linked to the return of seals to the North Sea and is influenced by various factors such as anthropogenic traumatic causes. Thus, the impact of human activities is playing a major role in the observed mortality. Concurrently, this growing intensification of anthropogenic activities, closely linked to the proximity of marine mammals, raises significant concerns regarding the potential spread of zoonotic diseases such as Brucellosis and Influenza. To assess this impact, selected samples from seals stranded between 2016 and 2023 were analyzed using qPCR and RT-qPCR techniques. Brucella spp. infections were confirmed, while no cases of influenza were detected. These findings underscore the necessity of further research into seal mortality causes and the exploration of zoonotic potential of these two diseases.

Cave usage by an adult male Mediterranean monk seal as inferred by camera traps

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The Mediterranean monk seal (*Monachus monachus*), with a global population estimated at <1000 individuals, remains susceptible to various threats despite the recent shift of its status by the IUCN from Endangered to Vulnerable. Therefore, adequate monitoring is required.
In a systematic photo-identification project in the central Ionian Sea, Greece, 15 important monk seal caves are being monitored with camera traps since 2018. Here, the use of a cave by an adult male monk seal (A017) in Southern Kefalonia Island is presented with data from July 21 2018 to October 4 2023. Since 2020, the cave is also used for pupping. Data refer to minimum values, i.e. on what is depicted on 2 cameras. The cave is frequented by A017 and, less regularly, by 5 other identified adult seals. Up to 8 animals were recorded simultaneously. Out of a total of 1419 days of active coverage, the presence of seals in this cave was documented for 460 days. A017 used the cave for a total of 113 days over the entire study period, with its presence recorded primarily between 00:00 and 06:00. The seal was present in the cave together with other seals on approximately ⅓ of the 113 days.
A progressive decline in the use of this cave by A017 and other seals over the 5-year study is indicated. A017 has not been recorded in any other of the 15 monitored caves throughout the study period. However, movements to the neighbouring Zakynthos Island and elsewhere are not excluded. Further coordinated monitoring is needed to clarify this male's behaviour.
Earlier studies in the Eastern Mediterranean have predominantly focused on the aquatic territory patrols conducted by adult males, with no details on cave usage. Our findings are unprecedented for the Mediterranean area.

Cetacean conservation trajectory: review of Trinidad and Tobago's whaling heritage to modern strategies

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This literature review thoroughly examines Trinidad and Tobago's Cetacean Conservation Trajectory, tracing the journey from historical whaling practices to contemporary strategies. Focusing on Caribbean whaling history, with specific attention to Trinidad and Tobago, the review emphasises the importance of strandings in Trinidad. It underscores their role in unraveling marine mammal health and threats. The critical analysis extends to evaluating the conservation threats faced by Caribbean cetaceans, highlighting the imperative for targeted interventions. Furthermore, the review identifies notable knowledge gaps in marine mammal research in Trinidad and Tobago, paving the way for future investigations and a comprehensive conservation framework. In synthesising historical legacies with contemporary imperatives, this review serves as a foundational resource for policymakers, researchers, and conservationists working towards the safeguarding of Trinidad and Tobago's marine mammal populations.

Cetacean conservation within the Ligurian Sea: status and proposal for its improvement

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The Ligurian Sea hosts eight cetacean resident species: *B. physalus*, P. macrocephalus, S. coeruleoalba, *Z. cavirostris*, *T. truncatus*, D. delphis, G. griseus, and G. melas. Genetically different from Atlantic populations, these species are bioindicators; consequently, their conservation is essential to preserve these subpopulations and the whole biodiversity of the Ligurian Sea. Nowadays, MPAs and the NATURA 2000 network are identified as the most efficient conservation tools due to their legally binding nature. The presence, density and biodiversity index of cetaceans in a central area of the Ligurian Sea were analysed to study their distribution and protection status in the Ligurian Sea, and identify areas where to propose new conservation measures. A 169 hexagons grid overlayed to the study area was used to map 4226 sightings, collected from 2008 to 2021. Only 39% of hexagons were under a real protection status (35.5% covered by French NATURA 2000 sites and 3.5% by Italians), with percentages varying according to the species. Considering medium or high presence, *T. truncatus* showed 62% of hexagons covered by French NATURA 2000 sites and none by Italians; for P. macrocephalus covered percentage is 52.6%, all by French sites. For the other six species less than 50% of medium and high presence hexagons are currently under protection. Considering biodiversity indexes, medium and high values were under protection for the 49% for Shannon index, and 46% for Simpson, evenness, and richness (all covered by French NATURA 2000 sites, and none by Italians). Two proposals were drafted to improve cetacean conservation under Italian jurisdiction: a D zone for the Isola di Bergeggi MPA, and two NATURA 2000 sites off the Italian coasts (based on the conservation results obtained from the French NATURA 2000 sites distribution, especially pelagic).

Cetacean diversity along the south-east coast of Sicily, Mediterranean Sea

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The waters along the east Sicilian coast have been identified as candidate Important Marine Mammal Area (cIMMA). The distribution and ecology of cetaceans in this area are still insufficiently documented. Since 2016 we are conducting a long-term cetacean monitoring project along the eastern coast of Sicily aiming at contributing to a better understanding of cetacean diversity and habitat use.
The present work reports on the results of cetacean species diversity gathered during visual boat-based surveys along the south- east coast of Sicily. Our findings are based on boat-based surveys carried out annually in June and July (2016-2023). Our study area spans a narrow continental shelf with steep continental slopes, followed by nearshore waters deeper than 1,500 m.
During 8,739 km of visual surveys, we recorded 224 on-effort sightings of eight different cetacean taxa: Striped dolphin (*Stenella coeruleoalba*), common bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), sperm whale (*Physeter macrocephalus*), fin whale (*Balaenoptera physalus*), and Cuvier's beaked whale (*Ziphius cavirostris*). Additionally, we obtained 69 off-effort cetacean sightings. Striped dolphins were the most frequently sighted species (77 %), while Risso's dolphins and rough-toothed dolphins were only sighted once each.
The results of our study show a high level of cetacean species diversity in a relatively small area frequented by most cetacean species considered regular in the Mediterranean Sea. Our results can support conservation actions, such as filling information gaps in the assessment of the existing cIMMA and an evaluation of whether an integration of the southern part of our study area into its boundaries should be considered. In this sense, as a next step, we will also use habitat modelling to further investigate the distribution and habitat use of cetaceans in relation to environmental and anthropogenic variables in the study area.

Cetacean diversity in the ADRION Region (Adriatic Sea and Northern Ionian Sea)

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In the framework of the LIFE Project ConCepTu Maris, the cetacean occurrence and diversity of the ADRION Region (Adriatic Sea and Northern Ionian Sea) was investigated, employing ferries as platforms of observation along the Ancona-Patra transect. Data collection on cetacean sightings, distributed across various bathymetric districts, was carried out by experienced Marine Mammal Observers (MMOs) of the University of Torino, belonging to the Fixed Line Transect - Mediterranean Network, coordinated by ISPRA. The observed species were bottlenose dolphin (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*), Risso's dolphin (*Grampus griseus*), beaked whale (*Ziphius cavirostris*), and fin whale (Balaenoptera physalis). Species distribution and encounter rate (N. of sighting / Km) were analyzed for each year and season from January 2015 to December 2019, with a particular emphasis on bottlenose and striped dolphin species. The Shannon diversity index was then employed to investigate the cetacean diversity of the Region. The results of this study highlight a variable presence of cetaceans across the different bathymetric zones. In agreement with the known ecology of the species, the sighting data indicate that most bottlenose dolphins occur over the continental shelf (0-200m depth), while striped dolphins have a higher encounter rate in offshore waters (200-2000m depth). The results also indicate that cetaceans tend to be present in areas with complex bathymetry, continental shelf, continental slope, and submarine canyons in both the Adriatic and Ionian Seas. At the same time, the central parts of both seas show lower chances of occurrence. Finally, the results of the Shannon Index highlight areas of varying cetacean diversity. The index values range from 0 to 0.3. The zones with a Shannon Index value between 0.15 and 0.3 are noteworthy and correspond to the abovementioned area, stressing their importance as hotspots for cetacean diversity conservation.

Cetacean group composition in the Pelagos Sanctuary with a focus on calves and newborns

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The Pelagos Sanctuary, located in the northwest of the Mediterranean Sea, serves as a vital habitat for several cetacean species. While extensive studies focus on adult cetaceans, a significant research gap persists regarding the presence of calves and group characteristics in this sanctuary. The aim of the present research is to obtain valuable insights into the group size and the group composition, particularly focusing on the remarkable number of calves observed for each cetacean species.

This study analyzes cetacean sighting data collected during whale-watching activities conducted in the Ligurian Sea from May to October in 2022 and 2023. The survey conducted aboard the motorboats Sagittario and Corsara, involved on-board biologists, emphasizing whale watching as an essential data resource. A comprehensive analysis of the collected data is carried out using statistical methods and Geographic Information System (GIS) mapping. Preliminary results reveal a substantial presence of offspring across different cetacean species within the Pelagos Sanctuary during both study years. The detailed GIS mapping visually presents the richness of the collected data and their association with the habitat. These preliminary findings underscore the importance of initiating research on cetacean calves in the Ligurian Sea and advocating for their protection, particularly within the Pelagos Sanctuary. According to the literature, the Pelagos Sanctuary is recognized as a significant foraging area in the Mediterranean for most cetacean species.

The significant number of observed calves and newborns signals the need for further investigation. These findings could form the basis for future studies on cetacean calves, contributing to conservation and management initiatives within the Pelagos Sanctuary.

This is especially crucial given the Sanctuary's status as the busiest area in the Mediterranean, marked by intense coastal activities.

Cetacean presence off the east coast of tenerife on the context of the development of offshore wind energy in the Canary islands

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The development of offshore wind energy in the Canary Islands, known for hosting one of Europe's richest cetacean diversities, poses challenges in terms of its potential impacts on this group of animals. Cetaceans provide indispensable ecosystem services and are an important source of income for the archipelago. Despite the rapid expansion expected for this industry in the region,specially for floating offshore wind farm, there exists a limited understanding of its potential effects and a lack of fundamental information on the ecology and biology of the species inhabiting the areas proposed for development. In Tenerife, an area with high potential for offshore wind development has been designated on the east coast of the island. Cetacean studies in this area are scarce due to the challenging oceanographic conditions, which is being reflected in the Environmental Impact Assessments (EIA) of the projects proposed. This study provides new information on the diversity and presence of cetacean species on the east coast of Tenerife, through on-land monitoring and sea transects. 9 cetacean species were detected being *Globicephala macrorhynchus* and *Tursiops truncatus* the most frequent species. A total of 17 cetacean species cited for the channel between Tenerife and Gran Canaria. 26.9% of the sightings occurred within the potential area for offshore wind development. The presence of calves and juveniles of 7 species and feeding and resting behaviour in the area was recorded. These findings underscore the importance of integrating on-land methodologies into environmental monitoring and surveillance processes and provides new baseline information on the presence of cetaceans in the east coast of Tenerife, needed to evaluate the potential impacts of the development of offshore wind energy.

Cetacean research for conservation in the Calabrian Ionian Sea (Central Eastern Mediterranean)

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Cetaceans are impacted by different anthropogenic pressures and many studies demonstrated that protection through the institution of a marine protected area (MPA) can be effective for marine mammal conservation, resulting in the improvement of their survival. As cetacean species are listed as Vulnerable to Endangered in IUCN red lists and are protected under the European Habitats Directive and various other conventions (Bern, Barcelona, Bonn) and agreements (ACCOBAMS), MPAs (such as SACs-Special Areas of Conservation) are required for their protection. Cetacean research carried out since 2019 in the Southern Ionian Sea, between Brancaleone (RC) and Botricello (CZ), has reduced the knowledge gap on the presence and distribution of cetacean species. This geographic area was previously unstudied, despite past stranding events and citizen sightings being recorded occasionally. The scientific research undertaken involved a multi-action approach including scientific field research and citizen science to increase knowledge and awareness regarding the marine environment and marine mammals' conservation needs. The goal is to complement the series of conservation programs for cetaceans in the Mediterranean to inform and raise awareness and to broaden knowledge about cetacean presence in the Calabrian Ionian Sea. The different species sighted in this area provides evidence of the importance of this region to cetaceans, justifying the need for research efforts during different seasons to aid the formulation of effective conservation policies and management recommendations. Within our study area there are two SACs "Fondali di Staletti" and "Spiaggia di Brancaleone" and the Marine Park "Baia di Soverato". This study helps define more precise conservation measures, in an area rich in biodiversity but affected by increasing anthropogenic pressures and threats, such as toxic organic and inorganic chemicals, vessel traffic (especially in the summer months), marine litter and by-catch.

Cetacean species occurrence in the South-West of Portugal: a 19-Year overview

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Cetaceans, as top predators, play a key role in ocean ecosystems. However, monitoring these populations is challenging, hindered by the complexity and cost of dedicated surveys, especially on the long-term. Understanding their occurrence is therefore crucial for conservation. This study investigates the spatio-temporal distribution of cetaceans in south-west Portuguese waters based on a long-term dataset of 19 years. Data regarding 8310 sightings was recorded off Sagres between 2005 and 2023 during opportunistic boat-based surveys from a dolphin-watching company and complemented with citizen science. GIS maps were used to relate cetacean occurrence patterns with oceanographic and topographic variables. All sightings were recorded at daytime within 18 Nm from the coastline (water depth < 1600m) comprising a total of 16 identified cetacean species. Common dolphin (73.24%), bottlenose dolphin (14.18%) and harbour porpoise (4.00%) were the most frequently sighted species and observed year round. Bottlenose dolphin and baleen whale sightings seemed to increase over time, while harbour porpoises seem to become less frequent. October was the period with higher species richness, and the same was verified for baleen whale species, recorded only from march to December. These results become even more significant for conservation management in the region with the occurrence of 2 critically endangered species - harbour porpoise and orca (0.53%) - and 3 vulnerable species - minke whale (2.17%), Risso's dolphin (2.05%) and fin whale (0.93%). This relevance increases with the poor coastal development recorded in the area. At last, this overview was only possible due to platforms of opportunity that despite their limitations reinforce their importance.

Cetacean strandings on the south-west coast of mainland Portugal: first three years of a regional network

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Cetacean strandings can provide valuable information on the occurrence and distribution of species, population dynamics and the threats they face. A regional stranding network along the whole Alentejo coast (southwest of mainland Portugal) was established in May 2021. From this date until December 2023, a total of 122 strandings of 6 cetacean species (4 Odontoceti; 2 Mysticeti) have been reported. We analysed the spatial distribution of strandings (Kernel density estimation using QGIS software), as well as their temporal variation (monthly or quarterly rates), and main causes of death (e.g. interaction with fisheries, trauma) for all the detected species. For the two species with the highest frequencies of reported strandings (*Delphinus delphis* and *Phocoena phocoena*), we also analysed the sex ratio and size structure of the stranded animals. The identification of areas and periods with a higher incidence of strandings, combined with the data collected from each stranding, can contribute to the development of future efforts targeted to the conservation of cetaceans in this region.

Cetaceans in galicia (spain): bycatch trends and an unusual stranding "outbreak" in 2023

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Galicia stranding network (CEMMA) registered a mean of 227 strandings of cetaceans yearly since 2000. In decreasing order, the most frequently stranded species were common dolphins (*Delphinus delphis*), bottlenose dolphins (*Tursiops truncatus*), striped dolphin (*Stenella coeruleoalba*), and harbour porpoises (*Phocoena phocoena*). In a previous retrospective study (1990-2022), we found that, of the stranded cetaceans examined, 41.4% presented evidence of fishery interactions (e.g., stranded with remains of nets, skin cuts, net impressions, perforations, fractures, amputations of the dorsal fin, caudal flukes or peduncle). During 2023, a total of 618 cetaceans stranded in Galicia. The number of stranded common dolphins was 3.5 times the average from historical data (459/132). In addition, a much high proportion of strandings occurred in the second half of the year. This trend of increased strandings apparently continues in 2024, with more than 50 cetaceans stranded in the first week of January. External examinations carried out on 226 relatively fresh stranded cetaceans (decomposition code 2-3) revealed that (at least) 49.5% of the common dolphins examined presented external lesions compatible with bycatch (91/184), also 9.1% of bottlenose dolphins (1/11), and 50% of harbour porpoises (3/6). Statistical analysis revealed significant increases in common dolphin (p=0.00) and bottlenose dolphin (p=0.039) bycatch mortality over time but no significant change in porpoise bycatch mortality (p=0.188), although it has been increasing since 2010. In addition, two individuals died due to other anthropogenic threats: an adult Cuvier's beaked whale (*Ziphius cavirostris*) due to massive plastic ingestion and a fin whale calf (*Balaenoptera physalus*) killed by ship strike. No external evidence of infectious epidemic disease was detected. Ongoing histopathological and molecular results determine if there is any change in the health status of cetaceans stranded during the last year.

Cetaceans monitoring in the MPA "Isola dell'Asinara": results and considerations for sustainable use

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The “Isola dell’Asinara” Marine Protected Area (MPA), established by the law decree of August 13th 2002, is situated within the southern portion of the Pelagos Sanctuary, covering an area of approximately 108 square kilometres. It’s characterized by a marine environment of great heterogeneity of micro and macro environments, making it a subject of notable scientific and naturalistic interest for Asinara National Park. The CRAMA Association deals with the management of the Sea Observatory and activities related to the conservation of marine fauna, cetaceans monitoring with particular attention to the bottlenose dolphins in the MPA as well as environmental education. Monitoring stands as the primary activity for observing biodiversity and the quality of the habitat where the species of interest live. This practice has been carried out for several years in the area, utilizing the same methodologies to identify key population characteristics and asses their long-term health status. This work aims to present the results obtained over 10 years of activity with particular attention to distribution, group structure, photoidentification, relationships between physical parameters and environmental aspects of the area, including cetaceans sighting. Additionally, it explores the connections between anthropic activities and the presence of animals, with particular attention to fishing activities and nautical traffic. The case study relating to an MPA will provide a comprehensive overview of the territory which, being protected, is subject to specific regulations due to the naturalistic value present in the area. The objective is to lay the foundations for a constructive discussion on potential management models that could be applied not only in protected areas but also in unprotected ones. This work also provides valuable insights into the necessity of striking a balance between human activities and the protection of animal species, with a focus on the conservation and sustainable use of the entire heritage naturalistic.

Cetaceans of the Southern Atlantic Coast of Morocco: The Dakhla Region

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Considered one of the most productive marine ecosystems in the world and in the region, Morocco's Atlantic marine ecosystem is characterized by a high level of fish diversity. This is favored by the permanent upwelling of cold, nutrient-rich water masses, which are essential for primary production. This biodiversity is further enhanced by the location of the Moroccan coast on the migratory route of several species, including marine mammals. Monitoring the stranding of these protected species has allowed us to map the areas where they are observed. We have also been able to identify some of the causes of their stranding. In the area between Lakraa (24°41'46.6"N 14°53'14.5"W) and Cap Blanc (20°46'11.8"N 17°03'01.1"W), about 15 strandings have been observed each year. *Balaenoptera acutorostrata*, *Megaptera novaeangliae* and *Phocoena phocoena* are the most common species seen.

Cetacean's Humerus bone radiodensity: variations between different families and diving behaviour

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Diagnostic imaging is often used to study bone tissue as it provides great morphological details including the possibility of radiodensity studies. Radiodensity is highly variable based on the species, the bone's function, the animal's age and the abiotic environment it is living in. The goal of this study was to determine the radiodensity of 11 cetacean species belonging to the Delphinidae, Physeteridae, Kogiidae, and Ziphiidae families and to explore if differences in bone radiodensity were better explained by the phylogenetic origin of species or the diving behaviour. The humerus body cortical and trabecular radiodensity in adult odontocetes (n=56) were measured following the methodology published by Consoli et al. in 2021. Species were grouped into shallow (<500 m depth) and deep (>500 m depth) divers. In order to discriminate between groups a Receiver Operating Characteristic (ROC) analysis was performed. The discriminant capacity of each marker was assessed as the area under ROC curves and then models for predicting the family or diving behaviour were obtained using the classification and regression trees procedure. As in terrestrial mammals, the cortex had a higher radiodensity than the trabecular bone. Following the Consoli's et al. protocol, the humerus was divided into three sections, and it was found that the most distal section, was the most suitable for discriminating the species. Shallow diving species presented a higher cortical and trabecular bone radiodensity. However, the classification tree predicting the family had fewer nodes, and less error, with 53 out of 55 (96.4%) species classified correctly than the classification tree predicting the diving group, suggesting that the phylogeny had a higher impact on bone tissue radiodensity than the diving behaviour alone. More importantly, It has been established the normal radiodensity of the bone humerus of 11 species. Normal values are necessary to identify radiodensity anomalies (i.e., lesions).

Chronic discospondylitis in a live stranded minke whale (*Balaenoptera acutorostrata*)

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On 4th April 2022 a juvenile minke whale (*Balaenoptera acutorostrata*) live stranded in Gorleston on sea, Norfolk, UK (CSIP reference SW2022/234). The stranding was attended by British Diver's Marine Life Rescue (BDLMR) and due to the age of the animal, location (out of usual habitat), and no sightings of any adult whales in the area, the whale was chemically euthanased under welfare grounds. A postmortem examination was carried out two days later on 6th April by a team from the UK government funded Cetacean Strandings Investigation Programme (CSIP) and the Royal Veterinary College (RVC) The 3.48 m, 440 kg (approx.) whale was found to have a normal nutritional condition but showed no signs of recent feeding. Its age was estimated at around 3-4 months and therefore was still maternally dependent. Multiple, extensive deformities of the vertebral column were observed. The animal was found to have severe discitis (inflammation of intervertebral discs) and associated spondylitis (inflammation and reactive changes to surrounding vertebra) with exostosis (new bone formation). Ankylosis (fused vertebrae) was observed in 5 sites from the thorax to the tail. CT scanning of the vertebral column (ex-situ) showed partial displacement (subluxation) of one thoracic vertebra, and complete displacement (luxation) of a distal tail vertebra, resulting in deviation of the tail. Discospondylitis is often associated with bacterial infection but due to the blood supply to the discs only being present in young animals, bacterial discospondylitis will only develop in neonates and young juveniles. Bacteriology was carried out on 8 samples taken from vertebrae and sub-lumbar lymph nodes, *Esherichia coli* and *Clostridium perfringens* was cultured from all 8 sites. *Esherichia coli* was also cultured in 5 additional samples of key tissues (liver, spleen, lung, brain, and bladder) Metagenomics of 3 discs detected *Photobacterium angustum* and ruled out Brucella sp. Histopathology revealed extensive necrosis and chronic active inflammation of intervertebral discs. Escherichia coli has been cited as a key pathogen in bacterial discospondylitis in in other taxa and is likely to be the cause in this case. Even If the initial bacterial infection had cleared up, the long-term damage to the vertebral column would have had a lasting impact on the whale's quality of life. The fact that this whale was still maternally dependant is the likely reason it had been able to maintain a normal nutritional condition, despite the severity of its deformities, the impact it would have had on mobility and the severe pain it most likely experienced. As the disease progressed, the young minke likely separated from the mother and subsequently live stranded. Discospondylitis is rarely reported in cetaceans with most recorded cases having come from museum specimen. This animal is the first recorded case of discospondylitis in a minke whale in the UK, since the inception of the Cetacean Strandings Investigation Programme in 1990.

Circadian acoustic patterns of bottlenose dolphins (*Tursiops truncatus*) under human care

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Study of bottlenose dolphins in the wild showed strong circadian acoustic activity. Dolphins under human care life are scheduled by fixed time of feeding, training and public exhibitions, making their routine very different from natural conditions with potential effect on their behaviour and welfare state. Our aim is to study the effect of captive-related activities on bottlenose dolphins' acoustic behaviour and their temporal patterns. Deploying an autonomous recorder in the 'Aquarium Mar del Plata' in Mar del Plata (Buenos Aires, Argentina), 253 hours of audio recordings have been collected from 2017 to 2020 and clicks and clicks train were analysed to investigate possible changes due to human care. The number of clicks and trains and the average clicks number per train were compared in relation to the year, the time of the day and three aquarium conditions: opening with show performance, closure and forced closure for COVID-19 issues. Over the years, the circadian patterns of all parameters resulted similar, showing two peaks, one in the morning and the other in the late afternoon. Clicks, trains number and averaged click number per train resulted significantly higher during dawn. Considering the aquarium conditions, a significant higher number of clicks and trains with lower number of click per trains was found during closure days. The heightened acoustic emission during dawn persists across all three conditions. However, it is noteworthy that only during closure and pandemic closure conditions, a significant increase in click and train numbers was also observed during dusk. Our results highlight how *Tursiops truncatus* in captivity shows an increase of acoustic activity during dawn as already found in natural condition. However, activities in aquarium can affect their acoustic behaviour, thus it needs to be taken in consideration during planning activities of the aquarium to support a better welfare condition.

Citizen Science and iEcology revolution: a critical review of innovations in cetacean monitoring and conservation awareness

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Over recent years, there has been a gradual increase in the application of citizen science for studying cetaceans.
Following the 2015 Paris Agreement on climate change, interest in this field expanded rapidly, aided by technological advancements streamlining data collection.
This critical review highlights both the strengths and weaknesses of employing citizen science for cetacean monitoring and its role in raising public awareness for protecting these vulnerable species. Participatory scientific approaches can be a valid alternative in studying cetaceans, given their extensive movements across vast oceanic expanses, including remote areas. By training volunteer observers, it is possible to create a widespread network capable of cost-effectively providing data on cetacean distribution and abundance, increasing observation efforts and coverage.
iEcology (i.e. internet ecology), defined as the study of ecological patterns and processes using online data, supports the importance of exploiting diverse online sources for data collection, which simultaneously contributes to the recruitment of new citizen scientists. Web pages, social media, online databases and several smartphone apps allow anyone to store countless data in the digital world: photos, videos, texts, sounds, GPS tracks and lots of other fundamental information relating to sightings like the number of individuals, the behaviour of animals, or presence of calves. These easily shareable data facilitate swift access for researchers.
The Marecamp Association actively engages in citizen science via the "Friends of Dolphins" Mediterranean network, fostering collaboration among maritime workers in marine mammal research and safeguarding. This program is gathering information on cetaceans in Sicily for six years, actively involving citizen scientists in marine fauna monitoring. Collaborative initiatives, led by expert biologists during awareness-raising events, improve data quality from eyewitness reports and elevate public consciousness. This concerted effort aims to nurture citizen scientists capable of advocating for effective conservation management policies.

Citizen science on the Catalan coast: a preliminary study to raise awareness on cetacean presence

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Most of the world's population lives within few kilometres from the coast. Despite this fact, general knowledge on marine biodiversity is scarce and the majority of the population is unaware of the species richness of nearby waters. Citizen science has been used as a connection between citizens and scientific knowledge and is a useful tool to raise awareness about marine biodiversity and involve them in species conservation. From the scientific perspective citizen science provides valuable scientific data to study species distribution, understand migratory routes and assess the adequacy of conservation measures. Aiming at raising awareness about the cetaceans inhabiting Catalan waters, in 2016 we started a citizen science project "Amics del Mar" (Friends of the Sea) to collect opportunistic cetacean sightings all along Catalan waters. Since it started, we have collected 294 sightings data (including time, coordinates and number of individuals) from eight cetacean species from 73 different citizens. The most recorded species were bottlenose dolphin (n=142), striped dolphin (n= 88) and fin whale (n= 29). Preliminary results on the distribution of sightings seem to agree with data collected along dedicated research surveys off the Garraf coast (central Catalan coast). The sightings seem to show a differential spatial distribution depending on the species, such as bottlenose dolphin sightings occurring in coastal waters and striped dolphin and fin whale sightings occurring primarily on the continental slope. These results highlight the relevance of citizen science projects to collect valuable data all year round arriving to areas where dedicated research surveys can't reach. Furthermore, they show how citizen science results can be paired with the ones obtained with professional scientific research, while connecting citizens with marine biodiversity found nearby their homes.

Click and fly: body length estimates methodologies for sperm whales

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The sperm whale represents one of the main top predators in the Mediterranean Sea. It is known that in the Mediterranean Sea, sperm whales at birth are 3.5 metres long, juveniles have body length between 6 and 7 metres, adults get body length over 7 metres. However, assessing whale body length estimates at sea is very challenging. Here we present and compare two methods used to determine body length in sperm whales: aerial photogrammetry using drones and acoustic analysis of multipulse structure of the clicks. Firstly, aerial pictures from a drone were collected to measure the body length through photogrammetry methods. Secondarily, acoustic emissions were recorded to get the Inter Pulse Interval (IPI), related to the sperm whale size. Due to the variability of the IPI value as a function of depth and sperm whale aspect, the cepstrum method was used to identify the most accurate value. The goal of the study is to understand whether the empirical formulas, which allow the body length of the sperm whale to be determined from the IPI, are also valid for the Mediterranean population, that is well separated from the Atlantic one. So far, aerial images have been analysed and average IPIs have been extrapolated from click recordings for 9 sperm whales sighted in the Ligurian Sea during the CLIC (Cetacean Listening Investigation and Conservation) project. For each sperm whale the body length was estimated using IPIs in the empirical formulas present in the literature. The results appeared rather discordant with the measurements obtained with the aerial images collected with the drone, suggesting the possibility that a new empirical formula specific for the Mediterranean population may be necessary.

Co-occurrence of bottlenose dolphin and fisheries activities within the Marine Protected Area of Camargue

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The bottlenose dolphin (*Tursiops truncatus*) has been studied along the French Mediterranean coast since the 90's, however a dedicated survey on this species was never carried out within the Marine Protected Area (MPA) of Camargue identified as Special Areas of Conservation. The relevance of the area for marine fauna is influenced by the biogeographic delta of the Rhône. These habitats, specifics of the Gulf of Lion are also favorable for fisheries which led to the creation of two protected areas. From this perspective, the main goal of this study was to investigate the co-occurrence between bottlenose dolphin and fishery activities in the waters of the MPA of Camargue. Using a GIS approach, we characterized and quantified the spatio-temporal distribution of these interactions. To do so, we used data collected on bottlenose dolphins and fishing activities between 2018 and 2023 through several boat surveys. Opportunistics sightings were also considered. The study area is divided into 8 sub-zones defined based on their habitat specificity and human activities. Over the study period, more than 16,000 fishing signals were recorded within the MPA, with an overall density of 27.6 signals/km². The average density for each sub-zone is 29.5 signals/km². Regarding observations of the bottlenose dolphin, more than 30 sightings occurred (average encounter rate per sub-zone: 0.019). The overlay of fishing signal density maps and bottlenose dolphin density maps allowed for estimating the co-occurrence of human activity and cetaceans. The two eastern sub-zones around the Beauduc spit have the highest fishing signal density. Bottlenose dolphins are predominantly observed near tributaries, particularly the Petit Rhône, as well as around the Beauduc spit. Further perspectives include the test of the methodology for assessing cetacean conservation issues within MPAs, covered by a larger project, Tursmed, implemented by Miraceti.

Codamozza/Fluker: the amazing journey of a fluke-less fin whale throughout the Mediterranean Sea

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7. *Vertical Horizon*
8. *Delfini del Ponente APS*
9. *Pelagos Cetacean Research Institute*
10. *MuMa Milazzo*
11. *CESRAM*
12. *Marecamp Association*
13. *WWF France*
14. *SOS Grand Bleu*
15. *Golfo Paradiso Whale Watching*
16. *Menkab: il respiro del mare*

Fin whales (*Balaenoptera physalus*) in the Mediterranean are described to move as nomadic opportunists, rather than follow a clear pattern of migration along defined directions, as is common in other Mysticetes. Nevertheless, regular movements of fin whales outside their summer feeding grounds in the Pelagos Sanctuary (North-Western Mediterranean Sea) have been documented, albeit only for short periods and relatively few individuals. Due to her unmistakable features, a completely fluke-less fin whale, a female called “Fluker” in France and “Codamozza” in Italy, could be tracked for a large part of her migration over a timespan of almost a year, providing new evidence of unknown large-scale movements of this species within the Mediterranean. This whale, known since 1996, suffered two distinct, temporally separated and most likely human caused accidents (entanglement in fishing gear and/or collision with a ship), leading to the severing of the whole tail. Nonetheless, she was able to travel at least 7,000 km in over 9 months, completing a round trip between North-Western and South-Eastern Mediterranean. Despite extreme emaciation, she reached the coasts of Syria, very close to the easternmost part of the basin. To the best of our knowledge, this record represents the first evidence a fin whale from the Ligurian Sea being sighted also in the Eastern Basin. This whale’s path may be the result of a combination of a “normal” route and favourable currents she might have taken advantage of. Whether her journey is representative of Mediterranean fin whales' typical movements across the basin, or if her impairment caused a deviation from her usual behaviour, remains a matter of speculation. Understanding the still uncertain movement/migratory patterns of Mediterranean fin whales is crucial for the effective protection of this endangered sub-population, and Codamozza’s track adds a new element to the overall picture.

Combining visual and acoustic approaches to determine seasonal and amongst-day variation in site use by marine mammals and their prey at a tidal stream energy demonstration zone

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With regards to tidal stream turbines, marine mammals are at risk of displacement by arrays and collision with turbine blades. Understanding this risk and detecting and mitigating impacts contributes to the environmentally sustainable development of the industry. However, tidal stream environments are spatiotemporally dynamic, characterised by strong currents and complex hydrodynamics. Therefore, understanding animals' occupancy of these environments requires different approaches. At a tidal steam energy demonstration zone on the coast of Anglesey, we use a variety of visual and passive-acoustic techniques to record the abundance and behaviour of marine mammal species. As is routinely done, these techniques are applied at a monthly scale throughout the year, confirming suspected seasonal variation in site-use. However, these monthly surveys have been supplemented with intensive surveys within key periods, better equipping the determination of within and amongst day variation. Additionally, echosounders are deployed during surveys to record prey availability, helping explain variation in site-use. By better measuring short-term variation in site-use, and the number of surveys needed to reliably estimate site-use within months, there is greater power to detect true-changes in site-use. With an improved understanding of factors of variation in site-use, the causes of changes in site-use following installations can be better explained, allowing the true-impacts of developments to be ascertained. This will ultimately lead to turbines being installed and operated in a manner which causes the least disturbance to marine mammals.

Combining whale-watching and research on male sperm whales in Northern Norway

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6. *Marine Ecological Research Ltd*

Whale2Sea is a commercial whale-watching company based in Andenes, Northern Norway, above the arctic circle, established in 2010. Here, the continental shelf edge is at its closest to the Norwegian coast. The bathymetry presents very steep features with depths reaching 2000m, contributing to an attractive area for many marine species such as cetaceans, and especially sperm whales (*Physeter macrocephalus*). This creates a unique opportunity for Whale2Sea to conduct year-round whale-watching tourism offering a long-term platform for collection of scientific data. Since 2020, collaborations have been established between Whale2Sea and several research institutes with which various research projects have been initiated. Several students, from BSc to PhD level, and marine biologists have worked as guides for the company and collect scientific data during commercial trips throughout the year. Data include photo-identification, acoustic recordings, faecal and eDNA samples, aerial photogrammetry, and behavioural observations. In addition, satellite tagging, suction cup tagging, and biopsies are conducted during dedicated research trips. The combination of whale-watching trips and dedicated research trips has proven to be a very powerful combination for collecting scientific data. For example, a long-term photo-identification catalogue was built, identifying 495 individual sperm whales, and revealing seasonal patterns in their occurrence. Over the last three years, 111 individuals were flown above with a drone to estimate their size. A total of 24 individuals were satellite tagged for long term tracking, and five of these were re-sighted up to three years after being tagged. Whale2Sea and Marine Ecological Ltd have been developing acoustic equipment for better localisation of sperm whales and for studying their acoustic behaviour. For Whale2Sea, the ongoing scientific work ensures access to updated information on the local marine ecosystem, increasing the quality of whale-watching operation and public outreach.

Common dolphin (*Delphinus delphis*) breathing interval and dive responses to swim-with-dolphin tourism activities in São Miguel, Azores

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Dolphin-based tourism has been growing exponentially worldwide in the last three decades. Cetacean exposure to whale-watching and swimming activities have been acknowledged to potentially induce both short-term and long-term impacts, suggesting the possibility of cumulative effects with physiological and fitness repercussions. In the Azores, swimming-with-dolphin (SWD) tourism operators focus especially on common dolphins (*Delphinus delphis*). The predominant boat approach performed for this activity is the J-approach, whereby the boat accelerates parallel to the dolphin's direction of travel, surpassing them and intersecting the path of the group. This approach has been described in previous literature as a technique that elicit strong behavioral responses in cetaceans. In this study, the responses of common dolphins to SWD activities were video recorded (4k, 60 frames per second), with a small unoccupied aerial system (UAS), off São Miguel Island. Only groups with the presence of calves were considered for this study. Breathing intervals (BI) of mother-calf pairs and number of group deep dives (NGDD) were recorded both in the absence and presence of a J-approaching vessel deploying swimmers, simulating the SWD activities. The experimental setup included three consecutive J-approaches to assess potential cumulative effects. Despite there were no statistically significant differences for mother-calf BI in the absence and presence of SWD activity, a statistically significant increase in the NGDD was observed when exposed to the J-approaching vessel and swimmers. No evidence of cumulative effects was found, between the approaches performed, for the response variables considered in the analysis. These results suggested that groups of common dolphins containing calves adopt a vertical avoidance strategy in response to swimmers deployed in their path using a J-approach.

Comparative analyses of tissue and preservation suitability for genetic analysis in stranded cetaceans

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Effective management decisions rely on accurate insights into a species' population structure, and individual provenance of a species. Genetic discrimination of individuals and populations is crucial in this context, and obtaining high-quality genetic material is a fundamental requirement. In the case of cetaceans, stranded animals are often a source of genetic material; however, ensuring samples meet stringent quality standards can often be challenging. Despite the frequent use of strandings in Cetacean genetic studies for conservation purposes, there is a lack of controlled studies comparing DNA quality and yield of different tissue matrices and preservation methods. In this study, we show preliminary results from a comparative analysis of DNA quality extracted from skin, muscle, and fat tissue samples, preserved using two commonly employed methods in stranded networks: 96% ethanol and frozen at -20 ºC. Samples originate from a tissue bank composed of stranded animals, consisting of 23 *Delphinus delphis* individuals and 2 *Stenella coeruleoalba* individuals (n=25), and include all decomposition condition codes established by international stranding guidelines (5 specimens for each code). All samples were subject to a standard protocol for the extraction, quantification, and quality control analysis of genomic DNA. Preliminary results suggest that skin tissue consistently exhibits a higher concentration of DNA, even in dolphins presenting advanced decomposition. In contrast to frozen preservation at -20ºC, ethanol 96% consistently yielded high DNA concentrations in skin tissue, even in advanced decomposition conditions. his study contributes to the standardization of sample collection protocols for stranding networks, by providing reference points for optimal tissue types in all decomposition condition codes, and respective preservation methods. This information has the potential to enhance the quality of genetic analysis for stranded specimens, by improving the reliability and comparative potential of genetic analyses based on diverse cetacean stranding networks.

Comparative skull shape analyses of coastal and offshore bottlenose dolphin (*Tursiops* spp.) skulls, using high resolution 3D modelling: implications for evolutionary processes and local conservation

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Bottlenose dolphins (*Tursiops* spp.) show considerable skull polymorphism worldwide. Skull shape commonly differentiates between coastal and offshore habitats, often in features related to feeding and communication. However, exact patterns of cranial polymorphism between coastal populations worldwide remain unclear, limiting our understanding of associated evolutionary processes.

We present data on 3D skull models from 225 individuals of *Tursiops* spp. worldwide, including six well described coastal populations/species and their offshore counterparts, and other less studied regions. Carrying out 3D Geometric Morphometrics (3DGM) based on 760 evenly spaced pseudo-landmarks, enabled the quantification of three-dimensional skull shape variation with high detail, avoiding shape distortions inherent to two-dimensional analyses.

Multivariate analyses, including supervised and unsupervised classification methods, showed that coastal taxa of *T. aduncus*, *T. erebennus* and *T. t. gephyreus* have distinct morphology from offshore specimens, as well as other coastal regions. Previously described coastal populations from California, Ecuador and the North Sea also differentiate from offshore, but show greater overlap with nearby regions (both coastal and offshore). Our results also suggest the occurrence of potential coastal groups in West South America, West Africa and Japan. This suggests Tursiops polymorphism is driven locally in coastal areas, influenced by connectivity from geographically close regions. Some

populations from distant ocean basins (e.g. North Sea and Japan), show relative skull similarity, possibly due to convergence.
Shape changes involved relative rostrum length and cranium width, but also a dorsoventral compression of the occipital region. Changes in the concavity of the ascending processes of the maxilla are also observed, with corresponding changes in the prominence of the mid rostral bump.
This study supports the recurring founding of Tursiops into coastal areas worldwide. It also shows that 3DGM can improve our ability to identify coastal populations and clarify the genus taxonomy, contributing to the more effective conservation of the group's biodiversity.

Cuvier's beaked whale atypical mass stranding event in Cypriot Coastline (2023)

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Strandings of Cuvier's beaked whales (*Ziphius cavirostris*) have been regularly documented in the scientific literature in the Mediterranean Sea since 1823, mainly related to anthropogenic activities, particularly exposure to underwater sounds. The aim of this study is to present the findings of an atypical mass stranding event, which was first observed on February 9th 2023, in the coastal area of Cyprus, where eight (8) animals from the species *Ziphius cavirostris*, were stranded in the area over which the government of the Republic of Cyprus exercises effective control. All standings were distributed within Chrysochou Bay, between the areas of Polis Chrysochous and Pachyammos. Out of these eight (8) animals, seven (7) were stranded alive and one (1) washed ashore dead. The response team arrived at the stranding areas, and after primary assessment attempted at refloating the animals. Despite these efforts, all animals died by the next morning. Full necropsy, tissue and DNA samplings were performed where it was feasible. Systemic gas bubbles (embolism) were found within the cardiovascular system as well as in other organs, including gas bubbles within the blood collected from the heart cavities. Selective tissue samples from viscera and blubber were also collected and submitted for histopathology. In conclusion, gross and histological findings indicate that this atypical Cuvier's beaked whales mass stranding event showed the characteristic features of a mass stranding due to acoustic related disturbance, probably associated temporally and spatially to mid-frequency sonar activities. This is another example of the adverse effects of underwater acoustic disturbances on beaked whales.

DELFISHPAM project: passive acoustics to assess dolphins' interaction with fishing and aquaculture activities in the Maltese Islands

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Malta's eastern and southern coasts are affected by aquaculture activities and fishing with FAD (Fishing Aggregating Devices). Both are known to have influences on the environment, habitats and biodiversity, by altering species richness and abundance, and thus having the potential to impact higher trophic level predators, including bottlenose dolphin (BD), either through direct (displacement and death/injury through entanglement) or indirect paths (changes in the abundance/availability of prey species and, in the case of aquaculture, increase in environmental contamination like fungicides, anti-fouling paint and antibiotics).
This study investigates the BD occurrence near, and the interactions with, fish farm facilities and FAD fishery in areas of conservation/protection located in eastern part of the island of Malta using both visual and passive acoustic monitoring (PAM). Preliminary data collected in 2019-2023 showed the presence of BD near the aquaculture cages of Atlantic bluefin tuna, sea bream and European sea bass all year-round, and the occurrence in the proximity of FADs placed at sea by fishermen from August to December to attract the target species, the dolphin fish. Here, BDs appear to exploit the structures as an aggregator of trophic resources rather than to feed on the fish contained in or attracted underneath. All age classes and both sexes seem to be involved in such interactions, using a variegate acoustic repertoire (clicks, whistles, burst pulses and bray-calls). These findings pose relevant conservation questions, since the magnitude of the effects of FADs in particular (potential entanglement in the anchoring lines) on the Maltese BD population is not known and no mitigation measures are currently in place for reducing possible impacts. Further results have the potential to provide useful information to allocate suitable areas designated for aquaculture and FAD fishery, so that marine mammal occurrence is taken into account and any potential conflict is minimized.

Delphinidae affected by chronic pathologies in the Gulf of Catania

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Various factors, including genetic problems, exposure to toxic substances or radiation, infections, or injuries during embryonic development, can cause animal malformations. Some malformations may be mild and not affect the animal's life, while others may be severe and limit the animal's survival abilities or the capacity to perform one's functions. Different malformations and chronic diseases can affect cetaceans, such as dolphins. Some of these pathologies may be caused by environmental factors, such as sea pollution, while genetic problems or infectious diseases may cause others. Malformations found in cetaceans may include the absence or deformity of body parts, such as fins, tail, rostrum, or spine, or even the presence of teeth in abnormal positions. These statuses can affect their health and behaviour, limiting their ability to feed, swim, and communicate. The most severe illnesses can even lead to the death of the animal. Studies carried out in the Gulf of Catania, Italy, by the Marecamp association, have shown cases of dolphins (*Tursiops truncatus* and *Stenella coeruleoalba*) with malformations and breathing difficulties even in this area of the Mediterranean. Thanks to continuous monitoring over time supported by data collection and photos, it can be understood whether the malformation is life-threatening, or the animal's pathology is chronic.

Delving into *Brucella pinnipedialis* pathogenesis and transmission in stranded bottlenose dolphins

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The emergence of Brucella infections in marine mammals composes a growing threat to both wildlife and public health. Our study elucidates the pathogenesis and transmission dynamics of *Brucella pinnipedialis*, by investigating a systemic infection in two stranded bottlenose dolphins (*Tursiops truncatus*) along the Cantabrian coast of Spain. Both individuals exhibited severe systemic lesions associated with Brucella infection, with a younger dolphin identified genetically as the likely offspring of the other. Utilizing real-time PCR, bacterial culture, and whole-genome sequencing, we identified and characterized the Brucella strains involved as *B. pinnipedialis* (ST25). This research greatly contributes to our understanding of the epidemiology and clinical impact of *B. pinnipedialis* infections in cetaceans. Brucella spp. are zoonotic pathogens, and while *Brucella ceti* has been identified in various cetacean species, there are very few documented cases of *B. pinnipedialis* in dolphins and whales. Our findings highlight the pathogenesis of *B. pinnipedialis* infection in two bottlenose dolphins. The study emphasizes the need for ongoing surveillance and accurate diagnosis, to comprehend the broader pathogenic implications of this organism on marine mammal populations and public health.

Dental anomalies in Grey seals from the Bothnian Sea

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Grey seals (*Halichoerus grypus*) are top predators in the Baltic Sea and strong indicators for the status of their ecosystem. Since the early 2000s, the Swedish Museum of Natural History has analysed samples from hunted Grey seals in the Baltic Sea and determined their age by counting growth layer groups (GLG) in the cementum of their teeth. The Bothnian Sea, particularly Gävleborg County, is an area in the Baltic where decreasing blubber thickness has been described in grey seals, and thus this was chosen as a study area. While blubber thickness is one of the most important indicators for grey seal health, dental anomalies have been linked to age-specific life history events, health and contaminant load in marine mammals. This study focuses on hunted seals, which are a randomized sample of the normal population. The dental histology of 303 grey seals from Gävleborg county from 2007-2022 was examined. The teeth were cut in sections (100 µm) and examined under a microscope with a polarized filter. GLGs were counted to determine the age, which increases in difficulty with the age of the seal. Anomalies were defined as: accessory lines, marker lines, pulp stones and/or disturbed root cementum. The presence of any of these anomalies were noted for each individual. The frequency of dental anomalies had a strong correlation with age ($p < 0.01$). The highest frequency was observed in seals over the age of 25 in the whole study period (90-93%). However, similar frequency could be seen in younger animals (10-15 years) in the earlier time period (2007-2013). No clear correlation could be seen between blubber thickness and dental anomalies, however further studies comparing tooth structures and diet in seals from the entire Baltic are needed to explore the link between dental anomalies and health status in these top predators.

Diet of minke whales (*Balaenoptera acutorostrata*) stranded along the west coast of Iberia

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There is little information regarding the ecology of minke whales (*Balaenoptera acutorostrata*) in southern waters of the Northeast Atlantic. To improve the knowledge about the foraging ecology of this species and validate the use of complementary methods for baleen diet estimation, we analysed stomach contents (n=24, 2005-2023) and blubber fatty acids (n=10; 2005-2010) from minke whales stranded in the west coast of Iberia. Overall, the main prey identified in stomach contents analysis were *Sardina pilchardus*, *Trachurus* spp., species from the family Ammodytidae, *Scomber* spp. and species from the family Mugilidae with the former two prey groups being predominant (numerical importance (%N): 36.6% and 17.1% respectively; biomass (%W): 27.1% and 23.7%, respectively). Despite the low sample size, minke whales stranded in Galicia (n=4) showed a predominance of *Scomber* spp. (%N: 89.1%, %W: 77.3%) in their stomachs. Females (n=10) show a less diverse diet compared to males (n=14), mostly composed of species from Clupeidae, Carangidae and Scombridae families. Results suggest a shift in the diet of minke whales in west Iberia (2005-2015 vs. 2016-2023), possibly related with changes in sardine abundance in this region. The estimated length of the main prey ingested by minke whales was within the legal landing size allowed for fisheries in the west coast of Iberia, suggesting a potential minke whales-fisheries overlap in resource exploitation, which may be relevant for future conservation management. The quantitative fatty acid analysis supported the results obtained from stomach contents for the subsampled animals (n=10), validating, for the first time, the use of quantitative fatty acid analyses for a longer-term diet determination in baleen whales. This study comprises the first description of the diet composition of minke whales in the southern part of their distribution range, in the North Atlantic.

Diet of striped dolphins (*Stenella coeruleoalba*) in the French part of the Pelagos Sanctuary

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This study is based on visual method of stomach contents from striped dolphins (*Stenella coeruleoalba*) stranded between 2005 and 2019 on the French coasts of the Pelagos Sanctuary (Nort-Western Mediterranean Sea). 34 on the 44 stomachs analyzed presented food remains. Results show that the dietary spectrum is highly diverse including 13 neritic species and 23 oceanic species, demersal or pelagic ones. Cephalopods were present in every stomach with food remains, accounting for 84% of the reconstructed biomass and the fish category represented only 16% of the reconstructed biomass. In terms of numerical importance, fish preys were more numerous with 59,3% of total prey, then the cephalopods with 34,3% and a small quantity of crustaceans accounting for 6,4% of all preys. The most important prey with the highest IRI (Index of Relative Importance) is the squid *Todarodes sagittatus* (42,1% W), followed by the squid *Ancistroteuthis lichtensteinii*, and then a small fish species among the Myctophidae, Ceratoscopelus maderensis. No difference has been noted in the diet between sex, but regarding the maturity state, juvenile individuals feed in smaller cephalopod preys than adults (no difference in size has been noted for fish preys). In a second time, these results will be compared to historical data in the same area to identify a possible shift in the diet of the striped dolphin related to anthropogenic activities such as overfishing and more globally related to climate change.

Diet of the harbour porpoise using multi-analysis approach

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Stranded and bycaught porpoises are continuously collected along the Swedish coast and necropsied for national health monitoring. It has been 12 years since the diet of harbour porpoises in Swedish waters was last investigated using such monitoring data, but this is essential knowledge as prey availability and quality have large impacts on the overall distribution and health of porpoises. Here, we use a combination of three different methods to determine the diet of 50 porpoises collected along the Swedish coast during 2019-2023. The methods include macroscopic stomach analysis, stable isotope (δ13C and δ15N) analysis of bone, muscle and liver, and eDNA analysis of gastrointestinal content. To our best knowledge, this is the first time these three methods are combined to study marine mammal diet. All individuals are analysed using all three methods, providing a detailed picture of each porpoise's diet, e.g. species composition, relative importance of different species, and potential temporal, spatial or individual differences in preferred prey, and allow comparison of method performance. Preliminary results indicate that the present diet of harbour porpoises in Swedish waters include a large variety of prey. Similar to results from previous dietary studies in the area the majority of identified prey species belong to families Gadidae, Clupeidae, Gobiidae, Ammodytidae and Cephalopoda. In addition, analyses of a larger dataset incorporating only two of the methods supports diet variation across season, geographical location, sex and age class. Preliminary results on method performance show that the use of eDNA-analysis of gastrointestinal content increase the number of identified species when compared to traditional macroscopic stomach analysis. This study provides fundamental information for conservation efforts towards harbour porpoises in Swedish waters. In addition, it offers an evaluation and comparison of the performance of method for dietary analysis allowing recommendations on method choice for future dietary studies.

Diet of three oceanic delphinidae species in the Canary archipelago

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The marine geography of the Canary Archipelago offers a vast variety of different niches for costal as well as deep sea species that results in a rich biodiversity in marine life such as fish, cephalopods and cetaceans. To better understand the trophic ecology of three seasonally sympatric species of small dolphins (*Stenella coeruleoalba*, *Stenella frontalis*, *Delphinus delphis*) a stomach content analyses were performed. The samples were taken by the Society for the Study of the Cetaceans of the Canary Islands (SECAC) during the biological studies of stranded cetaceans in the Canary Archipelago. In total 104 stomach content samples collected from the years 1994 to 2023 were analyzed. These unique long-term sample collection shows that deep see fish and cephalopod species are the preferred prey. However, each dolphin species prefers a specific range of prey, with a minimal overlap to each other. This indicates ecological niche partitioning according to water strata, enabling seasonally coexistence of the analyzed species in the area.
The presented results show that dolphin species are an important part of the Canary Archipelago, with the potential to serve as umbrella species whose protection will benefit the whole ecosystem.

Discovering genetic diversity over time: analysis of historical and modern samples of Risso's dolphin (*Grampus griseus*, Cuvier 1812) in Mediterranean Sea

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Grampus griseus is an odontocete cetacean belonging to the Delphinidae family and it is the only species of the genus Grampus. It is considered to be regular in the Mediterranean Sea, although it is rarely sighted. Information about its ecology, distribution, population trends and structure are limited and offer scope for novel studies. It's known from literature that a decline in population size in Mediterranean after 2005 occurred, probably as a result of increased exploitation of the trophic resource by fishermen in the coastal area and also a depletion of the resource due to changes in some environmental parameters such as chlorophyll and surface temperature linked to primary productivity. In fact, the presence of this species has significantly reduced in coastal and continental slope areas while it seems stable in pelagic ones. Generally, the decrease in the size of a population also lead to a decrease in terms of genetic variability and thus an increase in extinction risk for that population. Regarding this, the purpose of this research is to analyse historical samples (bone or tooth powder) and modern samples (tissues) through the use of genetic tools. A census to determine the number of specimens of this species preserved in museums and belonging to different areas of the Mediterranean has been done, with the aim of highlighting and extend the resource availability for further research insights. Preliminary results on historical specimens have shown haplotypes already described for modern samples in literature. All these analyses are conducted to characterize the haplotype diversity of this species before and after 2005, the year that marked the decline of the Grampus population in the Mediterranean. Obtained information will be very useful to improve knowledge about distribution, movement patterns of G. griseus and to implement its conservation and management plans.

Distribution and composition of the Risso's dolphin (*Grampus griseus*) population along the north coast of Tenerife (Canary islands)

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For the first time, comprehensive data on the distribution and composition of the Risso's dolphin (*Grampus griseus*) population inhabiting the north coast of Tenerife are presented. The challenging meteorological conditions at sea on this part of the island for much of the year have presented difficulties in studying the species, however, it seems to exhibit a strong affinity for the area. Over three years, information on the species has been collected on days under favorable weather conditions.

A total of 122 individuals have been identified and the local abundance of resident individuals was estimated using a mark-recapture technique of identifiable animals, employing a “closed population” model, with a best estimate of 47 resident individuals (95% CI 45 to 53). The observed groups have ranged from 4 to 35 individuals, with an average of around 15. Calves were present in 46.6% of sightings, while juveniles were observed in 73.3%. Sightings have occurred at depths ranging from 850 to 20 meters, with a higher frequency around the bathymetric contour near 543 (±189) meters. This varied depending on their behavior or possibly the target prey for their feeding. This study highlights the importance of the north coast of Tenerife for the development of the Risso's dolphin population, suggesting it as a particularly relevant area for the conservation of this species within the archipelago.

Distribution and responses of cetaceans to anthropogenic pressure

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The Mediterranean Sea is considered one of the major biodiversity hotspots, but at the same time, it is also highly impacted by human activities. It is a crossroads for ships, an area of high fishing pressure, and with an elevated concentration of floating waste. All these conditions represent sources of stress and danger for the species that live in its waters. This is particularly evident for cetaceans, species extremely sensitive to anthropogenic disturbances and currently protected by numerous international laws.

The studies on cetacean species distribution and anthropic disturbance sources can give an idea of the current cumulative effects of human pressure on them. Data of this research were collected by the Marecamp Association on board platforms of observation, like passenger ferries and cargo ships, in collaboration with the Fixed Line Transect Mediterranean Monitoring Network (FLT MedNet), in February 2022-March 2023 and along two fixed routes: Catania-Malta, and Porto Empedocle-Lampedusa. Records about cetacean species and anthropic presence in terms of naval traffic, fishing activities and marine litter were gathered to assess their distribution. Using the software QGIS, spatial analysis were conducted to visualize the possible existing relationship between cetacean's areals and anthropogenic pressures. Kernel density analysis were carried out on both variables, considering all anthropic elements as a whole in order to evaluate their cumulative effect.

Results demonstrate that the greatest density of anthropogenic pressures is observed near the island of Lampedusa, while they appear homogeneously distributed along the Catania-Malta route. Moreover, there is a noticeable intersection with the presence of cetaceans in those regions significantly affected by human activities, particularly near Lampedusa Island where the highest concentration of sightings was recorded.

This research demonstrates the current coexistence of cetacean species with human activities in the study area, while closely examining the threats that pose risks to their conservation status.

Dive behavior of orcas in the Strait of Gibraltar: a preliminary study

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Orcas have been a constant presence in the Strait of Gibraltar for at least 3,000 years, primarily due to the abundance of tuna in these waters. This study, conducted from March to June 2023, focuses on analyzing the foraging areas and associated behaviors of orcas near Barbate. Utilizing satellite tagging and catcam technology, we investigated their habitat use and hunting strategies.

A satellite tag deployed between April and June 2023 revealed that the killer whales moved more than 3,000 km, frequenting depths from 30 to 700 meters. Bayesian analyses identified their primary feeding zones between 30 and 200 meters depth. Catcams data provided insightful observations into their diet and hunting techniques. These findings confirmed the orcas predilection for red tuna and revealed their diving behaviors, including dives of at least 80 meters. Notably, the orcas employed silent hunting strategies, likely utilizing passive acoustics to locate prey.

This study highlights two significant aspects of orca behavior in the Strait of Gibraltar. First, it demonstrates the orcas consistent presence in the region over three months. Secondly, it provides evidence of a strategic approach to food searching using passive acoustic techniques, emphasizing complex and adaptive hunting behaviors.

Dive into sperm whale vocal diversity: insights from opportunistic recordings off São Miguel Island

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Sperm whales (*Physeter macrocephalus*) are known for their diverse repertoire of vocalizations. Even though they predominantly produce clicks, they also emit a wide variety of sounds, including slow clicks and trumpets produced by immature/mature males mostly in feeding grounds. In the Azores, sperm whales are sighted year-round by whale-watching vessels. This study intends to explore sperm whale vocalizations during dives, using recordings conducted opportunistically from July to September 2023 off São Miguel Island (Azores) during whale-watching trips. Sperm whale areas were located by land-based lookouts that directed the boats to the specific area. In total, 15 recordings were gathered (≈ 3 hours). Differentiation between solitary (n=4) and grouped individuals (n=11) relied on visual and acoustic data collected in the area. Regular click sequences were prevalent in all recordings. When whales were alone, slow clicks and a distinctive trumpet sound were identified, which is in line with the hypothesis that these types of sounds are produced by males. Two of the whales recorded were photo-identified, an adult male sighted since 2004 - “Mr. Liable”- and "Diamond", identified since 2014, mostly associated with a well-known social unit and seen alone for the first time in 2023. The recorded trumpet produced by “Diamond” occurred post-fluke, lasted 3.3 s, and was followed by slow clicks and preceded by codas and a regular click sequence. Identifying these distinctive sounds offers insights into the determination of the animals' sex, as may be the case of "Diamond", whose sex was undetermined until the recording of this sound, which indicates that this individual might be a male. Furthermore, this mark, to the authors' knowledge, the first documented instance of trumpet sounds around the Azores islands, which can lead to a deeper understanding of the behavior of sperm whales in this region.

Diving and surfacing characteristics of coastal minke whales (*Balaenoptera acutorostrata*) in the Moray Firth, Scotland: implications for visual estimates of population size

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A greater understanding of the intraspecific variation in diving behaviour and surfacing patterns is needed for the species to provide more accurate criteria for cue count abundance estimates. The aim of this study was to investigate the factors influencing diving behaviour, and thus surfacing rates, by analysing the effect of age (adult versus juvenile) and behaviour (feeding versus travelling) in these whales. 47 focal follows were collected between June and September 2006 to 2023 in the Moray Firth, Scotland. The mean number of surface events per hour was higher in adult and feeding whales. Both age and behaviour were found to significantly influence the time spent at the surface, however no factors were found to influence dive duration. Adults had longer pre-dive and post-dive surface durations than juveniles and feeding whales had longer pre-dive surface durations than travelling whales, irrespective of their dive duration. A strong correlation was found between surface duration and the number of breaths taken, showing that the whales take more breaths when recovering from longer dives to replenish their oxygen stores. Surface duration and dive duration were found to be negatively correlated, indicating that oxygen store management occurs over multiple dive cycles rather than single dives. Overall, the study concluded that age and behaviour significantly influence the time minkes spend at the surface and therefore the probability that an animal would be detected during a line transect survey. The key findings of this study will contribute to conservation and management strategies by updating current methodology for more accurate estimations of population sizes.

Does exceeding the legally permissible number of vessels impact feeding and socialising in bottlenose and common dolphins off southern Portugal?

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The presence of maritime touristic vessels is known to affect the behaviour of multiple cetacean species. Therefore, different countries have implemented legislations to regulate the number of boats in proximity of cetaceans. This study examines if exceeding the legally permissible number of boats affects the feeding and socialising behaviour of bottlenose (*Tursiops truncatus*) and common dolphins (*Delphinus delphis*) off southern Portugal, an area with high dolphin-watching boat pressure. Between 2012 and 2023 opportunistic, as well as dedicated boat-based marine mammal surveys were conducted. Data on the species, maximum number of boats, and initial and general behaviour of the dolphins were collected. When the initial behaviour was feeding and/or socialising we compared it to the general behaviour to determine if there was a change. Using Fisher's Exact Test, we analysed if feeding and socialising of either species ceased more often when the number of boats exceeded the legal maximum. A total of 967 sightings were analysed, 373 for bottlenose and 594 for common dolphins. In 29.58% of all sightings the legal number of boats was exceeded (N = 286), 45.31% for bottlenose (N =169) and 19.70% for common dolphins (N = 117). Neither, feeding nor socialising in either species significantly changed when more than the permissible number of boats were present. For any number of boats, both species seemed generally more prone to cease feeding, rather than socialising. Specifically, bottlenose dolphins appeared to stop socialising more frequently (16.95%) and feeding less frequently (19.59%) compared to common dolphins (11.61%, 28.86% respectively). These preliminary analyses highlight the lack of enforcing current measures and indicate potential differences in vessel exposure of both species. Further studies are needed to examine if surpassing the legal number of vessels affect other aspects of the behaviour of bottlenose and common dolphins off southern Portugal.

Does it pay to stick around? Reproductive success of a resident male sperm whale (*Physeter macrocephalus*)

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The Azores (northeast Atlantic Ocean) is a feeding and breeding ground for sperm whales, where the species is sighted all year round. Specific social units, stable groups composed of females and immature animals mostly living at mid to low latitudes, are resighted in the Azores between the years. Males of this species are solitary individuals and their migration routes to extreme latitudes are uncertain, as well as their geographical and social fidelities. They have a low resighting rate in the Azores, where they temporarily join social units to breed. One mature male sperm whale ("Mr. Liable") has broken this pattern, showing site fidelity to the Azores for more than 20 years. We investigated its reproductive success by determining its genetic relatedness with 16 other individuals (females and immatures) from different socials units. DNA from samples of sloughed skin samples were extracted and microsatellite loci were determined. Genetic polymorphisms were compared for kin relationship analysis. The results illustrate possible drivers of an alternative mating behavior.

Dolphin vocalizations occurrence in ambient sound of the Gulf of Oristano (Sardinia, Italy)

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The characterisation of marine underwater sound allows observation of the spatial-temporal distribution of vocalizing species and human activities, which can inform an assessment of their interactions. Passive Acoustic Monitoring is a valuable tool for obtaining information on the presence and habits of highly mobile species such as cetaceans. This work evaluated ambient sound levels (SPL dB re 1 µPa) and examined the seasonal occurrence of dolphins by their acoustic signals. Acoustic data collection was performed in the shallow waters of the Gulf of Oristano (Sardinia, Italy) using underwater acoustic equipment positioned on the seabed. The study area borders a special area of conservation (SAC) and a National Marine Protected area (MPA). Data were collected during three seasons: Summer, Autumn (2019) and Spring (2020, after the Italian COVID19 lockdown). A total of 6,868 .wav files in the frequency range 0.1-96 kHz were analyzed. Significant statistical differences were observed between seasons both for dolphins vocalizations and marine traffic as the number of vessel passages. Dolphins vocalizations occurred in all seasons and the species was attributable to *T. truncatus*. In the overall acoustic data, the analyzed vocalizations included both clicks (10-80 kHz) and whistles (5-20 kHz); clicks were detected in 36% of files, while whistles were in 10%, of which 8% were recorded in Spring 2020. Vessel passages accounted for 42%, masking most of the vocalizations in the low and mid frequencies (0.1-16 kHz frequency range). Significant difference for median SPL values were showed, the lowest in the Spring (120-140 dB re 1 µPa) and the highest the Summer (128-150 dB re 1 µPa) respectively. The acoustic monitoring of marine ecosystems is useful for assessing the ecological status of marine habitat especially where MPA are present. Such information is important for MPA and SAC management plans and conservation measures for cetaceans.

Eco-trophic-molecular assessment of the Maldivian cetofauna relying on eDNA analysis

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Marine mammals' distribution and abundance are fundamental bioindicators of marine health conditions. Being at the highest levels of the marine food chain, their conservation is pivotal for the regulation of their whole biological community. Until now, it was difficult to track simultaneously cetofauna biodiversity and its prey species distribution. Nowadays novel molecular techniques, based on environmental DNA (eDNA) analysis, allow the identification of multiple taxa within a single seawater sample (metabarcoding). Thereby, eDNA represents the elective tool for the evaluation of cetacean diversity and the trophic chain associated to their presence. The Maldivian archipelago, a biodiversity hotspot for both ceto- and ichthyo-fauna, offers a unique scenario to explore this application. Using a multi-primer approach, we aimed to enhance the detection of rare marine mammals' species on 39 environmental samples, while simultaneously exploring fish diversity. The water sample collection, which took place in 2020-2021 over a broad area of the Republic of Maldives, covered three different distinctive habitat types: within atoll, between atolls and kandu waters. Samples were screened for two markers, targeting the 12S-rRNA and the 16S-rRNA regions. Using an ad-hoc designed bioinformatic workflow, over 250 marine vertebrates' taxa were identified. Efficient cetacean detection was achieved (10 different species detected combining both markers, 4 of which spotted by both primer sets), often confirmed by species sighting concomitant to the sampling. The most commonly detected cetacean species (*Stenella longirostris*) mirrors the most frequently observed in the archipelago. Moreover, trophic levels distribution was consistent with the habitat types (e.g. higher incidence of top predators outside atolls), confirming the reliability of eDNA to resolve local communities at sampled sites. In conclusion, the application of a multi-marker eDNA technique seem promising in increasing cetaceans' detectability while simultaneously assessing fish community, providing a relevant approach for effective and inexpensive biodiversity monitoring and trophic community assessment.

eDNA based haplotype analysis of the Shannon bottlenose dolphins (*Tursiops truncatus*)

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Environmental DNA (eDNA) has been used successfully as a non-invasive method to detect presence of cetacean species. However, it is challenging to obtain intraspecific data from eDNA samples, therefore careful investigation is required prior to implementation. As part of the EU Biodiversa+ eWHALE Project, this study aims to determine if eDNA can be used to detect and assign individual bottlenose dolphins (*Tursiops truncatus*) to one of the three genetically distinct populations occurring in Irish waters. This study is focused on the resident Shannon Estuary population, which is well studied with 40 known biopsied individuals and a regularly updated photo ID catalogue. Individuals were approached using a RIB and water samples were taken from the fluke print. Water samples were immediately filtered onboard using both Waterra (50L) and Sterivex (1.5L) filters. These samples were taken in tandem with photo ID which was used to match the sampled individuals to the established catalogue of Shannon dolphins. eDNA was extracted from the filters using a DNeasy Blood and Tissue Kit (QIAGEN). Preliminary results from end point PCR using species specific primers indicate that bottlenose dolphin DNA was successfully captured in each filter type. Future work includes using qPCR to quantify the amount of eDNA collected from each filter to evaluate their efficiency and to use previously developed microsatellite markers to match the eDNA collected to the previously obtained biopsies. If this is successful, this study will provide evidence that eDNA can be used to identify bottlenose dolphins to population level, providing a basis for the use of eDNA as a non-invasive method to investigate cetacean population structure.

Effect of anthropogenic noise sources on beaked whales' fine-scale diving biomechanics and its energetic implications

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Behavioural Response Studies have shown that cetaceans react to anthropogenic sounds such as navy sonar in ways that can lead to increased energy expenditure. Beaked whales are the most sensitive group documented so far, and it is hypothesized that navy sonar can cause individuals to enter an over-exerted physiological state leading to lethal strandings. Locomotion costs are among the most significant components of cetaceans´ total energetic costs which could increase considerably due to avoidance. We analysed existing BRS data from four different beaked whale species fitted with DTAG or CATS biologging devices. We hypothesized that anthropogenic sounds lead to a change in behaviour that results in increased EE with respect to periods of baseline behaviour. Behavioural response studies of cetaceans have extensively used the Overall Dynamic Body Acceleration (ODBA) as a proxy for energy expenditure (EE), to identify and characterize avoidance responses to sonar. However, ODBA is dependent on body size and activity and. can overestimate the EE in large animals. This prevents comparative analyses and cannot identify periods of higher swimming speed. To overcome this, here we use a recently developed method for kinematic analysis, the “magnetometer method” that will allow us to calculate OSA, a proxy for EE that overcomes the limitations of ODBA. Beaked whales use fast and strong B-strokes which are hypothesized to be associated with recruitment of fast-twitch fibres when oxygen stores dwindle in long dives. If EE increases, so will oxygen consumption and therefore an earlier use of possible anaerobic strategies such as the use of B-strokes when oxygen stores are nearly exhausted. This research may help us to better understand why beaked whales appear to be specifically vulnerable to acoustic disturbance as they show more energetically expensive responses, i.e., longer diving durations with the appearance of faster and stronger gaits earlier than expected.

Energetic cost of behavioural responses to human-induced disturbance in wild dolphins, a non-invasive approach

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Short-term behavioural responses have been documented in cetaceans exposed to anthropic activities. Increase of swim speed have highlighted how cetaceans can exhibit a flight response when disturbed. While it is possible to quantify variations in swim speed, it is challenging to predict the physiological consequences of such behavioural changes. That is, quantifying the energy loss caused by human-induced flight responses is inherently difficult without an estimate of the cost of locomotion. Research on the energetic costs of swimming for cetaceans has been limited to a few dolphin species under human care and to the use of telemetry tags on larger species in the wild. However, tagging methodology is invasive and not always suitable for small, fast swimming delphinids. This study represents an attempt to determine the cost of locomotion in wild dolphins using a non-invasive technology. A small Unoccupied Aerial System (UAS) flying at 20 m altitude was used to conduct focal individual follows on 50 free-swimming adult dusky dolphins (*Lagenorhynchus obscurus*) in Kaikoura, New Zealand. Post-hoc video analysis focused on time intervals in which the focal dolphin swam in a straight line at constant speed. Respiration rates for dolphins swimming at speeds ranging from 0.9 m s-1 to 6.9 m s-1 were calculated and used as proxy for locomotion cost. Respiration rate increased exponentially with swim speed and their relationship was best described by the equation y = 2.42e0.2825U (R2 = 0.96). Water turbidity limited fluke stroke detection and further data are necessary to obtain a direct measure of the energetic cost of locomotion. The results of this study show how UAS can be used as a non-invasive tool to better understand the relationship between wild dolphin behavioural responses and associated energetic requirements.

Enhancing Cetacean photogrammetry precision: is integration between barometric and lidar altitude data needed?

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In recent years, the widespread adoption of Unoccupied Aerial Systems (UAS) has revolutionized marine and terrestrial research, offering a portable and cost-effective means for aerial photogrammetry. In the realm of cetacean morphology, UAS-borne photogrammetry stands out as a non-invasive approach, enabling broader population characterization without relying only on stranded individuals. However, for accurate photogrammetric measurements meticulous error minimization is necessary for enhanced measurement data reliability.
To address this challenge, we conducted accuracy tests on a tailored LIDAR (LID) applied to a commercial drone referring to standard calibration objects while also calculating UAS-borne camera distortions. Both barometric (BAR) and LID sensors were compared with the same calibration objects to test accuracy and evaluate reliability. LID accuracy, assessed through manually measured distances ranging from 5–40m, exhibited up to ±10cm error, depending on the incidence surface. Similar results were obtained from flights (range 20m-60m) framing known objects. We then conducted 80 at-sea flights aimed to collect information on individual total length from specimens belonging to four different cetacean species. Although BAR provided continuous data on UAS altitude, its estimation was generally underestimated during the whole flight. On the other hand, LID data were significantly more accurate but occasionally discontinuous. Overall, LID altimeter accuracy showed a crucial role in compensating for barometric inaccuracy which instead provided consistency against water surface reflections, flight vibrations, and drone inclination. Results therefore suggest benefits in coupling BAR and LID sensors for more accurate UAS-borne measurements.

Epizootic effects on long-finned pilot whales (*Globicephala melas*) social structure in the Strait of Gibraltar

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Studying the impact of a disease on a population is crucial to understanding their responses to environmental stressors and evaluating their resilience. Although sociality has been acknowledged as an important factor in disease transmission, there exists a significant gap in understanding how social structures may be influenced. Consequently, this study aimed to investigate the impacts of two morbillivirus epizootics in 2006–2007 and 2011-2012 on the social structure of long-finned pilot whales (*Globicephala melas*) in the Strait of Gibraltar. Analysis of their social organization and its temporal evolution from 1998 to 2023 has been conducted based on a large catalog of pictures and photo-identification method. Preliminary findings suggest alterations in social dynamics such as shifts in cluster affiliations and disruptions in traditional association patterns. By shedding light on these nuanced changes, the research not only adds to our comprehension of long-finned pilot whales' resilience in the face of epizootic events but also offers insights into broader implications for population conservation strategies. The proactive measures necessary to safeguard these marine mammals become evident, emphasizing the urgency of considering infectious challenges in marine conservation planning. This comprehensive exploration significantly contributes to the evolving body of knowledge surrounding marine mammal health and ecosystem dynamics.

Evaluating and comparing whale-watching activities in the Strait of Gibraltar and the Salish Sea to inform future management measures

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As whale watching (WW) is now an economically important activity in many areas, it is imperative that it is carried out in a sustainable manner that does not negatively impact wildlife. Respect for local WW regulations, and the development of a pro-environment attitude by WW companies are essential to improving the sector's sustainable credentials. This study evaluates the activities of the majority of WW companies based in Tarifa and Gibraltar (Strait of Gibraltar, Spain and UK), and those based in Victoria (Salish Sea, British Columbia, Canada). An assessment checklist based on 26 criteria was compiled by researchers at the end of 14 WW trips offered by 11 companies between 2018-2019. Evaluations covered both the adherence of each trip to local WW regulations (1) and to other sustainability criteria (2), which are (1) procedures for approaching animals, the course and speed of WW vessels, viewing manoeuvres, the number and coordination of vessels present during sightings, sighting duration, (2) environmental education services provided, company actions to reduce environmental impact, safety measures on board and whether visiting sites of cultural interest was included during trips. The ban on feeding, swimming with, or touching animals was respected on all WW trips evaluated, whereas the ban on separating associated adults/calves only in 71.5% of cases. WW companies followed the evaluated criteria in 51,5% of trips in the Strait and 59,8% of trips in the Salish Sea. Partial compliance with local WW regulations were observed in both WW areas, leaving room for improvement. Comparing WW operations in different areas could help to identify common challenges and best practices for the WW industry, highlight international differences and, together with a consideration of site-by-site specificity, can be used to help develop well-focused management actions for improving the sustainability of the WW industry.

Evaluating the effectiveness of the Valencian Community Stranding Network (central Spanish Mediterranean) to detect stranded cetaceans and sea turtles

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Stranding networks are considered a useful tool for assessing the status of cetacean and sea turtle populations, as they allow, not only to obtain biological information on the specimens but also to shed light on changes in mortality factors and/or relative abundance of cetaceans in a given area. The Valencia Community stranding network (VSN) covers 518 km of coastline in the Spanish Mediterranean and has been operating since 1990. We analysed temporal trends in stranding data to explore the effectiveness of the VSN for the detection of stranded animals. The VSN has recorded so far 1577 cetaceans of 11 species, especially striped dolphins, *Stenella coeruleoalba* (70% of stranded animals), and common bottlenose dolphins, *Tursiops truncatus* (16%); and 1436 sea turtles of 5 out of the 7 species, of which the loggerhead sea turtle, *Caretta caretta*, accounts for 99% of stranding events. Generalised additive models (GAMS) revealed curvilinear trends for the two most abundant species, i.e., striped dolphins and loggerhead sea turtles, with stabilization occurring 10-15 years after the VSN was created; nevertheless, remarkable inter-annual variability was observed since then. In contrast, the number of bottlenose dolphins increased linearly over the years and, for the pooled records of other cetacean species no trend was evident, perhaps due to the low number of stranded animals. The observed stabilization in the two most abundant species could suggest that the VSN is now able to detect all stranded animals, assuming that the mortality rate for these species has not changed significantly over the years. If so, the steady increase of stranded bottlenose dolphins would also suggest that mortality for this species is increasing, perhaps due to progressively greater population and/or, more likely, a more intense operation of mortality factors.
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Evaluating the efficacy of the DiD-01 acoustic deterrent in reducing human-dolphin interactions in artisanal fisheries around Filicudi, Aeolian Islands (Sicily, Italy)

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Increasing interactions between bottlenose dolphins (*Tursiops truncatus*) and artisanal fishing gear in the Mediterranean Sea pose significant challenges to marine mammal welfare and small-scale fishermen. This study, conducted as part of the Life DELFI European project, took place in Filicudi Island (Aeolian archipelago, Sicily, Italy) during the summer of 2023 (May 31 to September 15). In partnership with a local fisherman, we tested the DiD-01 acoustic deterrent on trammel nets. Each test involved setting two nets in similar conditions, one with a DiD device, and a control without, in similar conditions (depth and habitat types). The test nets (mean length = 679m ± 289m) required 1 DiD device with a 600m emission radius. Fifteen test-control pairs (30 hauls) were performed. Test nets were deployed at an average depth of 66.1m ± 20.3m and set for an average of 32 hours and 17 minutes ± 11 hours and 48 minutes. Control nets were deployed at an average depth of 80.9m ± 14.2m and remained for an average of 35 hours and 19 minutes ± 6 hours and 59 minutes before retrieval. To assess deterrent efficacy, we analysed the catch differences, species composition, length, and marketable catch percentage between test and control nets. Preliminary results indicate a total catch of 1057 individual organisms (508 in test nets, 549 in control nets), spanning 52 species (35 treatment, 44 control), excluding bycatch. Tests suggest no significant difference in dolphin interactions between control and test nets. However, we observed no direct interactions and recorded only 1 dolphin sighting during tests. Despite the presence of individuals around the island (other sightings n = 21), they interact less frequently with nets in the summer period. Further studies should be conducted during different seasons where dolphin-fishery interactions are higher, capturing dolphin behaviour variations, and employing hydrophones on nets.

Evaluation of UAS-Photogrammetry accuracy in determining age-class structure of critically endangered bottlenose dolphins

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The effective management of long-lived and slow-reproducing species requires the ability to monitor health status, demographic parameters, and detect trends in free-ranging populations. A stable age distribution, reflecting a certain proportion of newborn, immature, and mature individuals, serves as an important indicator of population health. Photogrammetry facilitated by Unoccupied Aerial Systems (UASs or drones), has emerged as a valuable and non-invasive tool for evaluating individual and population health, biological parameters, and demography in various taxa, including aquatic mammals. This study focuses on assessing the age-structure of the critically endangered sub-population of bottlenose dolphins (*Tursiops truncatus*) in the Gulf of Ambracia (western Greece). Two sources of information were applied: two decades of demographic data derived from regular monitoring and photo-identification efforts (i.e., actual age-structure), and UAS-photogrammetry data collected over three short field seasons. Using a log-linear model, we estimated the total body lengths (TL) of 160 known-age dolphins between 2021 and 2023 based on blowhole to dorsal fin distances (BHDF) measurements taken during surfacing. Animals were categorized into three age classes: calves (0-2 years), juveniles (2-10 years), and adults (10+ years). Age-structure comparisons across the two methods revealed no significant differences (Chi-square(X2) test: $p > 0.10$). The average age-class distribution based on long-term monitoring data was 14.23 % for calves, 17.52% for juveniles, and 68.25 % for adults. Similarly, the average UAS-estimated age-class distribution was 13.14 % for calves, 25.55 % juveniles, and 61.31 % for adults. Our findings indicate that UAS-photogrammetry is a reliable tool to rapidly and accurately monitor demographic parameters of free-ranging delphinids. Moreover, it holds substantial promise for gaining insights in populations lacking sufficient existing data. These advancements may play a crucial role in identifying potential implications for conservation and facilitating management decisions.

Evolution of the energetic landscape in odontoceti sperm cells: co-elimination and metabolic shifts in toothed whales

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The sperm cell stands out as one of the most specialized cell types in Metazoa. The energetic dynamics of these cell types play a crucial role in the successful fertilization, particularly during processes like capacitation that demand substantial substrate amounts to meet metabolic needs. In mammals, the uniqueness of sperm cells is evidenced by a dedicated glycolytic energy-producing pathway that ensures autonomy from somatic regulation. Here, we describe a peculiar case of gene co-elimination involving a sperm-specific ion cell transporter - sodium/potassium-transporting ATPase subunit alpha-4 (Atp1a4). Our investigation, supported by an ample comparative genomics and transcriptomic evidence, including a new RNA-seq dataset from a striped dolphin (*Stenella coeruleoalba*) testis, revealed multiple inactivating mutations in Atp1a4 of toothed whales. We suggest that this targeted gene erosion is possibly attributed due to the relaxation in selective pressures. Immunohistochemistry and Western Blot analyses, conducted on bottlenose dolphin (*Tursiops truncatus*) sperm cells, confirmed the complete dismantling of this transporter. Our results suggest a 'domino effect' in a scenario of reductive gene evolution. Novel capacitation assays in dolphin sperm cells underscored the absence of this protein and revealed their preference for specific substrates, including estrous sheep serum (ESS), to induce hyperactivation. Furthermore, metabolomic and lipidomic analyses of ESS highlighted the shift in energy utilization from carbohydrates to fatty acids in toothed whales. These fatty acids present in ESS (with high levels of palmitic, stearic, and oleic acid) can be used as an energy substrate during capacitation, and/or may contribute to cholesterol efflux and impact membrane fluidity, consequently influencing membrane properties relevant to capacitation. In summary, our diverse findings showcase the evolution of a distinctive energetic system in Odontoceti sperm cells. Additionally, this study robustly supports the significance of gene loss mechanisms as major drivers of Cetacea adaptation to the aquatic environment.

eWHALE: Combining environmental DNA sampling, whale watching and citizen science for stakeholder-driven marine biodiversity protection in the North-East Atlantic and the Mediterranean

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eWHALE is a European BioDiversa+ project that aims to obtain and analyze genetic data from cetaceans, sharks and their prey using environmental DNA (eDNA). In recent years, eDNA (the trace genomic material left behind by organisms) has been widely recognized as a non-invasive and cost-effective methodology to monitor marine megafauna. Furthermore, eDNA-based methods are gaining momentum for citizen science engagement due to the ease of sample collection and the scalability of the approach. This allows participation from whale watching vessels, which are frequent companions of cetaceans at many locations. The project comprises a consortium of eight European universities/research centres and six commercial partners, including whale watching companies (see eWHALE website for details). The main objective of the project is to obtain eDNA-based information beyond species presence for the megafauna target species (including *Physeter macrocephalus*, *Megaptera novaeangliae* and *Tursiops truncatus*). Paired biopsy samples are used to validate the eDNA-based individual identification and for population genetic analysis. As a secondary objective, metabarcoding and qPCR are used to identify putative prey species' presence and abundance. On top of eDNA sampling, considerable efforts are dedicated to disseminating the eDNA citizen science experience, including on-board questionnaires. To date, a total of 341 eDNA samples have been collected using a variety of filters: Waterra (n=113), Smith Root (n=62), Sylphium (n=128) and Sterivex (n=38). Sampling events occurred in the Azores Archipelago (n=104), Pelagos sanctuary in the Mediterranean Sea (n=66), Brittany in France (n=60), Skjalfandi Bay in Iceland (n=56), Irish (n=43) and Norwegian (n=12) coastal waters. DNA of target species has already been confirmed in a variety of samples. This project provides a proof of concept for international eDNA-based participatory biodiversity monitoring with the aim of conservation and protection of threatened species.

Examining the status of Risso's dolphin (*Grampus griseus*) populations in the Western Mediterranean: Are Integrated Data Sources Indicating a widespread presence decline?

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Despite the growing number of monitoring studies, our current comprehension of the status of Risso's dolphin population in the Mediterranean Sea remains inadequate. The Mediterranean subpopulation has been recently reassessed as Endangered on the IUCN Red List, thus remarking the urgency of improving the knowledge. This study aims to collate information from various sources, such as sightings and strandings, to enhance our understanding of the distribution of the species in the Western Mediterranean Sea. For sightings, we used presence-only data from the Global Biodiversity Information Facility (GBIF occurrence data, n: 914, spanning from 1991 to 2023) and effort-inclusive data, obtained from the Intercet platform (n: 271, data collected by four research institutes operating in contiguous areas within the Pelagos Sanctuary) over the 2000-2023 period. Additionally, strandings data collected from 1990 to 2023 by the Italian and French Stranding Networks were considered. Sighting data were mapped onto a grid with a cell size of approximately 0.165°, overlayed to MODIS Aqua 4-km monthly chlorophyll levels and grouped into subzones according to GFCM GSA zonation. The analysis of both presence-only and effort-inclusive data highlighted both the consistent preference of Risso's dolphins for the upper slope area (depth: 300-1,500 m), showing a temporal variability in the species' presence across distinct subareas. After a Spearman's rho test, the majority of GSA subzones showed no significant trend. A positive trend was evident in the North of Spain subarea, whereas negative trends were observed around the Ligurian and North Tyrrhenian seas. Consistency in stranding data further supported the patterns identified in sighting data. Furthermore, the regions where the species has been declining are characterized by a significantly lower primary productivity. These results suggest that ecosystem productivity might be a relevant key factor influencing Risso's dolphin population dynamics and distribution.

Expanding trophic understanding in teuthophagous cetaceans: isotopic relationships between cephalopod soft tissues and beaks

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Studies on the stomach contents of cetaceans indicate that many of them feed on cephalopods and some species are exclusively teuthophagous. However, diet analysis through stomach contents presents limitations such as requiring the access to healthy deceased animals and providing only a snapshot of the overall diet. In recent decades, stable isotope analysis has been employed to overcome these limitations. The use of stable isotopes, particularly those of carbon (δ13C) and nitrogen (δ15N), has been crucial for exploring diet, feeding habitats, and trophic position of cetaceans, through the isotopic ratios of the digested prey and predator tissues. Nonetheless, in cetacean stomach contents, the only identifiable remnants of cephalopods are their beaks, which are not digested due to their chitinous structure. Consequently, isotopic ratios of cephalopod beaks are inadequate for reconstructing the dietary contribution of cephalopods to the diets of teuthophagous cetaceans; contrary to the soft body parts that are digested. The aim of the current study is to provide valuable diet-tissue isotopic discrimination values that can be used in cetacean trophic ecology studies. Thus, here we describe the relationship between the isotope ratios of cephalopod beaks and other tissues (mantle, gills and tentacles) in two cephalopod species, *Todarodes sagittatus* (decapodiform, n=12) and *Eledone cirrhosa* (octopodiform, n=10) from the Northwestern Mediterranean Sea. Results reveal a substantial isotopic enrichment in 15N in the soft tissues of both species compared to their beaks (4.6‰ for *T. sagittatus* and 4.7‰ for *E. cirrhosa*), and no drastic changes in 13C between tissues. These enrichments can be used to calculate the isotopic profile of the soft digested parts of the studied cephalopod species from the isotopic ratios of the beaks when sampling whole cephalopods are not an option, offering a method to elucidate the diets of teuthophagous cetaceans based on the isotopic ratios of their beaks.

Expediton WhaleSonic: synchronized acoustic and video data of killer whales and humpback whales in northern Norway

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Cetaceans are renowned for their social proclivities as well as their diverse and elaborate vocal signals, making them excellent candidates to investigate the complexity of non-human communication systems. However, cetacean datasets combining acoustic recordings with video data are rare, due to the logistical challenges of obtaining such data in an aquatic environment. In northern Norway, conditions for cetacean data collection are highly favorable, given the shelter of the fjords and the reliable presence and acoustic activity of hundreds of killer whales and humpback whales each winter. Therefore, the expedition WhaleSonic under the coordination of ETH Zürich was carried out there from November 2023 to January 2024. The result is a large and multivariate dataset containing both acoustic and video recordings of killer whales and humpback whales. For acoustic recordings, an array of 4 hydrophone-buoys, designed to allow signal source separation and localization, was deployed from a motorboat in the vicinity of killer whales or humpback whales for typically 1 hour or more. Simultaneously, videos were recorded via drones flying above the animals. The unique value of this dataset is the potential to synchronize the hydrophone and drone recordings due to our strict timing procedures. We present an example of such a synchronized video with underwater audio, highlighting the possibility to relate behavior to acoustic activity. The WhaleSonic dataset, which will be published openly, will allow for crucial investigations into matters such as phonetics, signal-response associations, repertoire diversity and communicative turn taking, in order to further our understanding of the interactional dynamics, and the function of cetacean vocal communication.

Exploring cetacean habitats and diversity: a multidisciplinary expedition to the high-seas Vasco da Gama Seamount and Vigo Bank, NW Iberia

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Seamounts are linked to increased biodiversity, being home to a wide range of organisms. In particular, seamounts offer crucial and preferential habitat conditions for several cetacean species as grounds for feeding, resting and socialising. Offshore, northwest of the Iberia Peninsula, arise the Vasco da Gama Seamount and Vigo Bank (VGV). The VGV are impacted by fishing activities, including trawling, maritime traffic, and underwater cables, with a notable lack of comprehensive data on habitats and biodiversity. To address this knowledge gap, specifically concerning cetacean communities, a multidisciplinary expedition to the VGV, hereafter GAMA, was undertaken. GAMA had a duration of five consecutive days and the survey transects were designed to cross the area between Vigo port and the VGV, covering the seamounts from the base to the top. Various sampling methodologies were employed, including i) visual monitoring of cetacean occurrence; ii) cetacean photo-ID; iii) passive acoustic monitoring; iv) environmental DNA (eDNA) collection; v) recording of in-situ and water column physicochemical parameters. Through visual monitoring, we recorded the presence of *Delphinus delphis*, *Tursiops truncatus*, *Stenella frontalis* and *Balaenoptera physalus*. However, contrary to the expectations, the sighting rate in the VGV was low, with only a few occurrences recorded predominantly at the base of the seamounts. In fact, most sightings were registered in the adjacent areas of the VGV. Combined data from sightings and acoustics, as well as eDNA, allowed a more complete analysis of cetacean community composition and distribution across the sampled area. Analysis of drone footage revealed six new individuals of *B. physalus*, enriching the catalogue of the Galician population. The data obtained from GAMA enables a preliminary characterisation of the VGV oceanic area and the cetacean populations inhabiting it, thus significantly contributing to the conservation and management of these seamounts and their associated ecosystems.

Exploring the use of presence-only data: addressing knowledge gaps in UK marine mammal spatial and temporal trends

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The evidence for marine mammal distribution used by UK marine managers and policymakers is primarily that of large-scale standardised effort-related survey data. While this data is highly appropriate and suitable to assess the conservation status of species at a biologically appropriate spatial scale, the data is temporally limited by survey frequency, season, and reduced confidence in coastal density model outputs. There is a need to make better use of citizen science data to fill those knowledge gaps in marine mammal distribution, seasonality and long-term trends and better manage the coastal anthropogenic threats that our marine mammals face.
The UK has a long history of biological recording, with large volumes of presence-only records available for many marine mammal species gathered through biological recording databases in the UK such as the National Biological Network (NBN) Atlas, local biological record centres and other organisations. However, biases associated with this type of data (data quality, observer location preference, seasonality of effort, limited metadata) leads there to be limited opportunities for application in reporting, assessment and needs. Advances in modelling techniques have been made which take these biases into account. We present a review of a selection of such modelling approaches, demonstrating how presence-only data might be utilised and the application of their outputs in a UK context. A case study implementing an integrated model using both presence-only records and survey data for harbour porpoise in the North Channel is presented here and demonstrates how disparate sources of marine mammal occurrence records can be merged. We look forward to engaging with fellow colleagues at this meeting to further develop this review and identify best practices in modelling presence-only data for management needs.

Exploring *Tursiops truncatus* distribution and conservation potential in the Tuscan Archipelago and Corsica: a Citizen Science approach within the Pelagos Sanctuary

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The study focuses on common bottlenose dolphins (*Tursiops truncatus*) in the Mediterranean Sea, particularly around the Tuscan Archipelago and the northeastern coast of Corse within the Pelagos Sanctuary. The common bottlenose dolphin stands as one of the most prevalent species inhabiting the Mediterranean Sea. Primarily occupying coastal waters, this species frequently encounters human-related activities. Despite extensive research on their distribution and behavior, the understanding of the population structure and site fidelity along the Italian coastline remains limited. This study aims to address this gap by focusing particularly on the Tuscan Archipelago and the neighboring north-eastern coast of Corse, situated within the Pelagos Sanctuary. Between 2020 and 2023, "Le Vele del Panda" project, a WWF Italy-led Citizen Science and research initiative, conducted 90 surveys over 431 days, emphasizing bottlenose dolphin studies. These surveys

captured photo-ID data, GPS locations, surface behaviors, group sizes, and calf presence. Throughout the four-year monitoring period, 136 sightings of *Tursiops truncatus* were logged, identifying 147 distinct individuals. Significantly, over 70% of these sightings (n=97) occurred in the Tuscan Archipelago and neighboring Corse, designating this area as the primary focus of the study. A photo-ID catalogue was established to track re-sightings and investigate site fidelity patterns within and beyond the study area. Additionally, a species distribution modeling method was employed to analyze the relationship between environmental and anthropic factors and the presence of common bottlenose dolphins across the study area. Preliminary results indicate a sizable but loosely connected common bottlenose dolphin population in the coastal waters between the Tuscan Archipelago and the north-eastern of Corse. Collaboration between nearby research groups is vital to determine site fidelity levels. This study represents an initial step toward proposing conservation areas in this region. Furthermore, it highlights the efficacy of Citizen Science in gathering and analyzing data on *Tursiops truncatus* within the Pelagos Sanctuary.

Extensive immune reaction and highly expressed novel genes hint at a potentially molecular adaptation in the lung of non-healthy harbour porpoises (*Phocoena phocoena*)

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The harbour porpoise (*Phocoena phocoena*) is subjected to a multitude of anthropogenic pressures in the North and Baltic Seas such as shipping, noise and chemical pollution. Exposure to those activities affect the animals and can impair the immune system, leading to a higher susceptibility to parasites and bacterial infections. As a consequence, harbour porpoises show a high percentage of pathological lesions in the respiratory tract. Tagging results showed that harbour porpoises do not use their entire lung volume, possibly because the changes in the lung impact oxygen uptake. The aim of this project was to examine whether harbour porpoises have evolved novel molecular adaptations to compensate an inadequate oxygen supply, thereby staying competitive and sustaining their viability, despite severe lesions and an accumulating parasite load in the lungs. To achieve this, we generated the first lung transcriptomes of the harbour porpoise and conducted comparative RNA Seq analyses. Our results indicate an extensive response of the immune system to parasites, bacterial and viral infections and resulting tissue damages. Expression of transcripts involved in inflammatory processes, defence responses, adaptive and innate immune reactions were enhanced. Transcripts related to oxidative stress such as S100A8/9 and Haptoglobin were found highly expressed and protect from exceeding reactive oxygen species. Transcripts involved in transport of phosphate and monosaccharides were upregulated, hinting at maintenance of cell function and energy homeostasis. Furthermore, the lung transcriptomes of non-healthy harbour porpoises showed an increased expression of pulmonary surfactant proteins that have an immunoprotective role, are indispensable for proper lung maintenance and respiration and decrease the tension at the water-air-surface. Interestingly, 18 of the upregulated transcripts were unannotated and with unknown function, posing an ideal target for further functional studies of a potential adaptation to pathological lesions and reduced oxygen uptake in the lung which may aid in preserving their diving ability and foraging success.

Eyes on nature: protecting the cetaceans in a cosmopolitan waterline of Istanbul with the power of citizens

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Citizen-science becomes an important tool not only to enhance scientific knowledge but also to increase community involvement for the in-situ conservation of threatened species. Istanbul Strait is known to be a critical habitat for three cetaceans, yet it is also identified as one of the busiest waterways of the world with over 16 million people inhabiting this historical city. Istanbul holds unique geographical importance not only for cultural and economical reasons but also reveals the strength of wildlife in urban areas. Therefore, the Urban Ecological Systems Branch of Istanbul Metropolitan Municipality joined forces with WWF-Turkiye to set the first example of dolphin watch tours that is freely available to the public since 2022 where citizens of Istanbul unites to collect data for science while to spread the awareness on the immediate marine conservation. Overall, 11 tours were organized in 2023, with the involvement of 1360 local participants, of which min of 55 participants started using the “Eyes on Nature'' app where they have logged in their sighting. Harbour porpoises were encountered on 16 occasions, followed by bottlenose dolphins by 10 encounters and common dolphins were sighted only once. While bottlenose dolphins had the largest group size, reaching up to 15 individuals, it was less than five individuals for the common dolphin and porpoises. During the tours, five individuals were photo-identified and embedded to the existing photo-id catalog, of which one individual was sighted previously in 2012, revealing a min of 11 years of presence in the strait. Despite the high sighting rate, encountered individuals revealed starvations’ signs. The current project is the doorway to reveal the power of each individual on the successful implementation of research and conservation activities for threatened species in metropolitan yet important marine hotspots.

Far away from home: gastrointestinal parasites as indicators of the geographical origin of a grey seal (*Halichoerus grypus*) stranded in Western Mediterranean Sea

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Grey seals, *Halichoerus grypus* (GS), inhabit cold temperate and sub-arctic waters along the North Atlantic Ocean. Primary populations occur in NW and NE Atlantic (ca. 41ºN-67ºN) as well as in the Baltic Sea (ca. 54ºN-65ºN). Individuals of GS can regularly disperse towards southern areas (ca. 38ºN-39ºN) but occurrence at lower latitudes is exceptional. On 18th of February 2022, a 217-cm long male of GS was detected in waters off the SW Atlantic coast of Spain (37ºN), then entered the western Mediterranean Sea and wandered for 15 days until he died. Here, we use gastrointestinal parasites as biomarkers to investigate the geographical origin of the GS and the length of the journey towards Mediterranean waters. Four helminth species were found, namely, the digeneans *Ascocotyle septentrionalis* (n = 495,273 individuals) and Cryptocoyle lingua (n = 9,890), the nematode *Contracaecum osculatum* (n = 480) and the acanthocephalan *Corynosoma strumosum* (n = 59). The parasite composition closely resembles that reported in native harbour seals (*Phoca vitulina*) from the Dutch section of the Wadden Sea (ca. 53ºN); *A. septentrionalis* is also apparently endemic to this area. Assuming that (i) the seal could not be re-infected with *A. septentrionalis* out of the Wadden Sea, and (ii) the life span for a small digenean is 2-3 months, we infer that the GS was inhabiting waters ca. 53ºN at most 2 months preceding its stay in the Mediterranean. This hypothesis is corroborated by the elevated numbers of two other parasites found, i.e., C. lingua and *C. strumosum*, which are also restricted to high latitudes. To our knowledge, this is the first study using parasites to unveil the geographical mobility of pinnipeds. Supported by projects AICO2021/2022, Generalitat Valenciana, and VARACOMVAL, Biodiversity Foundation, MITECO.

Female philopatry may modulate the response of an Antarctic pinniped to global warming

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Most polar pinnipeds are non-philopatric capital breeders, which give birth, nurse their pups and mate on sea ice. As a result, their response to global warming during the breeding season will depend largely on the changes in the pack ice extent. Conversely, the Antarctic fur seal is an income breeder using ice-free beaches during the whole breeding season. Furthermore, females exhibit high philopatry to their natal colonies, which likely delayed the recovery of the species and the recolonization of their former geographic range after the cessation of commercial sealing. Similarly, such a strong philopatry might also delay its response to global warming and generate a potential mismatch between the location of current breeding colonies and that of the new food-rich patches resulting from the southward displacement of Antarctic krill in response to global warming. In this study, we modeled the response to global warming of female Antarctic fur seal during the breeding season under strong and relaxed philopatry scenarios. To do so, we used satellite tracking and Earth System Models to predict changes in habitat suitability for female Antarctic fur seals breeding in the Western Antarctic Peninsula under different climate change scenarios and used accessibility models to restrict the possibility of using suitable foraging grounds away from the colony at different levels of philopatry. Our results showed that in a strong philopatry scenario, seals will still have suitable habitat patches around the colony both in the weakest forcing scenario (SSP1-2.6) and the strongest one (SSP5-8.5), although to a lesser extent in the latter case. In a relaxed philopatry scenario, our model revealed the existence of new suitable foraging grounds at higher latitudes and hence a possible southward expansion of the breeding area, as far as ice-free beaches emerged in nearby areas by the century's end.

Female, juvenile and calf sperm whale (*Physeter macrocephalus*) records from Ireland

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Sperm whales are a widely distributed toothed whale species across the world's deepwater habitats, which are used to forage for food. The species displays extreme sexual dimorphic features and spatially segregates by sex and social behaviour when mature. Male whales move to higher latitude foraging grounds while females and young whales remain around lower latitude feeding grounds. Male whales make occasional migrations to southern areas to mate before returning to the foraging grounds. The Azores, Madeira and the Canary Islands constitute important nursery grounds for female and young sperm whales who typically remain further south than 40 - 45°N. Males utilise more northern habitats up as far as Svalbard at 80°N. Irish waters represent a mid-point for this species' spatial segregation, where the species occurs along the submarine canyon systems of the Porcupine Bank and Rockall Trough to the west of the country. Historically, just male whales were thought to be found in this region between 51 – 55°N, but 1 adult female was caught by commercial whalers in 1910, and a 5.49 m calf was found stranded in 1916. Between 1995 and 2023, 10 female sperm whales have stranded around the coast of Ireland, 8 have been since 2013, where there has been at least one record per year since 2019. 4 of these strandings have occurred in Donegal in the northwest of Ireland, indicating the presence of female whales along the continental shelf off of this region. 2 females stranded within a day of each other and were found in similar states of decomposition in February 2022 indicating the likely presence of an offshore female group as they were not vagrant lone individuals. Sperm whale calves and juveniles were also sighted in Irish waters in 2001, 2004 and 2010 in the Rockall Trough, along the Porcupine Bank and Goban Spur, where between 1 – 3 individuals were observed on four occasions. While the presence of female and young sperm whales has been recorded on occasion over the years, there has been an apparent increasing trend of female sperm whales stranded in Ireland, which is likely indicative of widespread habitat and prey changes due to the effects of climate change. This shift has implications for the management requirements for this species if different sexes and life stages occupy the same region, who may be more or less susceptible to different anthropogenic effects or have differing habitat requirements.

Finding Goby - Is bottom grubbing a learned technique?

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Harbour porpoises are typically shy animals, that are only briefly visible at the water surface. Therefore they cannot be observed in detail using boat- or shore-based visual monitoring techniques leaving crucial knowledge gaps about their behaviour. By using cost-efficient UAVs during summer 2022 in coastal Danish waters, footage of foraging behaviour of porpoises could be obtained. One behaviour documented in detail, especially in mother-calf pairs, was “bottom grubbing” which has previously been described in managed care. In this study we were able to confirm this behaviour in wild porpoises. The animals initialise bottom grubbing by scanning the area, increasing their swimming speed and diving downwards to search for benthic prey. At the seafloor, their body is positioned vertically in the water column with heads close to the seabed and their white bellies visible from above. This type of foraging potentially aims for small benthic prey species such as gobies between stones and reef like structures. The mother usually starts diving down and the calf then follows her. In mother-calf pairs we observed bottom grubbing in 52 % of 83 videos screened while in single animals this percentage was 14 % of 14 videos. These results lead us to the hypothesis that bottom grubbing is not an innate skill and the mother teaches the young at specific shallow areas with high availability of gobies indicating the importance of coastal areas to mother-calf interactions. This is supported by results from stomach content analyses which revealed that gobiidae otoliths are found mainly in stomach content of juvenile porpoises and are not only secondarily ingested food items via cod but a main prey. In addition, these findings may indicate that this specific area is crucial for raising the calves and thus possibly hints at a high vulnerability to human interactions and disturbances.

Fine-scale distribution of the lungworm *Halocercus delphini* in the lungs of the striped dolphin, *Stenella coeruleoalba*: implications about migration pathways and functional significance

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Despite their high pathogenicity, limited knowledge is available on intra-host migration pathways and microhabitat distribution of lungworms of the family Pseudaliidae. In this study, the distribution of *Halocercus delphini* in the lungs of the striped dolphin, *Stenella coeruleoalba*, was analyzed on three scales: between the right and left lungs, within the lungs, and between worm clusters. Lung perfusion appears to be the driving factor behind the parasite's large-scale distribution as evidenced by the clear correlation between the two factors both on a longitudinal scale and also when comparing parasite burden between the left and right lungs. This relationship, when coupled with the nesting pattern of colonization exhibited by this parasite indicates that, like many other metastrongyloids, *H. delphini* larvae arrive at the lung via the circulatory system. On a smaller scale, the concentration of lungworms around the major airways could be a further reflection of the well-perfused nature of these passageways. Equally, this distribution could be a strategy to maximise the diffusion of larvae to the environment and minimize the distance that these larvae have to travel to exit the lungs via the trachea, as do most other metastrongyloids. On a more localized scale, the tendency of *H. delphini* to form distinct heterosexual clusters even at low infection intensities indicates active mate-seeking behavior for reproduction. This project was supported by projects AICO2021/022, Generalitat Valenciana, and VARACOMVAL, Biodiversity Foundation, MITECO.

Fine-tuning the isotopic niche of a marine mammal community using a multi-element approach and variable spatial scales

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It is commonly assumed that the resolution of the isotopic niche of consumers can be improved with a larger number of chemical elements, but this is only true if steep environmental gradients exist at the appropriate spatial scale. Off Mauritania, δ13C and δ15N values have proven to be useful proxies to understand the distribution of marine mammals along the inshore-offshore gradient and to assess their trophic positions, respectively. In the present study, we incorporated δ18O and δ34S values to improve our knowledge about the habitat use of seven marine mammal species commonly occurring in the area. On one hand, the use of δ18O values as an independent habitat tracer largely improved the resolution of the isotopic niche, since the δ18O gradients spanned over broad spatial scales when compared to the home ranges of marine mammals, mostly reflecting the salinity differences between water masses. On the contrary, the δ34S values did not improve the resolution of the isotopic niche at the species level, because the δ34S gradients in the area develop over much smaller spatial scales than the home ranges of the considered species, although it was useful to identify individuals relying on food webs associated with seagrass meadows growing on sediments with a low redox potential. This study provides new insights into the use of a muti-element approach in isotopic ecology, and improves the understanding of habitat partitioning between the considered marine mammal species off North Western Africa.

First acoustic recordings of killer whales (*Orcinus orca*) encountered in the Canary archipelago

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The acoustic repertoire of killer whales (*Orcinus orca*) is known for its complexity, and comprises tonal whistles, pulsed calls, and echolocation clicks. This study provides the first description of the vocalizations of killer whales encountered in the oriental water of Lanzarote, Canary Islands. The infrequent occurrence of killer whales in this region highlights the significance of this study. In June 2009, the Society for the Study of the Canary Archipelago (SECAC) recorded a 9-hour acoustic repertoire during a rare sighting of this species. The analysis of the recorded sounds revealed a total of 242 vocalizations, of which 56 were selected. Whistles dominated the acoustic record, constituting 69.6% of the vocalizations. The frequency range of the whistles averaged 13.77 kHz (range 6.23-23.27 kHz). The maximum mean frequency was 20.35 kHz (range 13.71-28.67 kHz), while the minimum average frequency was 6.58 kHz (range 3.95-8.95 kHz). Whistles had an average duration of 0.68 s (range 0.07-1.58 s). A qualitative analysis of the whistles was carried out and involved detailed assessments of contour and modulations. Pulsed calls, comprising 30.4% of the vocalizations, underwent a quantitative analysis, shedding light on the frequency and patterns of these specific acoustic signals. The average frequency was 36.32 kHz (range 16.23-75.96 kHz), with an average duration of 0.28 s (range 0.03-0.77 s). These results were compared to those of similar studies on *Orcinus orca*, to identify acoustic similarities between different populations. The findings not only broaden our understanding of the acoustic behaviour of killer whales, but also offered insights into the ecology of these marine mammals in a region where their presence is rarely documented. This research underlines the importance of continued monitoring of this species in the Canarian archipelago, to increase our understanding of their ecological dynamics.

First confirmed live record of Sowerby's beaked whales (*Mesoplodon bidens*) in mainland Portugal

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Beaked whales are amongst the least known mammals worldwide, with the current identification of 23 species of ziphiids, very few of which are reported in Portuguese waters. Most beaked whale sightings in Portugal, recorded from whale-watching vessels, strandings, or platforms of opportunity, have predominantly occurred in the Madeira and Azores archipelagos. On mainland Portugal, only a handful of Ziphiidae family members, specifically the Cuvier beaked whale (*Ziphius cavirostris*), have been confirmed in recent years. Sowerby's beaked whales (*Mesoplodon bidens*) are exclusive to the North Atlantic Ocean and have been previously documented in the Azores and Madeira islands, as well as the Mediterranean Sea and the Canary Islands. However, despite a few anecdotal unconfirmed reports, including the stranding of a calf in 2011, this species has not been formally described in the literature for mainland Portuguese waters. This study presents the first documented live sighting of Sowerby's beaked whales in mainland Portugal. Data was collected using a commercial dolphin-watching vessel in Faro, Algarve. A pod of three Sowerby's beaked whales was observed approximately 10 kilometers off Deserta island, on the edge of the continental shelf. Properly collected pictures for identification and recorded behavioral states enhance the robustness of this sighting. While no prior sightings have been reported for mainland Portugal, this event aligns with previous research on North Atlantic waters, where models predict a higher abundance of this species along the continental shelf slope. We also hypothesize that beaked whales in southern Portugal might be impacted by heavy military surveillance, as their sonars and equipment have been shown to elicit negative reactions in the behaviour of ziphiids.

First documented observation of potential feeding behaviour of Humpback Whales (*Megaptera novaeangliae*) in its breeding range off southern coast of Tanzania

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Feeding and breeding activities of Humpback whales (*Megaptera novaeangliae*) are geographically and temporally separated, with feeding activities taking places generally in the higher latitudes. However, humpback whales may supplement their energy budgets by feeding outside of their polar foraging grounds, with opportunistic feeding behaviour being observed in mid to low latitudes globally. The records of supplementary feeding during migration in the southern hemisphere have been documented for various breeding stocks, except the East African stock. We present the first to our knowledge record of the humpback whales potential feeding event in coastal waters of Tanzania, that have been recorded during the dedicated boat surveys conducted during the breeding season in July 2023. We observed and photographically documented a motion characteristic for gulp feeders, performed by 2 individuals. Secondary cues included repeated vertical diving, tuna and birds feeding, and aggregations of five other cetaceans species near the groups of whales. Demonstrated behavioural plasticity may play an important role in adaptation strategies to global environmental changes. Given the amount of the energy required for the lunge feeding, there should be a certain level of prey for whale feeding to occur outside of their foraging grounds. Presence of feeding whales, therefore, indicates a good oceanographic productivity. At the same time feeding whales increase productivity by dispersing nutrients essential for the phytoplankton growth and consecutive consumption by the upper trophic strata. The present record demonstrates that southern waters of Tanzania may be used by humpback whales as an opportunistic feeding zone, which contributes to the trophic cascade, that might support the biodiversity and fish biomass consumed by coastal communities. This record underpins importance of the protection of this habitat, helping the country achieving its conservation goals. However, extent to which humpback whales feed in Tanzanian waters is unknown, and further investigation is required.

First insights into effectiveness of ballistics as a euthanasia method for stranded cetaceans: utility of behaviour and post-mortem computed tomography

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When stranded cetaceans are severely debilitated and their survival likelihood is low, euthanasia may be necessary to avoid further suffering. Euthanasia can be achieved using chemical or physical methods, including ballistics. Ballistics aims to cause instantaneous, permanent insensibility through complete brain destruction or significant brainstem disruption. Despite ballistics being widely applied, there is limited understanding of welfare outcomes. We examined behavioural responses of two maternally-dependent cetaceans following shooting and related brain lesions post-mortem using computed tomography (PMCT) to understand whether “euthanasia” was achieved. The animals were shot using different projectile types, one soft and one solid. Insensibility was not immediately assessed in the field following shooting, yet the shooters presumed both animals were ‘instantaneously insensible’. From our analysis, both animals displayed musculoskeletal responses to shooting, including immediate peduncle stiffening and slack lower jaw, followed by relaxation of epaxial musculature 24- and 10.3-seconds post-ballistics, respectively. The animal shot with a soft projectile also displayed agonal convulsion, tail lifting and fluttering for 16 seconds; these were not observed when using a solid projectile. PMCT findings were consistent with the observed behavioural differences, indicating that the solid projectile significantly disrupted the brainstem and spinal cord in a way likely to cause instantaneous insensibility. In contrast, no brainstem damage was evident for the animal shot with the soft projectile, suggesting delayed loss of awareness and the potential for additional welfare compromise. Our results highlight that ballistics can achieve a relatively rapid death in young, stranded cetaceans, but that careful selection of equipment is required to ensure effective euthanasia. To ensure a humane death, verification of insensibility, via reflex testing, must be systematically undertaken immediately following shooting. Further studies should examine ballistics-related behavioural responses and post-mortem lesions to improve knowledge of appropriate procedures and equipment, and to ensure a humane death for compromised stranded cetaceans.

First results of passive acoustic monitoring of odontocetes on the south-west coast of mainland Portugal

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Odontocetes have the capacity to echolocate, which allows them to exchange information and coordinate their behaviour using self-made clicks. Technological developments over the last few decades have led to the development of various devices for their specific detection, such as the F-POD (full waveform capture pod). F-PODs are passive acoustic detection sensors capable of detecting echolocation clicks between 20 kHz and 160 kHz in surrounding areas (more than 1 km). During this work, four F-PODs were deployed by scuba divers at four different locations along the south-west coast of mainland Portugal (Alentejo). One was deployed close to an industrial and recreational port (Port of Sines) and the others were deployed in a marine protected area (Natural Park of “Sudoeste Alentejano” and “Costa Vicentina”). Between June and November 2023, the four sensors collected information about the presence of cetaceans. This study reports on the first implementation of a passive acoustic monitoring network for cetacean detection along the Alentejo’s coast. The initial results are promising, revealing substantial potential for studying the spatial and temporal patterns of the occurrence of odontocetes. This pioneering effort underscores the importance of passive acoustic monitoring in advancing ecological studies and the conservation efforts of protected species, by shedding light on critical aspects of cetacean habitat and behaviour.

First UK HRA compensation measures for marine mammal species: vessel collision risk for a declining harbour seal population in The Wash, England

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A new energy development at the Port of Boston, UK will be constructed in the next few years; the Boston Alternative Energy Facility. The operation of this Facility would introduce the transit of up to 580 vessels through a Special Area of Conservation (SAC) for harbour seal. While the area is already very busy in terms of vessel presence (with up to 11,000 vessels in the same shipping channel per year), the harbour seal population in this SAC has recently been in significant decline. The reason for this decline is currently unknown, however, it results in the need to provide mitigation and management to ensure there is no potential for risk to individual seals.

While there was little risk of vessel collision from the operation of the Facility, the risk needed to be fully negated to ensure there would be no adverse effect on the integrity of the SAC. Standard mitigation and management measures were already agreed for the Facility (such as vessel speed restrictions wherever it is safe to apply them and restrictions on distances to haul-out sites), however, as the risk could not be fully negated, compensatory measures were required to offset the effect of any vessel collision events.

The compensation measures include (1) £10,000 yearly contribution to a local seal hospital, to allow the treatment and rehabilitation of any injured or ill seals (and for the improvement of facilities to better support the harbour seal population in the far future). This will apply throughout the operational lifespan of the Facility, and (2) £30,000 grant to undertake research into the cause of the harbour seal decline in the area, to enable better protection of them in the future.

This is the first time that compensatory measures have been required for any marine mammal species within UK waters.

Five years of integrated and long-term monitoring for cetacean management in the continental shelf of French Mediterranean sea with the MPA network

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Since 2018, as part of a project in partnership with the French Office of Biodiversity (OFB) and the association MIRACETI, an integrated and long-term monitoring program has been implemented for the management of cetaceans in the French Mediterranean MPA network. A standard protocol has been developed for MPA managers to collect harmonized data through the free application, ObsEnMer, since 2021. The cetacean data collected by managers through this application are automatically centralized and stored in a central database managed by the OFB. Eleven MPAs are currently using this standard protocol and the number of contributors is increasing. MIRACETI, completes the collection in MPA that do not have cetacean monitoring as well as in zones outside MPA along the continental shelf of the French Mediterranean.

Monitoring data were collected in a total of 12 MPAs and photo-identification was carried out in 7 MPAs. In total, 500 cetacean sightings of 6 different species were analyzed and photo-identification data have been collected for 4 different species. Preliminary analyses show that the most observed species is the Bottlenose Dolphin followed by the Striped Dolphin. The photo-identification data allow to highlight residency in MPAs and connectivity through the network of French MPAs in the Mediterranean, in particular in the Gulf of Lion.

The implementation of this standard and coordinated monitoring program in the MPAs, as well as the collection of additional data outside of the MPAs, aims to meet two European directives: to inform the indicators of the MSFD monitoring program (European Directive 2008/56/EC) at the scale of the French Mediterranean Sea, as well as the DHFF report for the European Commission.

Food stimulation in Bottlenose Dolphin (*Tursiops truncatus*) activates the autonomic nervous system, causing heart rate reduction

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Heart rate (HR) and its physiological variability (HRV) are important indexes of metabolism, energy expenditure and unconscious reactions to stress or relaxation, mediated by the autonomic nervous system. In particular the autonomic modulation of cardiac activity could indicate how cetaceans react to external stimuli, giving insight on their perception of the surrounding word. However, heart rate monitoring in cetaceans, even under managed care, is complicated by the need to record a tiny biopotential in a very conductive water medium. To study the physiological and behavioural reaction of Bottlenose Dolphins to external stimuli we deployed a submersible electrocardiogram-accelerator logger based on a suction cup attachment technique. With this method we recorded high resolution electrocardiograms that allowed us to study the reaction of captive bottlenose dolphins to intermittent feeding. Our recording at rest showed an average HR of 75±3 bpm with oscillation of cardiac frequency consistent with respiratory sinus arrhythmia (n=6). As expected, short apnea of 1 min decreased HR to 50±5 bpm (**p<0.01 by paired T-test, n=6). To test the activation of the autonomic nervous system in bottlenose dolphins we selected food (fish, squid, etc) as one of the strongest rewarding stimuli. For that, animals maintained in a stationary position were deprived of food for 2 min and then rewarded with continuous feeding for 1 min. During the 2 min of food deprivation HR and HRV were equivalent to resting conditions. Conversely, 1 min of feeding significantly decreased HR (69±2bpm) and increased HRV. Such HRV increase touched different indexes of variability consistent with parasympathetic increase and sympathetic decrease in the autonomic tone. We were thus able to record the autonomic response of Bottlenose Dolphins to an external stimulus, deployed in a minute time scale, providing a powerful method to test the perception of these animals to the external environment.

Fostering collaboration: ACCOBAMS best practices on cetacean population genetics

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Cetaceans are not bound by national borders, which is why many cetacean studies require international collaboration. This is particularly true in the field of population genetics, where the population structure can only be understood with samples from across the species' temporal and geographical distribution. To foster scientific collaboration and to promote best practices in cetacean population genetics in the Mediterranean Sea, Black Sea and contiguous Atlantic areas (i.e. the ACCOBAMS area), ACCOBAMS organised online surveys and two expert workshops, during which the "ACCOBAMS Best Practices on Cetacean Population Genetics" were drafted. These adopted guidelines provide a detailed practical roadmap, covering all essential phases of a population genetics study, including design, permit acquisition, sample collection, DNA preservation, molecular techniques, sample exchanges, data analysis, dissemination of results and data and sample archiving. Alongside this guidebook, databases were compiled with the number of available genetic samples for 28 cetacean species from 40 sample owners located in 17 countries within the ACCOBAMS area, as well as contact lists for potential collaborators and suitable genetic laboratories. Literature reviews identified knowledge gaps in population genetics for those species regularly occurring in the ACCOBAMS area to guide future research. The guidelines were

subsequently presented and adopted at the 8th Meeting of the Parties to ACCOBAMS in December 2022. They are now available in English and French on the ACCOBAMS website https://accobams.org/population-genetics/. The guidelines and related databases are living documents that complement those of the International Whaling Commission and will be updated regularly. By disseminating these resources to marine mammal scientists and conservation practitioners, we hope to facilitate more collaborative research in population genetics in the ACCOBAMS area and beyond, and contribute to identifying appropriate management units to inform conservation (including Conservation Management Plans) objectives.

Framework for the use of strandings data as a tool for monitoring cetacean population dynamics and health

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Understanding population dynamics is an important component of effective monitoring of declining cetacean populations. However, establishing even basic trends presents a challenge for these elusive species. Opportunistically obtained stranding data offers a unique opportunity to assess mortality trends in cetaceans and determine individual health, with almost all coastlines having some level of an operating stranding scheme and reporting framework. This plethora of data offers an invaluable opportunity to monitor population dynamics by establishing baseline trends in stranding rates and identifying unusual changes to when and where strandings occur. Post-mortem reports from freshly stranded animals allow for additional assessments of health that is not feasible with live monitoring. Understanding how the health of populations is changing over time will allow for a quantification of the effects of multiple stressors, aiding in mitigation efforts. The Scottish Marine Animal Stranding Scheme (SMASS) has been collecting stranding data and developing post-mortem reports on stranded marine animals for 30+ years. This long-term dataset presents an excellent case study for determining how stranding data can be used as a tool for monitoring cetaceans that can be applied across stranding schemes. This research analyses spatiotemporal trends in the demography of stranding rates for 17 cetacean species, determines seasonality and highlights unusual deviations that indicate changes to the environment. Associated pathology can then be used to develop a multidimensional health index to inform on the health and change therein of stranded animals. This health assessment complements baseline trends by highlighting where and when animals are at their lowest health, determining periods of vulnerability or areas with a high degree of stressors. This provides valuable insight into where further research efforts should be focused. If this methodology is applied across stranding schemes, monitoring of cetaceans could be improved and consequently allow for more informed conservation methods to be established for these sentinel species.

From current condition to future scenarios of striped dolphins (*Stenella coeruleoalba*) in the ADRION Region: Species Distribution Models (SDM) and Extension of Suitable Habitat (ESH) in relation to climate conditions

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Within the LIFE Project ConCepTu Maris, striped dolphin (*Stenella coeruleoalba*) distribution was analysed to investigate the extension of suitable habitats (ESH) in the Adriatic and Ionian basins under current and future climate scenarios. Species presence data were gathered by ferries by experienced MMOs belonging to FLT-Med Network, monitoring dolphin presence from the ferries' command deck along the Ancona-Patra transect. Year-round data (tracks and sightings) of the period 2015-2019 were organised using QGIS, together with geomorphological characteristics and climate variables. A Species Distribution Model (SDM) was then built for each basin at a time, employing the MaxEnt algorithm, with the resulting AUC equal to 0.925 for the Adriatic Sea and 0.963 for the Ionian Sea. MaxEnt suitable output maps were then reclassified in binary suitable-unsuitable predictions under the "Equal training sensitivity and specificity logistic threshold". The outputs of the binary suitable-unsuitable predictions raster were converted into polygon layers, including the highest suitable class only, to count the Extension of Suitable Habitat (ESH) in km2 for the investigated period. GAM was then used for building SDMs under the future climate conditions for the following years (RCP4.5): 2025, 2030, 2035, 2040, 2045, 2050. SDM maps were again reclassified in binary suitable-unsuitable predictions raster and converted into polygon layers to calculate the ESH. The resulting potential suitable habitats under future climate scenarios are quite different from the ones of current conditions. Instead of distributing along the sloping areas surrounding ocean basins, in the future, suitable habitats will be distributed more inward to the South Adriatic and Adriatic-Ionian Depressions. On the other hand, ESH values show a decline from the current condition up to 2045, with a final recovery in 2050. This phenomenon might be explained by the peak emission around 2040 under the RCP 4.5 scenario.

Further is better: a comparative analysis of two Risso's dolphin (*Grampus griseus*) distribution models in relation to physiographical variables in the Northwestern Mediterranean Sea

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The Marine Protected Area (MPA) of the 'Mediterranean Cetacean Migration Corridor,' situated between the Catalan coast (NE-Spain) and the Balearic Islands, covers a total area of 32,652 km2 and serves as an offshore habitat, particularly suitable for deep-diving cetacean species. An aerial survey conducted in April 2023 covered an effective effort of 4,694 km, with 11 sightings of Risso's dolphins (ER=0.00234 sightings/km). The spatial distribution of Risso's dolphins was analyzed using a Generalized Additive Model (GAM) with a binomial distribution and a logit link, incorporating four predictive variables based on local physiographical features. The results indicate a preference for offshore areas, with significant differences observed in relation to the distance from the coast. The results of this study were compared with data from previous research conducted in a neighbouring region, revealing geographical overlap with the MPA and involving a system of submarine canyons. The research was carried out off the central coast of Catalonia (NE-Spain) from 2009 to 2021, covering an area of 9,790 km² and involving a survey effort spanning 8,026 km. The study recorded 17 sightings of Risso's dolphins (ER=0.0019 sightings/km). The spatial distribution of Risso's dolphins exhibited a strong correlation with both the slope and slope variation. Furthermore, a significant association was identified between the presence of Risso's dolphins and the distance from the coast, underscoring a direct relationship between these cetaceans and their proximity to the shoreline. This study corroborates earlier findings that point to a shift in species' distribution towards offshore areas. However, this study adds a nuanced perspective by highlighting the importance of steep slopes, specifically placing this species in the terminal segments of the canyons. This suggests a critical need to extend protective measures to these specific areas, including submarine canyons, to encompass a substantial portion of the species' habitat.

Grey seal research and conservation in the Gulf of Riga (Latvia)

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The population of grey seals (*Halichoerus grypus*) in the Baltic Sea is slowly recovering after having been close to extinction in the past decades. Environmental pollution, which is particularly high in the Baltic Sea, represents a major threat to the conservation of the species. Riga Zoo, in collaboration with Nature Conservation Agency (Republic of Latvia), works as a rescue center for stranded seal pups on Latvian beaches. To assess the capacity of survival of the rescued seals, Riga Zoo has developed a GPS tracking program for the released seals. In collaboration with the Oceanosphera research group (University of Murcia), ecotoxicological monitoring has also been developed. This study allows to evaluate the quality of seals' habitat and through the "One Health" approach the data can be used for early monitoring of possible threats, including to humans. GPS data seem to indicate a normal behavioral pattern for this species, following known migration routes and visiting colonies and feeding areas within the Baltic Sea. The ecotoxicological results are important due to the lack of literature data on pollution in the Gulf of Riga and in juveniles (1-2 months old). The data seem to confirm problems of contamination by metals (Hg, Pb) and Polyciclic aromatic hydrocarbons (PAHs). The pollution by Persistent Organic Pollutants (POPs) seems to be reduced due to bans on their use.

Guidelines for rescue and rehabilitation of stranded harbour porpoises (*Phocoena phocoena*)

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Rehabilitation of stranded harbour porpoises (*Phocoena phocoena*) is not to be taken lightly and is an intensive, costly, and complex trajectory in which full recovery often takes 3-6 months. Rehabilitation is only attempted when acting in the animal's best interest and requires quarantine facilities, water management (water needs to be salt, refreshed or filtered, and stable in temperature), veterinarian care, volunteers, and animal caretakers for day/night shifts as the animal needs continuous support when weakened or due to muscle damage. The basin should be of sufficient size and oval-shaped, as when the pool is round and/or too small, animals can swim themselves crooked or die from stress. Upon arrival, the animal will have a health assessment, in which blood is drawn from the tail fluke. In the first twelve hours, the rehydration of the animal is crucial and fluid composition (ratios of %saline) will be determined based on the blood values. These fluids are administered utilizing a lubricated tube, directly into the stomach, or in cases of severe dehydration through an IV. After this first critical period, the digestion system may slowly build up by starting to feed small portions of fish dispersed over multiple sessions per day. If an animal receives too much food in a short period, there is a chance the digestive system can not handle this yet, resulting in an undigested ball of fish bones in the first stomach. In addition, it is important to closely monitor the animal and register: breathing frequencies (no. inhalations/5 minutes), upward or downward cramping, couching, colour and structure of defecation and behaviour. Upon releasement, the animal should form no threat to the wild population and must have a fair chance of survival. Therefore, the animal must show no hearing deficiency, be able to catch fish and be free of medication.

Habitat use of cetaceans near Barcelona - preliminary insights

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In the Western Mediterranean, nine species of cetaceans are regularly found, including the fin whale (*Balaenoptera physalus*) and eight odontocete species. Distribution and seasonal movements of these species are only partially known. To investigate cetacean presence in waters close to Barcelona, we conducted opportunistic observations from a 12m sailing vessel departing from Port Olímpic 2-3 times per week from early April to mid-June 2021 to 2023. Average speed was about 5 knots. Two professional observers looked for cetaceans with Bushnell Marine binoculars (Model 137500) for about eight hours per trip. We collected data about observed species, GPS-position, water depth, number of animals, time and duration of sightings, prevalent behaviour, presence and number of calves. Overall, we had 28 sightings of bottlenose dolphins (*Tursiops truncatus*), 13 of striped dolphins (Stenella coreuleoalba) and 14 of fin whales. We encountered bottlenose dolphins in waters of average depth 106m (range 3-487m), striped dolphins at average depth 372m (range 75-660m) and fin whales at average depth 268m (range 59-926m). Mean group size was 12,3 for bottlenose dolphins (range 1-35), 14,2 for striped dolphins (range 3-50) and 2,1 for fin whales (range 1-7). Calves were present in 64% of bottlenose dolphin sightings, 60% of striped dolphin sightings, and 7% (one occasion) of fin whale sightings. Feeding behaviour was observed in 19,2 % of bottlenose dolphins, 30,1 % of striped dolphins and 42,9 % of fin whales. These results show that despite intense shipping traffic (commercial and recreational), waters off the coast of Barcelona are regularly used by whales and dolphins, even close to the harbour. These animals deserve more attention than they have received to date. We consider it essential for the future to investigate how they are affected by vessel traffic and coastal anthropic activities, and work towards new conservation measures in the Barcelona area.

Harbour porpoises and operational offshore wind farms; occurrence and responses in time and space

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With the ongoing development of offshore wind energy in the North Sea, a substantial part of the distribution of harbour porpoises will overlap with offshore wind farms (OWFs) in the near future. Effects of the construction of OWFs on the distribution and ecology of harbour porpoises has received a lot of attention for many years, however, data on the presence of harbour porpoises in and around operational OWFs are relatively scarce. Gaining more knowledge on the spatial and temporal occurrence of harbour porpoises in OWFs is a prerequisite for adequate impact management. A total of 174 visits to multiple OWFs in the North Sea were carried out between 2007 and 2023. Additionally, harbour porpoises were recorded during Digital Aerial Surveys (DAS) in and around the operational OWF Borssele in 2021. We combined all harbour porpoise observations from these studies with the aim to study temporal and spatial use of operational OWFs. Harbour porpoises were seen year-round inside OWFs with highest abundances in winter. We found additional (smaller) peaks in autumn (September and October), which, to our knowledge, has not previously been reported. A comparison of observations in two nearby OWFs over a decade suggests an increase in the abundance of harbour porpoises in the area over time. Behaviour was not systematically recorded but foraging behaviour inside the OWF area was observed on a small number of occasions. Harbour porpoises were occasionally observed at close distances to operational wind turbines, even foraging. However, data from DAS shows that the probability of observing a harbour porpoise significantly decreases closer to wind turbines, which strongly suggests that harbour porpoises avoid close distances to operational wind turbines. Furthermore, we found that harbour porpoise densities do not significantly differ inside a OWF corridor compared to the OWF border or inside the OWF area.

Have you spotted them? Leveraging participatory platforms to highlight the need for a future Risso's dolphin network in NE Atlantic

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1. Association AL LARK

Risso's dolphin (*Grampus griseus*) is listed 'Data Deficient' by IUCN and 'Near Threatened' by the French Red List. Limited sightings in the UK and France expose their apparent patchy distribution that makes them vulnerable to recreational, commercial, and marine energy development disturbances. However, conservation efforts are hindered by limited information on their population ecology and distribution in the NE Atlantic. Using the ObsenMER participative platform, 11 organizations, including 88% NGOs, 8% parks, 3% water sports centers, and 1% French administrative services, collected observations from 1998 to 2023, involving 113 citizens. Segmented by the three Atlantic Sea Basins defined in France to address the requirements of the MSFD and the MSP Directive and considering English Channel observations, 314 sightings were recorded in the South Atlantic-SA (2%), the English Channel-EC (3%), the East Channel – North Sea-MEMN (7%), and the North Atlantic – West Channel-NAMO (88%). 75% of observations occurred in summer, 17% in spring, prompting questions about seasonal Risso's presence along French coasts. The mean group size was 4.81 ± 4.14 (1-33), with a significant spring-summer difference ($p = 0.01379142$). GIS analysis revealed a preference for shallow habitats (20 m ± 9.63, 0-41) near the coast (11 km ± 35.46, 0.009-212.37), differing from global patterns. 'Distance to the coast' tests showed significant basin differences between NAMO, SA (p-value= 2.653430e-04), EC ($p = 3.459103e-07$), and MEMN (p= 1.993511e-10) and a spring-summer distinction ($p = 0.0415283$). Depth differences were observed only between EC and NAMO areas ($p = 0.01084591$), suggesting distinct utilization of the English Channel's East and West coastlines. These findings align with habitat specialization hypotheses, potentially influencing management policies. This study provides baseline data for further research on Risso's dolphins in the North Atlantic, emphasizing the necessity of a comprehensive and multistructural North European network to improve the understanding of this species.

How climate change impacts on marine mammals' stranding events

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Climate change has profound implications for marine mammals, contributing to increased stranding events. Rising sea temperatures alter the distribution of prey species, forcing marine mammals to adapt by changing their migratory patterns. This can result in unexpected encounters with coastal areas, increasing the likelihood of strandings. One significant consequence of climate change is the shifting distribution of marine mammal prey such as fish and invertebrates. Marine mammals may follow as these species migrate to new areas in search of suitable habitats, bringing them closer to coastlines with a higher risk of stranding. Additionally, changing ocean currents and temperatures can disrupt established feeding grounds, further contributing to the displacement of marine mammals and increasing the chances of strandings. The impact of climate change extends to the coastal marine environment, fundamentally reshaping the lives and habitats of its wild marine fauna, including top predators as cetaceans. Rising sea levels, another consequence of climate change, can alter coastal landscapes. This can create new shallow areas or modify existing ones, confusing marine mammals that rely on navigational cues for their movements. These changes and extreme weather events linked to climate change can disorient marine mammals and lead to strandings along unfamiliar coastlines. Moreover, climate change is associated with increased frequency and intensity of harmful algal blooms (HABs). These blooms can contaminate marine mammals' food sources, leading to various health issues. In some cases, marine mammals may strand due to the neurological effects of consuming prey contaminated by toxins from HABs. In conclusion, climate change has multifaceted impacts on marine ecosystems, influencing prey distribution, altering migration patterns, and contributing to environmental changes that can lead to marine mammal strandings. Addressing climate change and implementing conservation measures are crucial to mitigating these effects and safeguarding the well-being of marine mammal populations.

How significantly do human interactions impact cetacean strandings? A comprehensive analysis over the years of data collection in the Italian National Stranding Data Bank

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Monitoring stranded cetaceans is crucial for managing marine environments. The Italian National Stranding Data Bank (BDS), available online at http://mammiferimarini.unipv.it, holds data on cetacean strandings dating back to 1713, although considering the widespread temporal gaps, at least until 1986 with the establishment of the Centro Studi Cetacei, when systematic data collection began and intensified only in 2005 with the Italian Stranding Network. From January 1, 1713, to December 31, 2023, the BDS has catalogued 6,306 stranding records involving a total of 6,433 individuals across 14 species. Sicily, Apulia, Sardinia, and Tuscany have been the most affected Italian regions, and the most commonly stranded species were *Stenella coeruleoalba* (40.9%) and *Tursiops truncatus* (28.2%). The database identifies six signs suggesting human interaction on stranded specimens: “bycatch”, “signs of fishing gear”, “presence of net", “presence of hook”, “firearm injuries”, and “collision”. Among all stranded cetaceans since 1986, 821 specimens were recorded to have interacted with human activities, reporting “bycatch” as the most reported type of interaction (47.3%), followed by “presence of nets” (6.2%) and “collision” (5.8%). Bycatch is frequently connected to other categories, such as the presence of net (28.5%), “sign of fishing gear” (4.8%), and the presence of hook (2.2%). Among the regular cetacean species, the interaction rate was evaluated for each species compared to their total strandings exhibiting different rates: sperm whale (36.2%), pilot whale (22.4%), fin whale (19.2%), Cuvier’s beaked whale (18.7%), striped dolphin (14.2%), Risso’s dolphin (11.9%), common dolphin (10.9%) and common bottlenose dolphin (9.4%). Therefore, the conservation of cetaceans is still challenged by fishing activities and marine traffic, even though only 12.8% of stranded specimens indicated human interactions. To adequately tackle this threat, standardized necropsy protocols will be utilized to accurately determine the current risk posed by human activities at sea to the well-being of cetaceans.

Identification of *Crassicauda anthonyi* in renal lesions of Cuvier's beaked whales (*Ziphius cavirostris*) stranded in Canary Island

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Cuvier's beaked whales (CBWs) (*Ziphius cavirostris*) are among the 31 different cetacean species identified in the Canary Islands Atlantic waters. Stranded CBWs usually show a high prevalence of nematode parasites of the genus *Crassicauda* affecting the kidneys and urinary tracts, as well as the arterial walls of the infected animals. However, no parasite identification has been carried out so far. With this aim, adult parasites were collected from the kidneys of 11 stranded dead CBWs with different conservation code (from 2 to 4). Morphological and molecular (a PCR targeting the mitochondrial gene cox1) identification were carried out. In addition, kidney samples were subjected to histopathological studies. As a result, the nematode *Crassicauda anthonyi* was molecularly identified in 4 animals (being the carcasses within the freshest conservation status) in agreement with the morphological parasitic identification. The renal nodular lesions were characterized by granulomatous processes of variable severity and extension which use to show intralesional nematodes, fibrosis, necrosis and multifocal mineralization. This study provides the first molecular identification of the nematode *Crassicauda anthonyi* as responsible for a high prevalence of renal and arterial lesions in CBWs stranded in the Canary Islands, contributing to improve the knowledge of crassicaudiasis in these cetacean species.

Impact Assessment of Anthropogenic Pressures: Acoustic Masking and Ship Strike Risks in Fin Whales during Southward Migration at the Cape of San Antonio (Alicante, Spain)

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In recent years, the expansion of socio-economic globalization has resulted in a surge of marine traffic worldwide. Unfortunately, this increase in ship routes poses a significant threat to marine species, mainly marine megafauna mammals like fin whales. These gentle giants face two primary hazards: the danger of collisions with ships and the risk of damage from underwater noise pollution generated by these vessels. Due to the low-frequency range of fin whale communication, larger ships are a significant noise source, causing interference in their communication channels. Therefore, monitoring and establishing a connection between human pressure from ship traffic and its adverse effects on fin whales is crucial. For the last three years (2021-2023), from late spring to summer, a land-based observatory in the Cape of San Antonio (Mediterranean Sea, Alicante, eastern Spain) and a passive acoustic monitoring device in the same area tracked the migratory pattern of fin whales in their voyage towards their North Atlantic Sea feeding grounds from their spring feeding areas in the Mediterranean. A total of 111 fin whales were observed. The geographical positions of 427 points from 59 sightings were estimated. Combining this data with detailed marine traffic information obtained from AIS, we determined the risk of ship strikes. Additionally, the team measured the underwater noise in the area to assess the risk of masking in communication among conspecifics. The results highlight the significant threat to fin whales due to fast ferries and the resulting noise pollution generated by marine traffic. It's essential to note that the fieldwork area for this communication falls outside any existing Marine Protected Area established for fin whale conservation.

Impact of the presence of visitors on the behavior and cortisol levels in captive bottlenose dolphins (*Tursiops truncatus*)

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The objective of our research was analyze the impact of the presence of visitors on the behavior and cortisol levels in captive bottlenose dolphins (*Tursiops truncatus*). To do this, observations were made of a group of 8 individuals at the Madrid Zoo Aquarium (Spain) over a period of five months. During this research, we´ve considered two phases, CP (without visitors), and IP (with visitors). In both phases, we collected from each individual, behavioral variables and saliva and blood samples. We´ve collected saliva and blood samples to analyze cortisol level (because the cortisol is a marker stress), and to check if the cortisol levels found in saliva are reliable.

Cortisol levels in saliva have been analized by LC-MS (Rickert and cols., 2022). In 7 individuals, the cortisol levels weren´t detected in saliva but were detected in blood (0,3 to 1,2 µg/L). Therefore, these results would indicate that the analysis of cortisol levels in saliva samples using LC-MS wouldn´t be reliable.

Likewise, we´ve taken behavioral variables from each individual. These variables were divided into three categories: INACTIVITY, ACTIVITY and STEREOTYPIES. We´ve seen that both phases showed high values of behaviors associated with the activity were observed, but in the IP there was an increase in these behaviors, as well as an increase in stereotyped behaviors, and it was observed that oldest dolphins had higher values.

When we correlate these results with blood cortisol levels, we've observed an increase in cortisol levels in the IP. These results, therefore, could be indicative of increased stress that could be related to external factors such as the presence of the visitors in the zoo.

Implementation of a deep-learning algorithm for automatic identification of cetaceans from aerial videos: a promising tool for detection and identification of different species

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As the use of drones and high-resolution imagery become increasingly common in cetacean studies, efficient data processing through Deep Learning tools still remains a challenge. To test suitability for cetacean monitoring, high-resolution videos were obtained through the fixed-wing and long-endurance drone TEKEVER AR5 Evolution, a medium-size RPAS (7.30×4.03m) operated by the REACT consortium and provided to the Italian Coast Guard by the European Maritime Safety Agency (EMSA) within a collaboration with the Tethys Research Institute. Videos were recorded in summer 2022 over a 1,041 Km2 area in the Pelagos Sanctuary (NW Mediterranean Sea) through an electro-optical video camera (1080p) with a mid-wave infrared sensor (512p). The convolutional neural network YOLOv.8 was implemented to automatically detect and identify cetaceans on the photograms extracted from the videos. A python algoritm was used to extract 667 frames, in which the presence of six species (*Balaenoptera physalus*, *Physeter macrocephalus*, *Globicephala melas*, *Ziphius cavirostris*, *Stenella coeruleoalba*, *Grampus griseus*) was confirmed. Individuals were labelled on the image-annotation platform Makesense.AI into predefined categories (species), based on their external diagnostic features. A matrix of labels was generated for probabilistic determination of the species. The model was executed through the Ultralytics YOLO Command Line Interface. During training (80% of the frames), it "learns" distinct traits on labelled images, from simple shapes (eg. pixels, edges, lines) to combinations of patterns resulting in complex shapes and colorations. During testing (20% of the frames), it recognizes the species on new unlabelled images. Validation of the testing dataset indicated robust generalization capabilities (precision rate=90%). Foreseen improvements will include balancing image count per species and performance optimizations on smaller species (eg. Stenella). The proposed methodology offers high potential for future work, being scalable to larger datasets and broader areas, and shows the suitability of RPAS to assist conventional cetacean monitoring.

Increase of cetacean exposure to whale-watching activities in Madeira

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In Madeira, whale-watching activities have been regulated by regional legislation since 2013, defining the number of licensed whale-watching vessels and regulating cetacean observation in terms of time, distance and manoeuvres. The objective of the study was to estimate cetacean exposure to whale watching boats in the main area of operation with 25 licenses. A combined land/vessel survey was undertaken in June 2022 involving 5 observers on two land stations, 2-3 observers deployed on-board whale-watching boats and collaboration from companies. The survey yielded 23 half-day sampling periods (morning/afternoon) with good weather conditions, during which an average of 4.9 (range: 2-11) cetacean groups were observed. Simultaneously, an average of 9.8 (5-15) licensed whale-watching boats and 12.4 (6-18) total boats (including non-licensed and private boats) were engaged in whale-watching activities. Over these 23 sampling periods, 90% (n=95) of the groups detected were approached by a vessel, and in 16 periods (70%) all groups were approached, with some difference between species. Bottlenose dolphins and short-finned pilot whales were approached on average by 5 (range: 1-13) licensed vessels which rose to 6 (1-16) when considering all vessels. The approached groups were observed an average total duration of 48 min, half of which were above the legal limit of 40 min, and a maximum of 2h50. Then results were compared to a similar survey from June 2012, with most parameters showing an increase of whale-watching pressure in the last decade, including twice the number of operating licensed boats per sampling period, plus extra non-licensed and private boats, and longer observation time. Although more groups were detected in 2022, it still resulted in the number of groups detected/available per operating vessel in 2022 (0.4 ± 0.2; n=23) to be half the value of 2012 (0.8 ± 0.4, n=18). Future studies should investigate possible effects on targeted cetaceans.

Increasing observations of fatal fluke entanglements of Indo-Pacific bottlenose dolphins with discarded fishing gear in the Northern Red Sea, Egypt

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Entanglement with discarded fishing gear is a global issue for many marine species, and by-catch is the world's largest cause of death of cetaceans. In the coral reefs off Hurghada in the Northern Egyptian Red Sea, increasing numbers of Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) are suffering from increased mortality and morbidity after being documented with a variety of rope types tightly entangled around the tail fluke. The categories of rope recorded include monofilament and braided fishing line, and thick ropes of uncertain origin. The objective of this presentation is to showcase videos and images of entangled dolphins to highlight this issue, to invite interdisciplinary discussions from colleagues on whether this has been observed in other study areas, how entanglements may occur, and steps required to minimise these incidences. Through a unique combination of boat-based and underwater surveys, 11 individuals were observed with fluke entanglements. Among these, three individuals are deemed as deceased, and one individual was reported free of any ropes. During a 3-week survey in November 2022, three individuals with entangled ropes were recorded. All entangled individuals observed have either been calves or juveniles. During underwater focal-follows, dolphins are often observed interacting with objects in the water column including seaweed, fish, ropes, and discarded plastics. However, it is uncertain how an increasing number of individuals are becoming entangled with high consistency around the fluke. Injuries and issues arising from entanglements are complex and include drowning, amputation of distal body parts, laceration of blood vessels, tissue damage and infection. Moreover, restricted movement from entanglement ultimately leads to an inability to forage or engage in natural behaviours. In summary, these impacts have implications for individual welfare and survival, and for a relatively small population, it's unclear whether entanglement incurs population-level effects, thus assessments are urgently needed to inform management actions.

Influence of benthic topography on minke whale (*Balaenoptera acutorostrata*) presence in the south coast of Portugal

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The minke whale (*Balaenoptera acutorostrata*) is a widely distributed species, which engages in seasonal migrations between low and high latitude areas. Although being the most abundant baleen whale in mainland Portuguese waters, the species faces vulnerability due to its discrete nature and limited studies. Consequently, relatively little is known about the species in this region. This study presents results of 12 years (2010-2021) of dedicated boat surveys and opportunistic surveys (whale-watching tours), conducted along the southern coast of Portugal to gain a deeper understanding of minke whales' habitat preference in this region. A total of 102 sightings of minke whales were recorded corresponding to a total effort of 8,485 hours. Sightings mostly consisted of solitary individuals, although groups of up to 3 whales were occasionally observed. We used generalised additive models to model the presence-absence of minke whales according to environmental conditions. Models were fitted using a binomial distribution and the most relevant environmental variables were selected (i.e. depth). Our models showed that the presence of minke whales was significantly influenced by depth, with highest occurrence probability in waters around 300 m. In particular, a high presence of minke whales was observed within the Portimão canyon. The topographic features present in the area may partially explain the preference for shallower waters as they influence prey aggregation, suggesting that this region might be used by this species as a feeding ground. The south coast of Portugal is heavily exploited for commercial fishing and whale-watching, which have the potential to considerably impact minke whales in this region. Our findings can aid the implementation of more effective species and habitat management strategies, ultimately contributing towards improving the conservation status of the minke whale population in mainland Portuguese waters.

Influence of environmental variables on the bottlenose dolphins' spatial distribution and habitat use

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The Strait of Sicily is a critical marine habitat for dolphin species, especially the bottlenose (*Tursiops truncatus*). The area is subjected to increasing pressures derived from human activities, such as marine traffic and offshore constructions, and therefore, knowledge about species distribution is crucial to develop effective conservation and management measures. The present study aims at investigating dolphin distribution and exploring the influence of environmental variables. Data were collected during boat surveys carried out from 2011 to 2021, over a total of 5084.35 km. Bottlenose dolphins (75 sightings) Encounter Rates (ER) were calculated as the number of sightings per km. The ERs were modeled by using Generalized Additive Models in relation to three environmental variables (sea surface temperature, depth, and distance from the coast) extracted from Copernicus Marine Service and Gebco facilities. Results showed a mean Encounter Rate of 0.015 (sd=0.11). The main environmental variables driving the distribution of the species in the area were Depth and Distance from the coast, accounting, together with sea surface temperature, for the 51.4% of the deviance explained. For Depth, GAMs showed two peaks: the first between 50 and 100 m and the second at 200 m, while for the or Distance from the coast, the peak is from 10 to 20 km. The outcomes of this study contribute to provide insights into the habitat preferences of dolphins in this region, supporting future marine spatial planning strategies.

Inner ear of the harbour porpoise using synchrotron phase-contrast imaging

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Cetaceans rely on hearing for their vital activities. With increasing underwater noise pollution due to anthropogenic activities there is also an increasing concern on how noise exposure can affect the animals' hearing. The application of high-resolution and non-invasive imaging techniques bear great potential to describe the soft tissues of the inner ear of cetaceans and detect potential cases of hearing loss, but are still lacking. In our study, we present a description of the soft tissues of the cochlea of harbour porpoise (*Phocoena phocoena*) at high spatial resolution (2 µm voxel size) showing normal and altered anatomy, based on synchrotron phase-contrast micro-computed tomography (DESY/HEREON, Hamburg). Three-dimensional image reconstructions show that synchrotron phase-contrast imaging is a non-invasive and well-suited technique for both, imaging the physiological anatomical cytoarchitecture of the cells of the cochlea at high resolution, and detection of pathological features. Further analysis will allow for a quantification of the number and volume of spiral ganglion cells (cell bodies of type I afferent neurons), as well as provide anatomical information of the inner ear which is needed for comprehensive modelling of sound propagation in cetaceans.

Insights into fin whale movements and foraging behaviour around Elephant Island, Antarctica

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Following near-extinction from twentieth-century industrial whaling, fin whales are now reappearing in growing numbers in Antarctic waters. Shipboard and aerial surveys have documented their return to ancestral feeding grounds along the Western Antarctic Peninsula. Using behavioural analyses based on satellite telemetry data, this study aims to complement existing knowledge on the ecology of fin whales, with insights into fine-scale movement patterns and behaviour of the large aggregations observed foraging around Elephant Island. In the austral autumn (March and April) of 2021 and 2023, four and nine fin whales, respectively, were equipped with satellite transmitters at the foraging grounds off Elephant Island. Their movements were tracked for durations ranging from 4 to 39 days (SD = 9 days). Behavioural analyses, employing Hidden-Markov models (HMM), were conducted to assess the whales' activity budgets. The HMM revealed that fin whales dedicated over 70% of their time to area-restricted search, a behaviour commonly associated with foraging. Most individuals (n = 8) exhibited a notable site fidelity to the waters off the Northern coast of Elephant Island, staying near the tagging location for the duration of tag transmissions. While two individuals were tracked for short durations of 8 days or less, resulting in weaker behavioural classifications, three whales moved away from Elephant Island in different directions: South-West towards the Bransfield Strait, East towards the South Orkneys, and South towards the Weddell Sea. The concentration of foraging behaviour around Elephant Island, the South Orkneys, and the North Weddell Sea highlights potential core feeding grounds within the Western Antarctic Peninsula and Islands IMMA (Important Marine Mammal Area). The identification of these foraging areas within an IMMA strengthens the urgent need for special protection to ensure the continued recovery of this species and preserve core habitats.

Insights on marine mammals occurrence in the Ross sea, Antarctica

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The Southern Ocean holds about 20% of the worlds' seals and whales, represented by 15 species of cetaceans and six species of pinnipeds. However, few studies have been focused on assessing occurrence patterns of marine mammals on board research vessels in Antarctica. In order to evaluate the occurrence of these animals in the Ross Sea, the Marine Mammal Monitoring Program at the Colombian Antarctic Program in cooperation with Italian Antarctic Program, conducted a marine mammal monitoring survey during the transit from New Zealand to the Ross Sea, and in the Ross Sea during the austral summer (January-February, 2020, February-March, 2022 and January-March, 2023). The survey was conducted on board the Oceanographic and research Italian vessel Laura Bassi, during 130 days, traveling approximately 32,193km, with a total of 1212 hours of visual effort. During these surveys, there were 357 sightings, in which seven cetacean species Minke whale (*Balaenoptera acutorostrata*/bonaerensis), Humpback whale (*Megaptera novaeangliae*), Killer whale (*Orcinus orca*), Sperm whale (*Physeter macrocephalus*), Long-finned pilot whale (*Globicephala melas*), Hector's dolphins (*Cephalorhynchus hectori*) and dusky dolphin (*Lagenorhynchus obscurus*); and four pinniped species New Zealand fur seal (Arctocephalus forsteri), Leopard seal (*Hydrurga leptonyx*), Crabeater seal (*Lobodon carcinophagus*), and Weddel seal (*Leptonychotes weddellii*), were reported. Our preliminary findings suggest that Minke whales, Humpback whale, the Crabeater seal, and the Weddell seal, were the four most common marine mammal species in the Ross Sea. However, it is necessary to implement a long-term marine mammal monitoring program in order to effectively understand the distributional patterns and changes in response to threats such as human disturbances and climate change. The Antarctic Research Program cruises are a unique platform to understand these patterns of marine mammals on a regional scale.

Integrating satellite tracking and photographic-identification to understand pilot whale connectivity between Madeira and the Canary Islands and support conservation

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Understanding the spatiotemporal movements of cetaceans plays an important role in various facets of conservation biology, however, obtaining this information poses challenges. Technological advancements have significantly enhanced the study of ranging patterns over the past decades. In the Macaronesia biogeographical region, short-finned pilot whale's movement patterns have been extensively studied using photographic-identification methods. However, knowledge of the fine-scale and off-shore movements of the species remains limited. To address this gap, satellite biologgers (Low Impact Minimally Percutaneous Electronic Transmitter - LIMPET SPOT6) were deployed in Madeira between 2018 and 2022, as part of a multi-purpose telemetry program. Combined with novel photographic-identification catalogue comparisons between three regions in the Macaronesia Region (Madeira, the Central and Western Canary Islands), the findings of both methodologies were used to infer on the animals' movements. Home range and move-persistence analyses of four individuals tagged with satellite biologgers moving between Madeira and the Canary Islands highlighted previously unknown connectivity between the Western Canary Islands and Madeira. This was corroborated by the higher number of photographic matches between Madeira and the Western Canary Islands compared to Madeira and the Central Canary Islands. Additionally, the high number of matches indicated that these movements are not solitary events. As all observed matches between regions were unique, this could indicate that the Western Canary Islands have specific ecological importance for Macaronesian short-finned pilot whales. This study shows that a comprehensive dataset encompassing telemetry and photo-identification information presents a robust foundation for informing the regional conservation management of cetaceans.

Inter-annual morphometric assessment of fin whales based on drone photogrametry

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Data upon morphometric attributes of free ranging cetaceans, such as length, proportions, and volume are reliable measures to determine the foraging success, energy reserve accumulation, individual fitness and the population status. Unmanned aerial vehicle (UAV) provides a new, low-cost, non-invasive platform to execute photogrammetric studies on free-living, large cetaceans, enabling quantitative assessment of temporal and permanent changes of the animal's body. The aims of this study were to accumulate accurate morphometric measurements of fin whales in the Northwestern Mediterranean Sea, along the Catalan coast to compute growth trends of several body proportions, assess the evolution of body area index and body volume over time, and to compare these parameters within three consecutive foraging seasons. In total, 1099 still images were measured during this project, depicting 82 individual fin whales from three consecutive years, between 2021 and 2023. The result indicates that there are strong correlations among the growth trends of certain body parameters. The most significant correlation was between the total length of the body and the eye-to-eye distance. It was determined that in some cases the growth ratios can be further influenced by the gender and the size of the whale. Moreover, measures of three resighted individuals showed moderate increase of the body length and four animals showed gradual positive progression of the body area index and body volume within and over the three seasons. Both of which demonstrate foraging success and energy reserve accumulation. In a more general scale, smaller animals displayed the highest body area index indicating better body condition and higher fitness, while the largest ones exhibited the lowest measures. The present study illustrates the utility of drone-based photogrammetry to detect and assess temporal and permanent changes in the body parameters of fin whales.

Interaction between Mediterranean monk seals *Monachus monachus* and marine fish farms in Greek waters

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Since 2023, the Mediterranean Monk Seal has been listed in the IUCN Red List as Vulnerable with a population assessment of approximately 450-600 mature individuals, with Greece as its main Mediterranean reproductive area. With 285 marine fish farms, the Hellenic Republic stands as the third fish farming producer in the world, and number 1 in the EU. Worldwide, pinnipeds are frequently reported to interact with fish farms, often causing damage to gear and fish stocks. In the process, seals may suffer from entanglement, illegal killing, injuries, habitat loss or disturbance. With the aim of investigating interactions between monk seals and fish farming in Greece, a questionnaire was distributed to fish farm operators across the country. So far, we received responses from 22 establishments. Preliminary results indicate a high degree of monk seal interaction (86%), typically involving one (71%) or two (29%) seals, which are mostly observed chasing and catching fish around the cages, but also resting on top of some fish farm structure (e.g., cage frame) and causing net damage. The majority of respondents (63%) reported an annual loss of less than 10% of the fish production, while 21% estimated a loss equivalent to 10-25% and only 16% considered it higher. Accordingly, loss was also reported due to damage to equipment (i.e., netting), resulting also in an increase in the cost of labor (i.e., repairs). In accordance with recent evidence of a significant increase in the population and range of the monk seal in Greece, an increase of at least 25% of monk seal interactions during the last decade was unanimously reported. Our findings may help designing strategies to reduce conflict, not only for the benefit the industry, but also to contribute to the conservation of one of the most endangered pinniped species worldwide.

Interplay of apex predators: a study on the interaction dynamics between bottlenose dolphins and seabirds in the Strait of Sicily

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Identifying the relationships between species is a key aspect of understanding the structure and functioning of an ecosystem. Even more crucial, particularly from a conservation perspective, is understanding the ecological dynamics among apex predators. The aim of this study is to investigate the interaction between bottlenose dolphins and seabirds. The study area is situated off the coast of the province of Agrigento, in the Strait of Sicily. The data were collected from 2017 to 2023 during one-day research expeditions, weather permitting, using a random sampling design. The chi-square test was used to analyse the statistical significance of the interaction between dolphins and seabirds separately within the four main behavioural categories (feeding, resting, socializing, traveling). The chi-square test was also applied to investigate whether the presence of trawlers was the driving factor for this interaction. The Spearman's rank correlation coefficient was used to understand whether the group size of dolphins and seabirds was correlated. A total of 207 surveys were conducted, resulting in 188 sightings of bottlenose dolphins and 2897 of seabirds. Seabirds were present in 86.17% of bottlenose dolphin sightings. The chi-square test highlighted the presence of a strong interaction, predominantly during feeding (95.27%), but also during traveling (70.73%) and resting (66.0%). During socializing, bottlenose dolphins were never seen with seabirds. The presence of trawler boats emerged as a key factor in the investigated interaction, while the group size of birds does not seem to be correlated with that of dolphins. In conclusion, the interaction between bottlenose dolphins and seabird species was observed to be sufficiently intense to be characterized as an association, since it seems to be a long-term interaction. It is worth noting how human activities play a fundamental role in shaping this association.

Into the dolphin skin: a first assessment of skin lesions in the bottlenose dolphins (*Tursiops truncatus*) of South-western Sicily

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Skin alterations are frequent on the skin of cetaceans, and, despite having unknown health repercussions, they can be an indication of a weakening or an over-stimulation of the immune system. This study aims at analysing the skin lesions present on the bodies of the bottlenose dolphins (*Tursiops truncatus*) in the Agrigento province (Strait of Sicily), using the photographical data collected between 2016 and 2020. Out of the 848 photographs of 82 identified individuals, 538 were deemed of good or medium quality and included in the visual analysis. A total of 14 types of lesions were found on 47 individuals: dark fringe (DF); white fringe (WF); white amorphous (WA); black amorphous (BA); rake mark-associated potentially pathogenic (RMA PP); rake mark-associated (RMA); dark spots (DS); cloudy white spots (CWS); orange hue (OH); vesicular lesion (V); parasites (P); spotted (SP); mottled (MO); shotgun wound (SW). The prevalence of each lesion type was calculated as the ratio between the number of bottlenose dolphins showing said lesion and the number of individuals identified in the study period. The most prevalent were WA (28%), WF (20%), DF (15%), DS (11%), and RMA (10%). The permanence of each lesion type was calculated by the number of years in which it was present on each animal, which allowed to classify them as "temporary" (≤ 4 years) or "permanent" (≥ 4 years). The lesions were largely temporaneous, only the one shotgun wound was found to be permanent. This study provides a baseline of the skin conditions in the sub-population of dolphins in Agrigento waters. Further studies on the aetiology of these skin alterations are needed to enact conservation and management measures at a local level, therefore achieving a mitigation of the probable causes.

Isotopic niche of blue whale and fin whale hybrids from Iceland as compared to their parental species

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The occurrence of hybrids between fin and blue whales appears to be relatively common and has been reported in many populations. However, nothing is known about the behaviour and ecological traits of such hybrids. We studied the stable isotopic values of nitrogen (δ15N), carbon (δ13C) and sulphur (δ34S) in the baleen plates from three hybrids caught during commercial whaling operations in Iceland (one from 2013 and two from 2018) and compared the time-related oscillations observed along the baleen plate with those of fin whales from the same area. The results show substantial overlap between the hybrids and the parent species, all which is indicative of coincidence in diet and habitat use. However, we also observed some decoupling in the timing of the baleen oscillations in hybrids relative to fin whales, which may suggest a slight difference in migratory regimes. One of the hybrids was a second-generation hybrid, that is, it was the descendent of a hybrid and a fin whale, and the mean values and oscillations did not show deviation from the first-generation hybrids. These results are consistent with the repeated observation of hybrids forming mixed schools with fin whales and indicate substantial competition between the hybrids and the parental species.
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Isotopic niche of fin whales (*Balaenoptera physalus*) in the Catalan coast feeding ground, NW-Mediterranean Sea

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Stable isotopes is a useful tool to characterize the trophic niche, trophic position and, trophic relationships between species within the food webs. In addition, it has been used to define migration movements in large cetaceans. In 2021, skin samples of 39 fin whales (*Balaenoptera physalus*) were collected by biopsy darting in the Catalan coast, especially in the Garraf coast, within the long-term Fin Whale Project. The twofold aim was to identify the isotopic niche and the potential origin (Mediterranean or Atlantic) of fin whales present in the area in spring. The samples were taken along the whole feeding season, mostly in April and May. Skin samples were divided into three layers: external, middle, and basal. The δ15N and δ13C stable isotopic values were analysed from the external and the basal layers. There were no significant differences between both layers. The isotopic results of the fin whales sampled was compared with previous isotopic results of fin whale sampled in the Mediterranean (Ligurian Sea), the Atlantic (Galicia, Ireland) and the Strait of Gibraltar. We did not find significant overlap between the Garraf individuals and the other sites. These results do not allow us to determine the previous geographic location of the sampled fin whales but indicate that the Catalan coast is an important feeding ground in spring for this species. The external and basal layers of the animals sampled from March to May did not show any tendency. This means that the sampled animals fed in the same area during the entire period of integration of the two skin layers, which is estimated to be around 163 days. These results coincide with those obtained throughout the visual observations along the Project conducted in the study area, indicating that fin whales move along the Catalan coast while feeding during the springtime.

Joint Mediterranean P-ID catalogue of the bottlenose dolphin (*Tursiops truncatus*): preliminary results within the LIFE DELFI project

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The bottlenose dolphin (*Tursiops truncatus*) is a resilient, opportunistic, and versatile species, which has been able to adapt to several anthropogenic pressures (e.g., fishing activities, maritime traffic, chemical and acoustic pollution, habitat degradation) in the Mediterranean Sea. Particularly, in the last decades, the interaction between dolphins and fishery activities and gears has become a topic of conservation and policy concern due to the ecologic and socio-economic consequences. Under this framework, in 2020 the LIFE DELFI project (LIFE18 NAT/IT/000942) carried out several actions thanks to the joint effort of 11 partners located in different areas of the Mediterranean Sea. Among those activities, a photo-identification monitoring campaign created regional photo-ID catalogues. Here, we compared photo-ID data collected in 6 different areas from May to October of 2023 in Italy (Tuscany, Aeolian Archipelago-Sicily, Abruzzo, Marche, Veneto and Croatia). The cumulative monitoring effort was of 310 hours, and they were covered a total of 1.985 nautical miles. During the whole monitoring period, 95 sightings events occurred, and 391 bottlenose specimens were identified. Specifically, 14 individuals in Tuscany, 59 in the Aeolian Archipelago, 14 in Abruzzo, 25 in Marche, 6 in Veneto and 273 in Croatia. The analysis of the photos of the dorsal fins of each dolphin will allow to create a joint photo-ID catalogue of animals distributing in areas both geographically distant and close. These pictures will help to gain information about dolphin population dynamic and fishery interaction in order to develop dedicated conservation strategies.

Key points to reduce the impact of interactions between killer whales (*Orcinus orca*) and sailing vessels in the Strait of Gibraltar

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In recent years, several interactions between killer whales and vessels have been reported, some of which have caused harmful damages, such as rudder breakage. This study aims to understand the dynamics of these interactions, assessing whether they affect both sailboats and motorized vessels, and developing strategies to mitigate their impact.

Through several maritime expeditions, different navigation tactics were tested and the reaction of the killer whales was monitored, also a "catcam" was deployed to monitor killer whale habitat use. The results reveal that killer whales do not discriminate between vessel types in their interactions. However, statistical models indicate that gradually increasing the sailing speed equal to or greater than 6 knots significantly reduces the risk of damage. This strategy is effective because at higher speeds, the more challenging it is for the killer whales to impact the vessels rudders with the same precision, allowing the vessels to maintain a safe distance from their hunting grounds. This finding provides a practical and simple solution for sailors, contributing to the safety of vessels while simultaneously minimizing the risk of negative interactions. This study not only sheds light on the killer whales behavior towards vessels, but also provides guidance for safe navigation in areas frequented by these animals.

Large scale cetacean conservation: The complex case of the Lesser Antilles

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The Caribbean Sea is recognized as a global marine biodiversity hotspot, and is rich in 33 documented marine mammal species. Established in 2020, the Caribbean Cetacean Society (CCS) has undertaken extensive surveys across the entire Lesser Antilles arc since 2021, recently extending its scope to the ABC islands. Conducting research and cetaceans conservation presents formidable challenges in this area, comprising 18 territories, several being part of Europe. In this context, comprehending species movement patterns between islands and assessing anthropogenic pressures at the Lesser Antilles scale is a preliminary step for potential conservation planning. To address this, we conducted a movement and scar analysis using photo-identification, complemented by spatial risk assessments. Our findings reveal that cetacean species are not uniformly impacted by human activities. Kogia and blackfish species emerged as the most affected, with at least one out of two individuals featuring a scar of anthropogenic origin. Additionally, we identified evidence of three distinct movement patterns in the area: migratory (humpback whales), residential (pantropical spotted dolphins), and regional traveling at the Lesser Antilles scale (Fraser's dolphin). These results underscore the importance of regulation and conservation enforcement at the Lesser Antilles scale, necessitating cooperation between territories to reduce the anthropogenic impacts on cetaceans, as cetaceans are not constrained by borders. Highlighted by this necessity, the CCS is actively building capacity by offering training in cetacean data collection and developing projects with a growing network of experts in the Caribbean, dedicated to cetacean conservation. Sea Camps have been organized in St Vincent and the Grenadines, where dolphin hunting is legal, to raise awareness among children regarding marine biodiversity preservation. Lastly, we are actively involved in a new bilateral MPA establishment, in collaboration with the respective government. Our goal is to provide field-sourced support data and policy recommendations, aiming for cetaceans conservation.

Lateralised lunge feeding behaviour in Southern Hemisphere fin whales at Antarctic feeding grounds

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During the austral summer months, Southern Hemisphere fin whales (*Balaenoptera physalus* quoyi) congregate at feeding grounds near the Antarctic Peninsula, regularly forming large feeding aggregations. Like most balaenopterids, they employ dynamic feeding lunges to efficiently forage on the abundant krill (Euphausiids) in the upper ocean layers. While lunge feeding, the whales frequently perform side roll manoeuvres along the longitudinal axis, likely maximising engulfment success and enhancing their energetic efficiency. Among Northern Hemisphere fin whales (*B. p. physalus*) a right-side preference of around 90% has been described for side lunge feeding manoeuvres.

Here, we investigate lateralisation, or side preference, of the Southern Hemisphere subspecies (*B. p. quoyi*) using aerial video imagery of surface lunge feeding behaviours at the feeding grounds off Elephant Island, Antarctica. Video data were collected during RV Polarstern expedition PS112 in the austral summer of 2018 using drones and on-board helicopters to record 3:54h of aerial footage. We found observational evidence for strongly lateralised side lunging behaviour in Southern Hemisphere fin whales with right-handed lateralisation observed during 100% of all documented side lunging events (n= 63). In addition, the majority (98.3%) of lunging events showed arced, clockwise swimming directions, substantiating a strong right-hand bias in feeding behaviours. Observations of group lunging events of 2 - 4 individuals (n= 14) demonstrated synchronous movement patterns during 40% of all lunging events, including arced, clockwise swimming direction, suggesting some degree of coordination during group feeding.

Our results provide the first information on laterality in B. p. quoyi and complement existing information on lateralised feeding behaviour in Northern Hemisphere fin whales, confirming a strong right-sided bias across the fin whale sub-species. In addition, new observations of synchronised feeding behaviour identify a need to further investigate the potential existence of cooperative feeding strategies in Southern Hemisphere fin whales during group feeding events.

Long-term monitoring of harbor porpoise (*Phocoena phocoena*) in the Pomeranian Bay, Baltic Sea, reveals increasing detection rates over the last decade

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In the framework of environmental monitoring we conducted long-term passive acoustic monitoring (PAM) of harbour porpoises (*Phocoena phocoena*) in the Pomeranian Bay, Baltic Sea, and adjacent waters east of the island of Rügen. Our data from up to 23 CPOD stations deployed from 2010 to 2021 within an area of approximately 7,000 km² show that harbor porpoises occur regularly in low to moderate numbers in this area, located in the transition zone between the Belt Sea and the Baltic Proper populations.

Bayesian trend analyses and tests of proportions showed a significant increase of porpoise detections in spring, summer and autumn over the study period. Since the positive trend of porpoise detection rates was strongest for the months May to October, when seasonal population peaks also occur further to the west, the trend is assumed to be mainly caused by a potential seasonal expansion of the Belt Sea population towards the Southeast including the Pomeranian Bay during the warmer season. In winter, no clear trend occurred, and numbers were generally very low during this season.

The observed positive trend is of particular interest as SCANS IV recently observed a decrease in harbour porpoise sightings for the Western Baltic Sea, West of our study area, while our results might indicate a distribution shift within the Belt Sea.

Long-term trends in the diet of the striped dolphin, *Stenella coeruleoalba*, in the western Mediterranean: an update

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In a stomach content analysis of 140 striped dolphins, *Stenella coeruleoalba*, stranded along the Spanish Mediterranean coast in the period 1990−2012, both oceanic and neritic prey were regularly found throughout the whole period, but the number of oceanic cephalopods sharply decreased in the samples since the year 2000, whereas neritic prey increased; two lower-shelf prey, i.e. juvenile hake, *Merluccius merluccius*, and southern shortfin squid, *Illex coindetii*, accounted for over 50% of the index of relative importance (IRI). These patterns suggest that dolphins increased predatory incursions into neritic waters since the 2000s. In the present study we analyze further stomach content data from 61 striped dolphins collected from 2013 to early 2020 in the same area. A total of 49 prey taxa were identified to at least genus level, of which only 5 were new records compared with those from the previous survey. The dietary spectrum of fish included 13 neritic and 12 oceanic taxa, whereas that of cephalopods included 12 and 12, respectively. Juvenile hake (% IRI: 31.8%) and southern shortfin squid (22.4%) remained as the most important prey in the diet, although the consumption of the former somewhat decreased with respect to the previous decade. The data from the whole time series suggests that the significant reliance on neritic resources has lasted two decades.

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Looking at the details: compound specific stable isotopes tell the diet history of east Australia migrating humpback whales

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Based on stomach content, fatty acid and bulk stable isotope analyses, east Australia-migrating humpback whales (*Megaptera novaeangliae*; E1) are secondary heterotrophs following a high-fidelity Antarctic krill (Euphausia superba) diet. Previous research showed that interannual variability in the fatty acid profiles of E1 humpback whales is as high as spatial variability in the fatty acid profiles among different southern hemisphere humpback whale populations. We therefore quantify the trophic position of E1 humpback whales using amino acid-specific stable nitrogen isotope compositions (TPCSIA). Source amino acids, which undergo minimal trophic 15N enrichment, serve as a proxy for primary producer δ15N. Trophic amino acids undergo 15N enrichment with each trophic level. Source and trophic amino acid δ15N of E1 humpback whale blubber samples collected between 2008 and 2018 were compared to estimate TPCSIA and show whether baseline or trophic differences lead to the significant interannual variability observed in prior studies. TPCSIA estimates only varied by 0.2 trophic steps over the 10-year period but were 0.5-1 trophic steps lower than trophic position estimates derived from bulk stable isotope results of the same whales. Source and trophic amino acids had δ15N mean and standard deviation values of 0.8±1.7 and 11.5±0.8, respectively. The larger standard deviation of source amino acids indicates an interannual shift in the nitrogen source at the base of the food web. These results align with prior hypotheses that interannual variability arises in the biochemical markers of the whales' prey, rather than being caused by changes in the whales' diet, providing further evidence that E1 humpback whales are high-fidelity Antarctic krill consumers.

Lost in the deep: a story of gene loss in sperm whales

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The land-to-water evolutionary transition experienced by cetaceans involved profound morphological, physiological, and behavioural changes driven by molecular processes, including gene loss. These adaptations enabled cetaceans to thrive in new aquatic habitats, some with extreme living conditions (e.g., deep waters). Within Cetacea, the superfamily Physeteroidea, composed of three extant species of sperm whales, diverged earlier in the Odontoceti lineage. Sperm whales are recognized for some unique features, including their exceptional deep-diving capacity and the presence of the spermaceti. While their unique morphology is clearly identified, the molecular mechanisms underscoring such characters are mostly unknown. Here, we examine the molecular evolution of the Patatin Like Phospholipase Domain Containing 1 (PNPLA1) gene. This protein is key in synthesizing omega-O-acylceramides, playing a crucial role in forming the skin barrier and regulating the lipidic composition of the phospholipidic membrane. Using a consolidated pipeline, we scrutinized the coding status of PNPLA1 across 47 Cetacea genomes. Strikingly, the detailed sequence analysis demonstrated a specific loss of PNPLA1 in sperm whales. Additionally, light microscopy immunohistochemistry on the sperm whale (*Physeter macrocephalus*) skin was conducted to further support the absence of the PNPLA1 protein in this group. In a knockout (KO) mouse model, the loss of PNPLA1 leads to the overproduction of lipidic droplets, serving as a source for non-shivering thermogenesis and anti-freeze compounds. Therefore, dismantling this gene might provide increased thermal insulation for sperm whales during long deep dives. The results reported here constitute a robust approach to disentangling gene loss events in specific lineages and understanding the molecular basis of phenotypic variation.

Marine Ranger app - Citizen science tool for collecting data on marine mammals in the Mediterranean

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Human activities in the marine environment have a profound impact on marine organisms, including marine mammals. To identify these impacts and their respective effects, such as changes in species distribution and abundance, researchers make use of a variety of platforms. In the past decade, citizen science has become a standard mean of collecting data, utilized to append systematically obtained data with opportunistic observations reported by the public, with emphasis in gaining new information on the presence of low-abundant species. The success of citizen science programmes relies on creating and maintaining public engagement to ensure the timely and unencumbered delivery of information. Therefore, all implemented tools should present simple and accessible means of data sharing. Due to their ubiquitous use and diverse functionality, dedicated applications for smart devices have recently become the most prominent and obvious choice to achieve quick and effective means of information transfer. In comparison with traditional communication channels, these allow for additional benefits such as concurrent education of users and the creation of a user community fuelling engagement. One such example is the Marine Ranger – a free app for mobile devices for reporting Mediterranean marine mammal observations, bycatch, injured and stranded animals and providing feedback to citizens that has been developed as part of the EU co-funded project LIFE DELFI – Dolphin Experience: Lowering Fishing Interactions. With over 3.500 users, a community of engaged citizens who are actively contributing to conserving the marine environment and increasing the knowledge on marine mammals is growing. The observations reported using the app contribute to better understanding of presence, movements, distribution, and interactions with marine mammals, most notably within densely populated and heavily used coastal areas. Marine Ranger app already proved effective in providing additional data on individual bottlenose dolphins known from scientific photo identification databases in areas not regularly monitored by researchers.

Marine traffic overlap with cetacean distribution in the “Mediterranean Cetacean Migration Corridor” Marine Protected Area

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1. SUBMON

In 2018, the “Mediterranean Cetacean Migration Corridor” was established as a Marine Protected Area (MPA) and subsequently declared as a Specially Protected Area of Mediterranean Importance (SPAMI) by the Barcelona Convention. However, several important shipping lanes use this area and therefore, cetacean species are critically exposed to ship strikes and noise pollution. To address this threat, a Particularly Sensitive Sea Area (PSSA) that includes this MPA has been recently declared. Since a management plan for the MPA is being developed, it is essential to provide decision-makers with enough information to facilitate management in this area and identify high-risk areas for cetaceans.

Data from aerial and boat surveys conducted between the Iberian Peninsula and the Balearic Islands from 2020 to 2023, employing visual and acoustic techniques, was used to predict fin and sperm whale densities and distribution. By overlaying the distribution of sperm whales (*Physeter macrocephalus*) and fin whales (*Balaenoptera physalus*) with maritime traffic density in the area (cargo, tanker and passenger vessels), we identified those areas with higher risk of collision between ships and these sensitive species. Our research indicates that fin and sperm whales are potentially exposed to marine traffic throughout the north of the MPA. Furthermore, we have identified a large high-risk area for sperm and fin whales in the waters adjacent to this MPA. The area, located west of the ‘Mediterranean Cetacean Migration Corridor’, includes several submarine canyons off the Catalonian coast (northeast of the Iberian Peninsula). The results of the study highlight the need to reconsider the boundaries of the “Mediterranean Cetacean Migration Corridor” in order to include the Catalonian submarine canyons within this MPA, enabling effective mitigation measures to be implemented in all the identified high-risk areas.

Mediterranean monk seal occurrence in the Southern Adriatic and Northern Ionian Seas as inferred by eDNA analysis

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The last IUCN Red List report elevated the Mediterranean monk seal (*Monachus monachus*) from Endangered to Vulnerable status, mirroring its recovery in both numbers and range. Despite this, the species distribution is still unclear in most of the Central and Western Mediterranean Sea, where both species density and monitoring efforts are very low. In such situations, due to the species' elusiveness, the environmental DNA (eDNA) has been proven to be a valuable tool to detect the seal's presence. This study focused on one of the six hotspots previously identified in the Central and Western Mediterranean Sea and used citizen science to collect eDNA data on a spatiotemporal scale unreachable by researchers alone. The study area included the Southern Adriatic and Norther Ionian Seas between Italy, Albania and Greece. The study period was from September to December 2022, which corresponds to the monk seal peak of the reproduction period. Results suggest a more constant and spread seal presence than previously thought, identifying seven “distinct signal clusters” and three locations with a high probability of breeding activity that need to be further investigated with other techniques. The study also corroborates that eDNA can foresee or confirm seal sightings. Overall, we highlight the need to monitor monk seal presence in data-deficient areas and update its official distribution.

Mesopelagic cephalopods are critical prey for several marine megafauna species

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Mesopelagic organisms serve as a food source for many marine megafauna (hereafter MM) species, including cetaceans, pinnipeds, seabirds, turtles, sharks, and fish. Increasing interest in harvesting mesopelagics and projections of high losses of mesopelagic biomass under climate change could, thereby, have severe impacts on some MM. Understanding these impacts requires knowledge of the extent to which these predators rely on mesopelagic prey. Although several studies documented the contribution of mesopelagics (or of specific taxonomic groups) to the diet of individual predator species within given locations, a comprehensive assessment of the importance of different mesopelagic taxa to the diet of MM over large ocean regions is still lacking. To fill in this gap, we compiled raw diet data from 363 studies across the North Atlantic (NA) and the Mediterranean for 27 cetacean species, 8 pinnipeds, 26 seabirds, 4 marine turtles, 18 sharks and 36 fish, and applied a probabilistic approach using maximum likelihood estimation to quantify the contribution (in %weight) of mesopelagic prey to the diet of each predator group by region. Overall, the largest dietary contribution of mesopelagic prey was found for Tuna (83.8%), Bathypelagic fish (60.4%) and Cetaceans (31.2%), and the lowest for Pinnipeds (0.5%) and Turtles (0%). Among mesopelagic prey, cephalopods contributed to >65% of the diet of Cetaceans, Pelagic fish, Tunas, and Sharks, while Bathypelagic fish and Seabirds mainly consumed mesopelagic fish. Contribution of mesopelagic prey varied greatly across regions, being higher in the Offshore NA (46.3%) and Mediterranean (19.7%), and lower in Tropical (0.8%) and Boreal (0%) NA waters. Our analysis shows that MM predators rely to varying degrees on mesopelagic prey, but some predators are extremely dependent on this resource. Importantly, mesopelagic cephalopods appear to be crucial for various MM species of conservation concern or economic interest.

Metagenomic and metatranscriptomic analyses of an ill dolphin from the Adelaide Sanctuary in south Australia

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There has been an increase in the incidence of infectious diseases in coastal dolphins. In Adelaide, South Australia, Indo-Pacific bottlenose dolphins (*Tursiops aduncus*) live in the highly industrialised Port River estuary. Recently, concerns have risen about the health status of this population, with several individuals dying in 2021. To aid in the mortality investigation, metagenomic and metatranscriptomic analyses were carried out to samples collected from a dolphin that was euthanised due to its ill condition and from seawater. Bacteria (Proteobacteria, Bacteroidetes, Firmicutes, Actinobacteria and Chlamydiae) were the most abundant microbial taxa in the dolphin, followed by a small representation of viruses (retroviruses, Papillomaviridae, Poxviridae). No evidence of infection by RNA viruses (e.g., morbillivirus, caliciviruses), was found in the dolphin's lung, kidney, heart, brain, liver, and spleen. However, several bacteria of pathogenic potential were identified in the gastro-intestinal tract (e.g., *Photobacterium damselae*, *Clostridium perfringens*), and those associated with polluted environments were observed in non-lesioned skin (Alcanivorax). The analyses showed major differences in the diversity and relative abundance of microbial taxa between the dolphin's body regions and seawater. The study corroborates the idea that distinct physiochemical conditions and disease status impact animal microbiomes and demonstrates that metagenomics and metatranscriptomics are valuable tools for pathogen surveillance in marine mammals.

Metagenomic survey of unusual mortality of Caspian Seals in 2022

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The Caspian seal (*Pusa caspica*) is endemic to the Caspian Sea and the sole mammal in the sea's megafauna. Unfortunately, in recent years, the frequency of Caspian seal mortality has seen a concerning rise. Preconditions include human activities and infectious diseases. More than 190 seal carcasses were washed ashore in the Bautino spit of the Tupkaragan peninsula and the Kulaly archipelago in Kazakhstan part of the Caspian Sea in November 2022. To determine the virus involvement in this unusual mortality, we carried out a metagenome shotgun sequencing analysis on tissue specimens (brain, lung, liver, spleen, kidney, and lymph nodes) sourced from dead Caspian seals. The compositions of viral communities from two sampling sites were analyzed by pooled tissue type. Through bioinformatics analysis of the obtained sequence data, contigs similar to viral sequences were classified into seven viral families. The viromes in this study were dominated by the genus Gammapapillomavirus, which was particularly prevalent among brain and lung tissues across two sampling sites. Notably, specimens (from slightly decomposed carcasses) from the Bautino presented a unique and only pattern of viral community composition with a relative abundance of the virus Papillomaviridae family in pooled lung samples. The Alphainfluenzavirus genus has been revealed in both brain and lung tissues from fresh carcasses on Kulaly Island. Additionally, mixed liver, spleen, and kidney samples were characterized by a predominance of viruses belonging to Parvoviridae and Herpesviridae. And the genus Hepatovirus (Phopivirus of Seals) was found in lymph node sample. Nevertheless, except for the Alphainfluenzavirus, other viruses associated with high mortality rates among marine mammals were not revealed in specimens of found dead animals.

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Methods for the classification of patterns in the songs of the Mediterranean fin whale

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The fin whale (*Balaenoptera physalus*) is the only regular mysticete species of the Mediterranean Sea. Its acoustic repertoire consists of two types of 20-Hz calls: the classic pulse ("type A"), with most energy in the range between 17 and 23 Hz and the backbeat ("type B"), from 18 to 22 Hz. These vocalizations are often structured into complex patterned series called songs. In this work, we present the protocol developed for the analysis and classification of song notes and patterns within the songs detected in the Gulf of Catania (Ionian Sea). The alternation of the two vocalizations and of the inter-note-intervals (INI) were studied for the first time in combination to assess the occurrence of recurring patterns. The MATLAB automatic signal detector, "SAW", was used to detect 20-Hz calls. As a novel approach to study note sequences, a software tool was developed for each song, which automatically creates a "map" plot reproducing the note type and exact INIs alternation. This analysis was performed on 43 hours of acoustic recordings containing fin whale calls, sampled at 2 kHz, and extracted from the annual dataset of NEMO-SN1, deployed at 2100 m, 25 km offshore Catania. Approximately 2300 calls were found in 28 sequences. Of these, 35% were classified as type A, 24% as type B, and the remaining 41% were classified as "unknown" due to a poor signal-to-noise ratio. Four main note patterns were identified: simple doublet "B–A–B", short triplet "B–A–As–B", complex short and long triplets "B–(A–As)n–B" and "B–(A–Al)n–B", showing a bimodal distribution of A-A INIs. These results represent an essential contribution to the study of fin whale songs. Developed software tools and methods will be useful to assess the occurrence of song patterns in future studies from different recording locations.

Microplastics in marine mammals of Arctic waters

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Plastic pollution is a global and pervasive problem that affects all ecosystems. In 2022, global plastic production exceeded 400 million tonnes. Once broken down into smaller pieces, microplastics smaller than 5 mm (MPs) enter the Arctic environment through a variety of pathways. These include water inputs, seabirds and, due to climate changes, melting ice. As a result, the biota of this sensitive ecosystem is exposed to MPs and additives added during plastic production. Indigenous people are also exposed to MP and related contaminants through the consumption of marine mammals. Little is known about the current level of MP contamination in marine mammals from Arctic waters. In addition to quantitative analysis of stomach and intestinal contents and faecal samples, our current project aims to detect MPs in tissues and to identify their polymer structure. Visualising MPs in tissue samples is essential to understand the pathways of MPs in the organism. This project is testing different histological approaches as well as confocal microscopy to establish a method and protocol for examining tissue samples for the presence of MPs. Tissue samples from seals with the highest likelihood of contamination (stomach and intestine) were sectioned at 40 µm using an appropriate microtome (Leica Biosystems). The thin sections were then stained with different immunofluorescent dyes. The staining of tissue structures (nucleoli and actin filaments) and potential MPs (Nile Red) allows the visualisation of MPs and the generation of a 3D construction of the sampled tissue using a confocal microscope (OLYMPUS FV3000). First attempts have been made to achieve this goal. A second section is taken and dissolved in KOH. The solution is then filtered and analysed by Fourier Transform Infrared (FT-IR) spectroscopy to obtain information about the polymer structure and thus learn more about the origin.

Migratory variations of baleen whales off southeastern São Miguel island, Azores

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Baleen whales are known for their extensive migrations from summer feeding grounds in mid-high latitudes to breeding grounds in (sub)tropical regions during winter. The Azores are a well-known point of passage for several species, including blue (*Balaenoptera musculus*), fin (*B. physalus*), sei (*B. borealis*) and humpback whales (*Megaptera novaeangliae*). Some of these animals make transitory stops to forage on plankton and fish. We explored whether the presence of baleen whales has varied over the years, focusing on the southeastern part of São Miguel island, Azores. Observational data were collected during whale-watching tours from 2009 to 2023, aboard Azores Whale Watching TERRA AZUL. We standardized the data by selecting a total of 5 baleen whale species seasonally sighted within the region, counting the days they were observed and creating trend graphs to track how their presence evolved over time. Changes in their tendencies were observed in only 3 species: blue whales (representing 14.6 % of the registered 2009-2023 baleen whale sightings) fluctuated in cycles, while sei whales (29.8 %) and fin whales (43.2 %) showed a positive and negative trend respectively. The data for humpback and Bryde's whale (*B. edeni*) were insufficient to draw any conclusions, but both species are strongly seasonal, with peak sightings in spring and summer respectively. The observed trends raise questions about causality. To what extent are these baleen whales reacting to changes in the climate and ocean environment? Are they altering their migration patterns? Species are likely to react differently to changes in the ocean, shaped by their ecological and intrinsic traits - a pattern that appears to be present in the data analyzed in our study. Collaboration is key to understanding the migratory variations, emphasizing the importance of a holistic and interdisciplinary approach.

Minke whales migrating to Scotland's west coast show longest history of sightings in Europe

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The Hebridean Whale and Dolphin Trust (HWDT) maintains a catalogue of photographs and associated sightings information for cetaceans on the west coast of Scotland. Records of minke whales (*Balaenoptera acutorostrata*) have been collated for the region since 1990. Observations were recorded at-sea by whale-watch operator Sea Life Surveys and during dedicated visual surveys conducted from HWDT's research vessel Silurian under license by NatureScot. Records submitted by contributors to HWDT's long-standing community sightings network, Whale Track, were submitted from land and sea-based observations. Animals with permanent, identifiable features that allow for recapture were assigned a unique alphanumeric code and sightings histories stored and maintained using the DISCOVERY photographic data-management system. The catalogue has been published online at HWDT.org to encourage more citizen scientists to contribute data to Whale Track and facilitate collaboration with researchers to better understand minke whale movements in the northeast Atlantic. Between 1990 and 2020, 308 identifiable individual animals were identified during 698 encounters. The majority of animals (67%) were seen once. 19% were seen in multiple years, and some such as FM02 (Snowy) and FD27 (Knobble), were regular long-term visitors to the area. Sightings of Snowy span a 27-year period, the longest known history of sightings for minke whales in Europe. Knobble was first seen in 2002 and since then has been seen 62 times returning to the waters around the Isle of Mull most years for almost two decades. Individuals, which return year after year, highlight the importance of the area to this species. These data are now being analysed in more detail to further examine the site fidelity of minke whales on the west coast and identify any specific areas of importance. This information is essential to inform the development of suitable conservation and management measures for minke whales on the west coast of Scotland.

Modelling the spatio-temporal distribution of cetaceans in the Western Mediterranean

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Although the Mediterranean Sea is a crucial marine biodiversity hotspot, it faces numerous anthropogenic pressures, especially in coastal areas. Cetacean populations in the region are particularly susceptible to human-induced threats including fisheries by-catch, habitat degradation due to marine pollution, maritime traffic, and the resulting acoustic pollution. The aim of this study is to enhance current knowledge regarding the habitat preferences and spatial-temporal distribution patterns of cetaceans in the Western Mediterranean using Species Distribution Models (SDMs). We used boosted regression trees (BRT) to assess habitat preferences of 8 cetacean species prevalent in the study area: striped dolphin (*Stenella coeruleoalba*), bottlenose dolphin (*Tursiops truncatus*), common dolphin (*Delphinus delphis*), fin whale (*Balaenoptera physalus*), and sperm whale (*Physeter macrocephalus*), as well as less-studied deep-divers: Risso's dolphin (*Grampus griseus*), Cuvier´s beaked whale (*Ziphius cavirostris*), and long-finned pilot whale (*Globicephala melas*). A long-term cetacean occurrence dataset, comprising over 20,000 sightings collected through boat and airplane surveys over the last 30 years, was gathered through international collaboration, and with the support of the Intercet platform (https://www.intercet.it/). Predictive habitat models were built by analyzing cetacean presence/absence data in relation to dynamic (e.g.,

temperature, chlorophyll concentration, Eddy Kinetic Energy), and static (e.g., bathymetry, slope) oceanographic variables, sourced from the Copernicus Marine Environment Monitoring Service and the General Bathymetric Chart of the Oceans, respectively. Preliminary results indicate both static and dynamic variables were relevant to assess habitat preferences of cetaceans, and highlight the spatio-temporal variability among the different species. While the study concentrates on the Western Mediterranean Sea, the methodology is transferrable to other regions. The spatially and temporally explicit information provided by these models has diverse applications in cetacean management and conservation, with major implications to assess their exposure to human threats. *Supported by projects IOS4DOM, GVA, & VARACOMVAL, Biodiversity Foundation, under the NextGenerationEU PRTR.

Monitoring of harbor porpoises (*Phocoena phocoena*) in a noisy estuarine habitat: C- or F-PODs that`s the question

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Passive Acoustic Monitoring of harbor porpoises in German estuaries is realized by Cetacean & Porpoise detectors (C-POD). Shifting to Full-waveform capture porpoise detectors (F-POD) poses the question, 1) whether F-PODs detect more porpoises than C-PODs, 2) whether the advanced settings of F-PODs increase precision and accuracy in noisy environments. Detectors were deployed together in the inner Ems estuary during spring peak presence (Feb 15th – June 30th 2023). F-POD classification used standard and two advanced settings ("100 kHz": 100 kHz high pass filter, "20 SPL": 100 kHz and 20 SPL high pass filter). Click-trains of high and moderate probability classes from both devices were validated manually and compared. Harbor porpoise detection and non-detection were modeled as a classification problem as a function of environmental indices using eight different modeling frameworks. Both devices stopped recording when recording limits were reached (C-POD: 3.25; F-POD: 4.09 %). F-PODs detected more signals classified as porpoises than C-PODs, which led to significantly higher detections per time. C-POD data required three-times less validation than F-PODs, because less minutes contained click trains of any source. Advanced settings reduced the overall number of clicks considered in classification and raised the number of identified narrow band high frequency (NBHF) clicks. The "100 kHz" setting performed best, but missed verified detections identified in the "standard" and "SPL20" settings, as well as C-PODs. Classification of C-PODs showed higher precision and accuracy than F-PODs (precision: 86.5 vs. 34.1 %; accuracy: 96.3 vs. 48.0 %). Differently from C-PODs, unvalidated NBHF clicks of F-PODs led to an overestimation of porpoises' presence (1.3 to 3.7-fold). Random Forest was the most accurate modelling approach. Most important variables of these models were the number of recorded clicks (N_{all}), ratio of clicks 100-120 kHz and N_{all}, ratio of clicks 120-140 kHz and N_{all}, and filtered clicks.

Montenegro Dolphin Research: Reporting upon the success of Seven Years of Investigating Cetaceans in a Previously Data-Deficient Region, highlighting Regional Conservation Implications

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Montenegrin waters were considered an area of data deficiency regarding cetacean presence, despite this region being a known global hotspot for biodiversity. Montenegro Dolphin Research have conducted the first long-term survey of cetaceans within the Eastern South Adriatic Sea. A dedicated annual and seasonal survey effort employing a combination of land and boat-based surveys collected delphinid data, with the aim of this contributing towards effective conservation management strategies. The annual, and seasonal sightings rates, combined with behavioural states observed, group sizes, calf presence, and associated anthropogenic pressures has been evaluated for this region to curate a report on the project success for the seven-year study period ongoing to September 2023. Annual and seasonal presences have delineated temporal area usage, with a fluctuation in sightings occurring throughout the study period, which could be associated with temporary anthropogenic phenomenon ongoing in the region and worldwide. Further analysis was restricted to common bottlenose dolphins (*Tursiops truncatus*) due to the limited dataset on striped dolphins (*Stenella coeruleoalba*). The behavioural states recorded of bottlenose dolphins are predominantly diving behaviours, potentially indicative of foraging activities, with travelling and travel-diving behaviours also observed in abundance. Analysis highlighted that alongside notably small group-sizes; groups additionally showed an overall annual decline. Sub-adult presence has shown a similar pattern of yearly decline with some fluctuation, and the highest recorded calf-presence is during the proposed Adriatic calving season, Summer. Assessing delphinid distribution alongside the anthropogenic pressure of tourism, a key economic sector in Montenegro, has suggested that areas of extreme burden are overlapping with important areas of dolphin distribution. These activities are least persistent in the Winter season, which coincides with the season with the highest dolphin sighting rate. The findings reported highlight the need for further research, alongside the development of dedicated protective measures in Montenegrin waters.

Movement patterns and inferred behaviour of short-finned pilot whales with different residency patterns in Macaronesia from satellite telemetry

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The Canary Islands and Madeira are cetacean biodiversity hotspots, with documented movements of individuals between the two archipelagos. Within the framework of MARCET II project (Interreg-MAC, 2014-2020), a pilot study was conducted between 2020 and 2023 to assess the movement patterns and habitat use of short-finned pilot whales (*Globicephala macrorhynchus*) in the waters of these archipelagos through satellite telemetry. A total of 16 LIMPET SPOT-365A tags were deployed following a common protocol, 8 in the Canary Islands and 8 in Madeira. In the former archipelago, the tags' transmitted between a few hours to at least 73 days (still transmitting), while in the latter between 20 and 45 days. As much as possible, the tags were deployed on animals with different known residency patterns, based on previous photo-identification data (e.g. residents, visitors, transients). Tracking data was processed in R package AniMotum by using state space models to regularise the tracks, accounting for ARGOS positions uncertainty, and represent more adequately the true path of the animals by removing incorrect on-land positions. Furthermore, a move persistence model (an index of movement behaviour, t) was applied to the data to estimate the animals' movement pattern based on autocorrelation in speed and direction. In general, the tracks showed movements consistent with the animals' known residency patterns, although the results of the tags with very limited transmission time should be interpreted with caution. In general, the move persistence estimates showed the highest t (i.e. more directed movement) in offshore waters and the lowest t (consistent with a restricted search area behaviour) closer to the islands, especially southeast Madeira, south La Gomera and southwest Tenerife, known as important areas for this species. The animals with offshore movements travelled from the islands towards the African coast to either nearby seamounts or the African continental slope.

Movements of Atlantic white-sided dolphins tagged in the Faroe Islands

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The Atlantic white-sided dolphin is one of the most abundant delphinid species in the North Atlantic Ocean. However, their biology, ecology, migration patterns, and population structure remain poorly characterized. This study is part of an effort to better understand the ecological role of delphinids along the Greenland-Iceland-Faroe-Scotland Ridge. On six occasions, we tagged a total of 23 Atlantic white-sided dolphins in the Faroe Islands, with fin-mount satellite transmitters. We received horizontal movement data across three years for the period from June to December. Ten tags transmitted for more than 10 days, with five exceeding one month. The longest transmission period was 175 days. Our findings confirm the species' preference for continental shelf and slope areas. Tagged dolphins spent extended periods in two areas characterized by high productivity. These areas could be of high importance for the Atlantic white-sided dolphin population, and the underlying ecosystem. One such area is the Irminger Sea on the east coast of Greenland. Two of the tagged dolphins crossed the North Atlantic to get here. These individuals demonstrated a previously unknown capacity for long-distance, high-speed migrations within the species. In all tagging events, tagged dolphins separated from each other shortly after release. This separation confirms the fluid social structure of Atlantic white-sided dolphins, as well as low relatedness between individuals, as suggested by genetic studies. Our results also indicate that the species most likely comprise one single stock in the North Atlantic Ocean. Our study shows that long-term tracking is a powerful tool for understanding habitat preferences and species distribution and behaviour, and for exploring pod and stock structure. There were no signs that the tagging operation had any negative impact on the dolphin.

Multipurpose strategies to mitigate interaction between dolphins and small-scale fisheries in eastern Sicily

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Interaction between dolphins and fisheries is a prevalent issue in the Mediterranean, and there are numerous reports from artisanal fishers in the eastern Sicilian region. Dedicated studies carried out by the Marecamp association in the last 5 years have allowed for finding the most frequent events, identifying the bottlenose dolphin and the striped dolphin as the most involved species, and narrowing it down to the coastal areas of the Western Ionian Sea Geographical Sub-Area (GSA 19) as the region most significantly affected by these types of events. Consequently, trials for testing mitigation measures through multipurpose strategies are currently underway in the hotspot subzones Riposto-Aci Castello-Catania, Brucoli-Augusta, and Portopalo di Capo Passero for enhancing data collection on dolphin-fishery interaction, and assessing the effectiveness of proposed measures compared to standard practices.

The methodology applied aligns with FAO-GFCM technical protocols and recommendations, emphasizing the involvement of expert observers and collaboration with small-scale fishers. It builds on insights from past “Depredation” projects and addresses the shortcomings of other methods tested in the past like using pingers.

Four key mitigation strategies are included in our scientific plan, including the implementation of mitigation measures and monitoring activities aiming at addressing both depredation and by-catch events: echolocation disturbance using lead rods in longlines; visual deterrents like mirrors and LED lights in trammel nets; the Acoustic Alert System (AAS) utilizing full waveform capture PODs (F-PODs) and hydrophone buoys in single-wall nets; and structural changes of single wall nets. Combined actions as land-based interviews, onboard observations, and advanced acoustic data collection are contributing to fostering awareness on dolphin-fishery interactions among fishing and scientific communities, and policy-makers in the study area. By engaging with local stakeholders and disseminating results, we are seeking to contribute valuable insights into cetacean conservation and the livelihood of small-scale fisheries at regional and national levels.

Navigating the depths: a comprehensive review of cetacean distribution models and conservation insights

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Accurately understanding the spatial ecology of cetaceans is challenging due to their mobility and the difficulty of surveying underwater habitats. However, addressing these challenges is imperative for informing conservation strategies for marine biodiversity, particularly as species face increasing threats from human-induced pressures. Cetacean Distribution Models (CDMs) have emerged as essential tools connecting cetacean's occurrence and environmental factors and supporting regulatory decision-making for both risk assessments and conservation of crucial areas for vulnerable species or habitats. To summarize existing modelling approaches for future applications, we conducted a systematic scientific literature search yielding 277 published scientific papers after a rigorous selection process. The analysis highlighted the exponential growth of CDMs in the last twenty years (R=0.85). Delphinidae was the most studied family among toothed whales, accounting for 55% of studies, while Balaenopteridae was the focus for baleen whales, accounting for 38% of studies. Geographical efforts predominantly targeted the Northern Hemisphere, particularly the Atlantic Ocean, with the exception of a substantial number of studies focusing on baleen whales in the Southern Ocean. Different approaches and models were used, with regression-based methods, especially Generalized Additive Models, being the most prevalent. Machine learning techniques, especially Maxent, showcased substantial applicability, while emerging approaches like Point Process models and Bayesian methods were identified, each with distinct strengths and limitations. The review not only explored diverse modelling techniques but also meticulously summarized associated environmental predictors, model validation strategies and produced outputs. Surprisingly, the integration of CDM results into risk assessment maps was limited (11%). Despite this, CDM holds immense potential as a key tool for identifying areas of anthropic threats to species. As CDMs applications evolve, this review may represent a worthwhile state-of-the-art tool, potentially guiding the development of standardized methods for comprehending and conserving these iconic marine species.

New beaked whale atypical mass stranding linked to military activities around the strait of Gibraltar (2022)

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Several beaked whales were reported to have seen during the morning of the 19th of October 2002 in different points of the Gibraltar strait coastal area. Two of the 3 animals found stranded were reintroduced and one of these appeared dead stranded in the same area shortly, time later. Another beaked whale was found floating near Gibraltar several kms from that beach hours later. Therefore, it was considered with a high reliability than at least 4 Cuvier's beaked whales (*Z. cavirostris*) were involved in this atypical mass stranding, of which 2 dead animals were recovered for necropsy the 19th evening. The characteristics of this “massive atypical” stranding of *Z. cavirostris* showed body condition of the animals from good to moderate, with digested or partially digested stomach contents, with a pathology (macro and microscopic) characterized in both animals by cardiopulmonary, cardio-circulatory, renal, and nervous findings consistent with the so-called “Systemic Gas-Fat Embolic Syndrome in stranded beaked whales”. This pathology has been described in “atypical mass strandings of beaked whales” associated spatially and temporarily to naval military activities and Mid Frequency Active Sonar (MFAS) (Canary Islands, 2002, 2004, as well as in Almería, 2006, 2011 and Grecia, 2011). Even though, there were non-official information about military activities in the area. The information regarding to official military naval maneuvers and/or acoustic activities in the Gibraltar are still under investigation.

New records of minke whales in the Pelagos Sanctuary

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1. *Menkab: il respiro del mare APS*
2. *Delfini del Ponente APS*

Within the Mediterranean Sea two mysticetes species are classified as visitors: the humpback whale (*Megaptera novaeangliae*) and the common minke whale (*Balaenoptera acutorostrata*). While humpback whales have been sighted about thirty times, common minke whales have been rarely observed as alive individuals, but mostly as strandings and bycatching records. This species is regular off the Atlantic coast of the Iberian Peninsula but its frequency in the Mediterranean is still unknown. Here, we report two sightings of two minke whales in the Northern and Western areas of the Pelagos Sanctuary respectively in October 2017 and May 2023. In the first sighting, the whale was alone, close to the Marine Protected Area of Bergeggi Island, swimming around 8 fishing boats and performing feeding dives of 6-8 minutes. The body length was visually estimated between 5 and 6 metres and the whale appeared emaciated with some concavity in the epaxial muscle with visible vertebral spines. No signs of ship strike or entanglement were observed. In the second sighting, one whale was sighted 2.5 nautical miles off the coast of Sanremo, in 220 metres of depth performing a feeding behaviour with short dives of 3-4 minutes with frequent changes in direction. The body length was estimated at around 5 metres, comparing it with the research boat. In this case, no bad body and skin conditions were observed. Photo-ID and estimated length demonstrated they were two different individuals. These two sightings represent the first and the second records of alive minke whales on the Italian side of the Pelagos Sanctuary. Lastly, several visitor species have been observed in the Ligurian Sea. Sharing these rare sightings with other researchers is fundamental for a better understanding of their occurrence patterns.

Numerical simulations of long-distance propagation of the signal of seismic surveys in the Ionian Sea. Implications for the impact on marine mammals

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Marine seismic surveys contribute heavily to acoustic pollution in terms of energy and ranges of influence in time and space domains. Sounds produced by airguns can be audible at distances of many hundreds of kilometres and hamper marine mammals' behaviour at a considerable range. Therefore, scientists and other stakeholders require quantitative estimations of acoustic fields to assess potential impacts and translate them into effective mitigation measures and policies. In this contribution, we discuss the modelling of airgun-array signals emitted during the ULYSSE seismic cruise off the Western Coast of Crete. These signals were recorded between November 4th and 20th, 2012 by the cabled seafloor observatory NEMO-SN1, which is installed at a depth of 2100 m in the Gulf of Catania, Western Ionian Sea, at an approximated distance of 650 km. Modelling was performed for two different configurations of 18-element G guns and BOLT airguns (total volumes of 11441 and 8867 in3), using JASCO Applied Sciences' (JASCO) Airgun Array Source Model to predict the sound levels for the broadside and endfire directions of the array. The signal was then propagated using JASCO's Full-Waveform Range-dependent Acoustic Model (FWRAM) along a radial direction from the source to the position of the NEMO receiver station. The modelled results were compared with the data recorded at the NEMO-SN1 deep-sea observatory, which clearly exhibited the airgun-array signal. Cetacean species known to occur at the receiver location, including the endangered Mediterranean fin whale (*Balaenoptera physalus*), communicate acoustically at low frequencies that may be spectrally overlapped by the array pulses. The results presented highlight the relevance of modelling with accuracy the generation and propagation of airgun-array sounds in complex environments. Such information is crucial to understanding the impact of seismic surveys on marine mammals and the ecosystem and implementing efficient mitigation strategies.

Ocean literacy programs in Sicily, Italy, for cetacean conservation and aware citizens

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Ocean literacy encompasses a broad understanding of the ocean's influence on Earth, as well as the impact of human activities on all the seas. The concept was born from the understanding that public knowledge about the ocean is often lacking and underestimated, and so the need to disseminate its importance including the role in regulating climate, supporting biodiversity, and providing resources.
Various approaches, as incorporating ocean education in school programs, promoting citizen-science, challenges, and direct field experiences are employed in ocean literacy. Community attention, and interventions in favor of environmental conservation in Southern Italy regions are very lacking compared to the Italian average and other European nations. Usually, NGOs carry out local sea literacy projects, but fragmented and not long-lasting. In Sicily, for over 10 years the Marecamp association has been involving both the youngest and different categories of workers at sea in learning the importance of the marine ecosystem and its species, and becoming active citizens to further disseminate the message. From 2014, 9 ocean literacy projects under the "Dolphin watching and Conservation in the Gulf of Catania" umbrella programme, based on awareness about cetaceans linked to social inclusion, scientific research and training have been completed, involving over 6.000 people, and electing 33 Ambassadors of the Sea. Actions as the celebration of the Maritime Days, the participation in sea cleanup sailings, and the institution of the "Floating Laboratories" network strengthened the recognition of the cultural, economic, and recreational value of the Mediterranean by administrations, consumers, fishers, and other sailor categories, and promoted responsible stewardship to ensure its long-term health and resilience; projects as "Cetologist for one day", "Blue generation", "Blue week", "The Sea we want" helped youngsters understand ocean processes, marine ecosystems, the importance of cetacean conservation, and the significance of sustainable practices for maintaining oceans in good health.

Organochlorine contaminants and heavy metals in skin biopsies of the Critically Endangered common bottlenose dolphin *Tursiops truncatus* Gulf of Ambracia subpopulation

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The Gulf of Ambracia, in western Greece, where the common bottlenose dolphin (*Tursiops truncatus*) is the only cetacean species present, hosts one of the highest densities for the species in the Mediterranean. However, its semi-enclosed nature results in water quality being strongly affected by the input of organic matter and pollutants, notably from the Louros and the Arachthos rivers, which transport agricultural runoff, and intensive fish farming. The Gulf of Ambracia bottlenose dolphin sub-population was listed as Critically Endangered in the IUCN Red List in 2021. In June 2023, skin biopsies from eight dolphins were collected via remote biopsy to evaluate organochlorine contaminants (hexachlorobenzene HCB; dichlorodiphenyltrichloroethane and its metabolites DDTs; 30 congeners of polychlorinated biphenyls PCBs) and heavy metals (Hg, Cd, Pb, Cu). The analysis of the two groups of contaminants utilized capillary gas chromatography and atomic absorption spectrometry, respectively. DDT and metabolites were the most present contaminants (18.51±16.41 mg/kg lipid weight) followed by PCBs (8.53±7.69 mg/kg lipid weight) and HCB (0.05±0.05 mg/kg lipid weight). Ranked heavy metal levels were Cu (3.88±0.73 mg/kg dry weight), Hg (1.10±0.44 mg/kg dry weight), Pb (0.31±0.20 mg/kg dry weight) and Cd (0.02±0.01 mg/kg dry weight). Predominance of DDTs and Cu reflects the past extensive use of the pesticide, banned since the 1970s, and the involvement of copper-based fertilizers. PCB levels have exceeded the 17ppm lipid weight threshold for PCB-induced adverse health effects, including immunosuppression, in only two animals. Efforts to increase the number of samples, and to obtain information on sex and age of sampled dolphins, are scheduled for summer 2024. These data should provide more robust results and shed light on the intricate interplay between human activities, agricultural practices, and the health of marine ecosystems, facilitating mitigation of anthropogenic impacts on the Gulf of Ambracia and its unique dolphin population.

Overlap between cetaceans distribution and marine litter in the western Ligurian sea

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1. Delfini del Ponente APS

Floating marine litter (ML) represents a major issue affecting many species globally. Cetaceans exhibit detrimental effects on their health attributable to different sizes and types of ML. Due to its hydrography and morphology, the Ligurian Sea potentially presents a high concentration of ML. This study aims to describe the density of meso and micro litter in the coastal area of the Western Ligurian Sea (NW Mediterranean Sea) and its overlap with cetaceans species. Data on cetaceans' occurrence were collected during 132 boat-based surveys from March to June from 2018 to 2023 resulting in 129 sightings: 91 of bottlenose dolphins (Encounter Rate (ER) = 0.0141) and average depth of 78.47m (SD = 79.55), 28 of striped dolphins (ER = 0.0043) with mean depth of 459.13m (SD = 204.11), 5 of fin whales (ER = 0.0008) and mean depth of 430.91m (SD = 158.27) and 3 of sperm whales (ER = 0.0005) with average depth of 621.07m (SD = 37.70). In 2023, 81 superficial water samples were collected and analysed, recording an average of 4.896 (SD = 3.286) particles/L. An average of 2.067 (SD = 1.863) were of organic origin, the rest comprised fabric fragments (average density = 1.360, SD = 1.972), plastic/metal particles (average density = 1.104, SD = 1.482) and particles of unknown origin. Density of the total number of particles (both organic and non-organic) differed significantly ($p < 0.01$) while ML density did not differ significantly between shallower locations (≤ 200 m depth) and deeper ones. This study showed a strong overlap between ML presence and cetacean distribution in the coastal area of the Western Ligurian Sea. ML is linked to bioaccumulation and biomagnification of pollutants and heavy metals in cetacean tissue. It is therefore important to monitor their concentration in an area strongly used by these species.

Particular aspects of the presence and behaviour of cetaceans during offshore operations in the Western Black Sea Basin between May and July 2022

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The Black Sea is an intercontinental saltwater body, connected to the global marine water system through the Mediterranean basin, via a narrow straight. All three cetacean species found here are adapted to the particular conditions of this sea, low salinity, lack of upwelling and the presence of hydrogen sulfide below depths of 150 - 200m and are considered subspecies. These subspecies are listed by IUCN as: 'Vulnerable' – the Short-beaked Common Dolphin - *Delphinus delphis* ssp. *ponticus* (Linnaeus, 1758), 'Endangered' – the Common Bottlenose Dolphin – *Tursiops truncatus* ssp. *ponticus* (Barabash-Nikiforov, 1940), and 'Endangered' – the Harbour Porpoise – *Phocoena phocoena* ssp. *relicta* (Linnaeus, 1758). Despite the small number of species and the study efforts made by scientists, little is known about their presence and behaviour in the far offshore. This study was conducted onboard two vessels offering support for offshore activities roughly 100 km east of Constanta City, between May and July 2022. The monitoring was performed during daylight, using binoculars, telephoto cameras, and drones. We used an electronic form in which we recorded, for each observation, the date and time, GPS coordinates, the species, the number of individuals, their type of activity and the approximate bearing of their travel direction. We observed travel behaviours – bow-riding, porpoising, surfacing; feeding behaviours – pursuit, diving and between dives; social behaviours – breaching, tail slapping, chorus line and even mating. On two occasions, a partially white, Harbour Porpoise individual was observed presenting normal dive and between dive behaviour within a large pod. We found that the most abundant species was the Harbour Porpoise, with 109 observations and approximately 547 individuals, followed by the Short-beaked Common Dolphin, with 111 observations, totalling 406 individuals, and the Common Bottlenose Dolphin with 4 observations of 24 individuals.

Pathogenic microorganisms and gut microbiome profile in cetaceans from Pelagos Sanctuary (Northwestern Mediterranean Sea): how far terrestrial and coastal processes influence the marine environment?

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Increased urbanisation and intensive systems in coastal regions, including both terrestrial and aquatic activities, constitute a major anthropogenic stress factor within the Mediterranean Sea. This phenomenon poses a substantial risk of transfer of potentially pathogenic microorganisms into the marine ecosystem, emanating from urban sewage, agricultural runoff, and industrial and medical waste discharges. Among marine species, cetaceans emerge as prime sentinel species in light of their extended lifespans, positioning within a high trophic level, and heightened sensitivity to chemical contaminants, biological toxins, and pathogens. The presence of pathogenic microorganisms was investigated by molecular analysis in 34 faecal samples obtained from free-ranging individuals of fin (n. 11), sperm (n. 18) and long-finned pilot (n. 5) whales collected within the Northwestern portion of the Pelagos Sanctuary area over the years 2000 to 2022. In addition, the cetaceans' gut microbiome composition was also characterized. By molecular analysis, Giardia duodenalis Assemblage A was identified in samples of fin whale (n. 5) and sperm whale (n. 3), Cryptosporidium parvum genotype IIa in samples of sperm whale (n. 4) and long-finned pilot whale (n. 2), Blastocystis ST1-ST3 in samples of sperm whale (n. 5) and long-finned pilot whale (n. 2). Furthermore, the gut microbiome composition analysis relieved specific bacterial taxa associated (Chi square test, $p<0.05$) with the overall presence of zoonotic parasites. Our study, besides providing an overview of the gut microbiome composition, identified zoonotic intestinal protozoan parasites in three cetacean species circulating within the Mediterranean Sea, all assessed as Endangered according to the IUCN Red List of Threatened Species. These results suggest how far terrestrial and coastal processes can influence the Mediterranean marine environment and provide further information that can be used to better understand cetacean health issues and to implement dedicated monitoring protocols.

Perilous surveys for a species in peril: the Atlantic humpback dolphin (*Sousa teuszii*) in Guinea, West Africa

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The Critically Endangered Atlantic humpback dolphin (*Sousa teuszii*) is one of the four most threatened cetaceans globally, and the second most threatened small cetacean. Endemic to a very narrow strip of coastal waters along western Africa, the ecology of this species is extremely poorly known, with almost no detailed information on abundance, population structure, vital rates or mortality. Even the occurrence of this species in several countries within its known range remains uncertain. The leading threat is bycatch in artisanal fishing gear, but coastal development, including mining, port construction and associated coastal development projects, is also increasingly degrading habitats. These threats will continue to drive the species to extinction in the near future unless effective conservation measures are identified and implemented. To address some of the vital knowledge gaps hindering effective conservation, we studied the occurrence, abundance and habitat use of this species in the waters of the Republic of Guinea in West Africa during 2022-2023. The work, which included capacity building and community engagement, was implemented by a collaboration of national and international scientists. We carried out boat surveys in four different areas along the Guinean coast, combining line-transect surveys, photo-identification, acoustic recordings, drone imaging and sampling of water parameters. Unlike in many other parts of the species' range, humpback dolphins were observed relatively far from shore on several occasions, though always within the species' known preferred depth ranges. Females with calves were observed in most groups. Photo-identification across different seasons provided evidence of site fidelity, enabling estimating abundance using mark-recapture techniques. While surveys were challenging, and required excellent teamwork to persevere, they also highlight the scarcity of resources and opportunities available to scientists and conservationists in Guinea and the wider region. Results will inform national management measures, as well as conservation measures across the wider range.

Photo-identification and capture-mark-recapture techniques for population studies on Bottlenose Dolphin (*Tursiops truncatus*) in the Gulf of Catania, Ionian Sea, Italy

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A decade-long study in the waters of eastern Sicily conducted by the Marecamp Association on bottlenose dolphin (*Tursiops truncatus*, Montagu, 1821) has enabled the update of the catalog of photo-identified individuals in the coastal waters of the Gulf of Catania and surrounding areas. The Gulf covers around 300 kmq and owns high productivity, principally due to the combined influence of several river mouths (Simeto, Gornalunga, San Leonardo) and currents from the Strait of Messina. However, this coastal area is subject to strong anthropogenic impact that can negatively influence the local ecosystem and flora and fauna populations, including apex predators in the trophic chain as cetaceans. The bottlenose dolphin is the cetacean with the greatest coastal distribution and stationary habits in the Mediterranean, resulting highly vulnerable to the effects of human impact. To evaluate composition, health, and social interactions of this local population, we applied photo-identification and capture-mark-recapture techniques. Photo-identification, applied both through manual analysis and software aid comparison (FinFindeR), allowed the distinction of each individual through high-definition images of dorsal fins with unique profiles and distinctive scars or marks. This process has enabled the creation of a representative catalog of bottlenose dolphins based on first sightings since 1997, with a continuous update based on sighting surveys from 2018 to the present in the study area. This study identified both potential sedentary and migrant individuals, and documented changes in the local population over the years, recognizing the belonging to the catalog of over 70 photo-identified bottlenose dolphins. While some individuals recorded in earlier years have not been sighted again, the specimens included in the catalog in more recent times have been “recaptured” almost every year over the last 5 years. Further efforts are ongoing to better comprehend bottlenose dolphin population dynamics and social structure in the waters of eastern Sicily.

Physiological and behavioural responses of bottlenose dolphin *Tursiops truncatus* to gustatory, olfactory and trigeminal chemical stimuli

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Chemical perception stands out as the first modality that evolved in animals to sense the surrounding world. In terrestrials' mammals, chemical perception plays a crucial role in feeding, orientation, communication and much more. Conversely, information regarding this aspect is notably scarce in marine mammals, especially in cetaceans. The limited studies available so far indicate a partial regression of both anatomical structures and key genes families involved in olfaction and gustation. However, different behavioural observations suggest that chemical perception is still present. In this study, we aimed to shed light on the chemical perception of Bottlenose Dolphins, investigating three primary aspects of chemoreception: olfactory, gustatory and trigeminal. Olfactory perception is usually characterized as the detection of molecules through olfactory receptors (ORs), while gustatory perception is its counterpart through taste receptors on the surface of papillae. The trigeminal system constitutes a chemical sense apart. It provides information about irritating or noxious molecules resulting in sensations such as freshness, warmth or tickling. We used pioneering methods and protocols. In particular, we reliably recorded the underwater electrocardiograms (ECG) in dolphins under managed care, thanks to a bio-logger that we designed. We placed this ECG-logger on the animal chest based on a suction cup attachment technique, recording heart rate changes, indicative of autonomic modulation, in response to different chemical stimuli. Alongside the heart rate and its physiological variability (HRV), we also analysed behavioural responses to those chemical stimuli (mouth opening range, movements towards stimuli, etc.) through video recording. Our method thus offers the significant advantages to match ethological and physiological recordings to investigate the extent to which chemoreception in Odontocetes is still functional. Ultimately, this study could provide insights on attractive and repellent compounds for cetaceans, opening prospects for solutions within the context of human-cetacean interaction in natural environments (such as fishery interactions).

Pioneering photo-ID catalog: first characterization of a bottlenose dolphin (*Tursiops truncatus*) population along the Palermo coastline

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In 2023, "Avvistiamo" obtained the status of a Social Promotion Association (APS) with a primary objective of conducting systematic data collection and research in the maritime region of Palermo. The designated study area spans from the Palermo port area extending eastward to the Lighthouse of Capo Zafferano and westward to Isola delle Femmine. To implement the datasets, several approaches are adopted. On a broader Mediterranean Sea scale, since 2020, cetacean species have been monitored through avvistiamo.it, which serves as the "citizen science'' data collection tool. Since 2020, 198 sightings have been collected: *Tursiops truncatus* (104), *Stenella coeruleoalba* (38), *Delphinus delphis* (18), *Balaenoptera physalus* (11), *Physeter macrocephalus* (15), *Grampus griseus* (9), *Globicephala melas* (2) and *Ziphius cavirostris* (1). Since January 2023, the use of Local Ecological Knowledge (LEK) has been implemented. Starting in May 2023, visual surveys have been initiated, incorporating the photo-identification technique. This methodological approach led to the creation of the very first catalog of *T. truncatus* along the Palermo coastline. From 6th May to 30th July 2023, a total of 19 transect surveys have been performed, resulting in the collection of 19 sightings. Three different species have been monitored during the surveys: *Stenella coeruleoalba* (3), *Delphinus delphis* (1), and *Tursiops truncatus*, with a total of 12 sightings. Photo-identification revealed 11 individuals of *T. truncatus*, each assigned a distinct name from Tt_01 to Tt_11. Some, like Tt_01 “Pinnamozza,” exhibited dorsal fin absence and signs of collisions. The average group size of *T. truncatus* is 5 individuals, ranging from 1 to a maximum of 8. Approximately 67% of the sightings occurred between Palermo Port and Capo Gallo, at a bathymetry of 100m, while the remaining 33% were observed at a 200m bathymetry.

Population Abundance Trends of Long-Finned Pilot Whales and Bottlenose Dolphins at the Special Area of Conservation “Underwater valleys of the Mazarrón scarp”

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The escalating human activities in marine ecosystems, particularly the rise in maritime and recreational navigation, pose significant threats to marine megafauna, especially cetaceans. This study, co-funded by the European Union in the project LIFE PortSounds (LIFE20 ENV/ES/000387), investigates the population abundance trends of two Delphinidae species – the long-finned pilot whale (*Globicephala melas*) and the bottlenose dolphin (*Tursiops truncatus*) – within the Special Area of Conservation “Valles submarinos y Escarpes de Mazarron (SAC ES6200048, Natura 2000 Network)” from 2018 to 2023. Employing an integrated methodological approach, we combined traditional distance sampling with boat and aerial surveys, enhancing these with drone imagery and acoustic monitoring. The approach aimed to address the perception bias common in cetacean surveys due to their diving behaviour and the associated bias when recording cluster size. The results suggested distinct population trends for the studied species. The bottlenose dolphin population remained stable over the five years, suggesting resilience to the prevailing environmental conditions and human activities. Conversely, the long-finned pilot whale population showed a potential decline, raising concerns about their long-term viability and underscoring the need for targeted conservation measures. However, it's important to consider that these trends might reflect changes in distribution rather than actual shifts in population abundance. These insights are critical for guiding conservation efforts, highlighting the imperative for continuous monitoring and developing strategies to mitigate human impacts, particularly those related to maritime traffic and recreational navigation. This study contributes important data on cetacean population dynamics and exemplifies the efficacy of blending traditional survey techniques with cutting-edge technologies like drone imaging. The results highlight the difficulties of achieving accurate population estimates. The results will contribute to future conservation policies and management actions within the Natura 2000 network, aiming to safeguard these essential marine species in the face of increasing human activities.

Population dynamics of Risso's dolphins (*Grampus griseus*) in the Pelagos Sanctuary (northwestern Mediterranean Sea): perspectives from whale-watching operators in the Gulf of Genoa

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The Mediterranean subpopulation of Risso's dolphin (*Grampus griseus*) has recently undergone a significant change in its conservation status, now being officially reassessed as Endangered on the IUCN Red List. For nearly three decades, the Tethys Research Institute (TRI) had consistently observed a resident population of Risso's dolphins of approximately 100 - 150 individuals in the northwestern portion of the Pelagos Sanctuary, about 100 km west of Genoa Canyons, and almost 300 individuals were photo-identified from 1990 to 2014 (TRI-catalogue). From 2010 to 2014 the encounter rate of Risso's dolphins significantly declined and then almost disappeared in the area monitored by TRI. Instead, whale-watching operators have reported a constant presence of Risso's dolphins in the Gulf of Genoa since 2013, with a progressive increase in encounters from 2018. Therefore, they developed a photo-identification catalogue of their own (WW catalogue) featuring individuals photographed from 2017 to 2023. A total of 95 individuals were photo-identified during 44 sightings, mainly occurring above the Gulf of Genoa canyons system, at depths ranging from 300 to 1000 meters. To investigate Risso's dolphins' movements between the two areas, a comparison between the TRI and the WW catalogue was performed and 13 matches were found. These results confirm that some Risso's dolphins moved from the westernmost area to the Gulf of Genoa, albeit being a small fraction of the "missing" resident population. Moreover, despite recent studies suggesting a distributional shift of the Mediterranean sub-population to pelagic waters, Risso's dolphins in the Gulf of Genoa were all encountered in the continental slope area. The current study highlights the significant scientific contribution provided by opportunistic platforms, which although not specifically designed for data collection, play a crucial role in providing essential information on low-density species like Risso's dolphins in the Mediterranean.

Population parameters of the sperm whale in the oceanic waters of Madeira Island

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The sperm whale (*Physeter macrocephalus*), the largest of odontocetes, holds significant ecological importance; however, they face various threats. Due to its deep-diving behavior and high mobility, knowledge of population parameters of this species is limited throughout its distribution. Madeira Archipelago, one of the most isolated oceanic habitats in the North Atlantic, is surrounded by underwater canyons and deep waters due to its volcanic origin, facilitating access to the study of this species. To understand population movement patterns, it is essential to assess site fidelity and demographic parameters, such as abundance, survival and capture probability. Photo-identification data collected on Madeira Island in 2022 and 2023, obtained opportunistically from whale-watching boats operating on a daily basis and aboard research vessels, were used to update an existing catalogue containing photos since 2008. In a set of 429 photo-identification events, with an average duration of 20 minutes, 304 individuals were identified and most of them (92%) were well marked. Only 22% of individuals were seen more than once. Inter-annual recaptures showed higher values than intra-annual recaptures. This dataset will be used to assess survival, capture probability, and abundance for the first time for this species in Madeira, using the mark-recapture methodology already employed in studies for other species. This study requires in-depth analysis and extensive validation to ensure robust conclusions, thus, the results obtained so far are preliminary, reflecting an early and exploratory phase of research. This can contribute with valuable insights to inform conservation strategies. As we delve deeper into the complexities of sperm whale behavior, our efforts aim to improve understanding and contribute to marine conservation.

Potential effects of geographic isolation on patterns of sociality of coastal dolphin populations

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The drivers of sociality in animal populations remain poorly understood, including in small cetaceans such as bottlenose dolphins (Tursiops sp.), for which extensive social structure studies have been carried out across a range of locations and ecological contexts. However, due to variation in sampling strategies and regimes, comparisons of datasets on the social structure of these animals are challenging to undertake, particularly to identify the drivers of sociality. Thus, some environmental features may constitute barriers to dispersal, leading individuals to only associate and build social network with close neighbours, and/or create social fragmentation, which can ultimately affect population structure. Here, we investigated the spatial variation in social structure of Indo-Pacific bottlenose dolphins (T. aduncus) in the southwestern Indian Ocean using data collected in four locations: southern Kenya, Zanzibar, Mayotte and La Réunion. We explored the potential effect of geographic isolation on association patterns (half-weight index) and social network parameters. Similar social patterns were observed between Zanzibar and Kenya (continental East Africa), and between Mayotte and La Réunion, two oceanic islands located in the Mozambique Channel and in the Mascarene archipelago, respectively. Dolphin social networks were more complex in Kenya and Zanzibar, compared to more geographically isolated populations of Mayotte and La Réunion. Geographically isolated populations exhibited weaker social bonds than those living closer to continental coastlines. In contrast, network parameters in Kenya and Zanzibar revealed that dolphins associated directly and indirectly with higher proportions of individuals within their respective social networks. Although the drivers of sociality are challenging to quantify among populations, our results suggest that bottlenose dolphins have more complex and cohesive social structures in areas where potential interactions with immigrant dolphins are higher. As a result, dolphins appear to develop stronger associations between individuals, with higher number of social interactions, and shape more diversely connected networks.

Preliminary analysis of the kidney pathological findings of a Risso's dolphin (*Grampus griseus*) stranded along the Central Adriatic Sea

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On November 3rd, 2023, a fresh carcass of an adult female Risso's dolphin (*Grampus griseus*) in poor nutritional condition was found stranded along the central Adriatic Sea. This stranding event was the only one recorded in 2023 along the Italian coastline, and the 23rd individual recorded in the Italian Stranding Database since 1987 in the Adriatic Sea. Among the 23 cases, the Italian Stranding Network (ISN), coordinated by C.Re.Di.Ma., had the opportunity to conduct post-mortem investigations only on 13 specimens. The species is listed as Least Concern by the IUCN worldwide, while the Mediterranean subpopulation assessment recently ranked it from Data Deficient to Endangered. G. griseus shows mainly high site fidelity and is usually observed in deep pelagic habitats, especially over steep shelf slopes, which are environmental characteristics not present on the Italian side of the Central Adriatic Sea. The case and the unusual stranding location raised the scientific attention of the ISN, who responded to the stranding by conducting a complete necropsy. Samples were collected and analyzed for virologic, microbiological, parasitological, histological, and serological examinations to identify pathogens, including anthropozoonotic infections. Moreover, tissues for ecotoxicological analyses were collected and special attention was paid to any findings of human interaction. No pathogens were isolated, while the histopathological investigations showed a distinctive histopathological feature observed at the kidney level and characterized by an evolving chronic nephrotic syndrome with glomerular, tubular, and vascular changes. Additionally, there was a pulmonary pattern of edema and hemorrhages. The present study represents an initial report of mortality due to non-infectious natural causes of death. Considering the estimation of 1.467 individuals inhabiting the Southern Adriatic Sea and the conservation status of the species, the results of this investigation can be considered an important contribution to the knowledge gap about G. griseus mortality in the Mediterranean Sea.

Preliminary analysis on cetaceans stranded along Sri Lankan coasts following the X-Press Pearl disaster

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In June 2021, the Singapore-registered container ship X-Press Pearl sank in the coastal waters of Sri Lanka, after burning for 12 days. The event is known as Sri Lanka's biggest marine ecological disaster for the dispersal into the marine environment of dangerous goods, chemical substances, fire residues, and plastic pellets. Despite the Sri Lanka's marine mammal species richness, the country lacks a stranding monitoring and responding network able to respond and analyze cetacean carcasses systematically. For this reason, to assess the environmental and socio-economic impact, the Marine Environment Protection Authority (MEPA) involved the Veterinary Pathobiology Department of the University of Peradeniya (UPe), and the Department of Comparative Biomedicine and Food Science of the University of Padova (UniPD), to carry out post-mortem investigations on cetaceans found stranded in that area soon after the accident.
This preliminary study investigates, through a complete standardized post-mortem procedure (necropsy, histology, immunohistochemistry, virology, parasitology, and toxicology) the causes of death in 4 different cetaceans: S. longirostris, S. coeruleoalba, T. aduncus, and K. sima. Gross evidence of fishing interaction was reported in 3 animals, such as cutaneous net marks. The decomposition code of the animals allowed histopathological diagnosis only in 1 specimen showing only mild-moderate diffuse pulmonary edema. 1 (S. longirostris) of the 2 individuals molecularly tested for Dolphin Morbillivirus and Herpesvirus was positive for both pathogens. No parasites were reported. Toxicological investigations for assessing several chemicals are ongoing on all specimens, including fuel breakdown products, heavy metals, petrogenic and pyrogenic PAHs.
The preliminary results highlighted the presence of 2 of the most widespread viral pathogens and interactions of the animals with fishery. An integrated and multidisciplinary approach, including the toxicological analysis, is needed to understand the X-Press Pearl disaster's short- and long-term impact and, mostly, to develop a conservation management plan for Sri Lankan cetaceans.

Preliminary analysis on the emission contexts of the bray-call sequences of the Mediterranean common bottlenose dolphin

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The common bottlenose dolphin (*Tursiops truncatus*, BD) can produce distinctive sequences composed of multi-unit rhythmic signals at low frequency and short duration, known as the Bray-Call series (BC). BCs have mainly been recorded during feeding activities, but little is known about their possible communicative function in social contexts. The BD population inhabiting the Tiber River estuary (Central Tyrrhenian Sea, Rome) exhibits a complex repertoire of BCs, composed of 13 distinct types of single- and multi-element sequences made up of different arrangements of 3 main sounds (i.e. Gulp, Grunt, and Squeak). Here, the context of emission of these sequences identified from recordings collected between 2017 and 2020 is investigated, to gain insight into their usage. To highlight potential differences in the amount of sequences emitted in feeding and social behavioral states, the Emission Rates (ER=n. sequences/minute) were compared through Mann-Whitney test. To address the influence of behavior on BCs diversity, a GLM Poisson was fitted assuming the total types of sequence as the response variable and behavioral states as predictor variables. Results showed that ER varies significantly in the two contexts ($W=4831.5$, $p<0.001$), with higher values during socializing. A significant diversity in the type of sequences emitted during feeding and socializing emerged as well ($z=3.298$, estimate=0.61587, $p<0.001$), with all 13 types used in social contexts only. A single-element sequence, composed of Gulp repeated in series, appeared to be the most emitted in both contexts. These results suggest a strong relation between BCs production and sociality, opening up the new scenario that the use of these sequences is not limited to foraging, and supporting the hypothesis of a communicative function in both contexts. Unrevealing the role of BCs may facilitate behavioral and habitat use studies through passive acoustic monitoring and may reveal possible alterations of communicative processes by anthropogenic and ecological factors.

Preliminary study of the noise generated by salmon aquaculture operations in Chilean Patagonia

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To document impacts of salmon aquaculture operations in the Chiloense region of Chile (northern Patagonia-Los Lagos region), we collected visual and acoustic data from operational salmon farms, "resting salmon farms" (with no salmon and a skeleton crew), abandoned farms, areas impacted by plastic debris produced by salmon farms, salmon industry shipyards, and shore facilities. We spent 12 days at sea and covered 553 nautical miles. We captured images from both the boat and an aerial drone and recorded nearly 100 hours of underwater acoustic data with Soundtrap recorders on sub-surface moorings, both near operational salmon farms and in control locations without farms. In addition to documenting the visual evidence of environmental degradation caused by this industry, we aim to evaluate anthropogenic noise originating from salmon farms. These farms are equipped with compressors for air circulation in fish pens, oxygen diffusers, water pumps, fish pumps, feeding pumps, and diesel generators for power, all of which produce noise under water. In addition, noise is generated by chain moorings anchoring the pens and buoys, and boats transporting personnel and supplies. We are characterizing the different types of noise generated in each area, as well quantifying their Sound Pressure Levels (SPLs) and Power Spectral Densities (PSDs). Preliminary results suggest that noise generated by the salmon aquaculture industry has the potential to adversely impact marine mammals. Of particular concern are threatened and endangered species, including blue whales, Peale's dolphins, and Chilean dolphins (which are endemic to Chilean Patagonia). This industry is largely unregulated in Chile and continues to grow each year in response to high demand for salmon, especially in the United States. More research is urgently needed to document the harmful effects of salmon aquaculture farms on this unique and fragile ecosystem.

Preliminary study on common bottlenose dolphin's (*Tursiops truncatus*) interactions with fisheries in the Western Ligurian Sea

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Interactions between common bottlenose dolphins (*Tursiops truncatus*) and several types of fisheries have been regularly recorded in many areas of the Mediterranean Sea. They can have a detrimental impact both on the species and the economic activities. Thus, a deep understanding of their occurrence and entity is pivotal to putting into action effective mitigation measures. The Western Ligurian Sea is regularly inhabited by common bottlenose dolphins and, due to the narrow continental platform, the overlap with human activities is high. Fishing in this coastal area mostly consists of deployed nets, trammel and bottom-trawler boats. Using ad-hoc surveys designed to monitor the presence of bottlenose dolphins as well as fishing activities, this work is the first preliminary assessment of the occurrence of these interactions in the area. Total encounter rates were determined for bottlenose dolphins, nets, trammels and trawlers in activity in 2km² grid-cells. These were used to analyse the distribution overlap between sightings and fishing activities. During 365 surveys (April 2018-October 2023) 205 bottlenose dolphin sightings, 3530 deployed nets, 713 trammels and 247 trawlers in activity were recorded. Behavioural observations of interactions between the species and fishing gear were also documented and consisted of 14 events: 12 with nets, 1 with a trammel, 1 with a trawler. The greatest distribution overlap was found between dolphins and nets, followed in smaller measure by operating trammels and trawlers. Despite the spatial co-occurrence of bottlenose dolphins and fishing activities, the frequency of interactions in the study area appears to be quite sporadic. Further studies incorporating acoustic/visual monitoring deployed on fishing gear will be essential to confirm the current preliminary results. These outcomes show how the local situation is unlike what has been observed in many regions, even close by, of the Mediterranean Sea where interactions are registered on a regular basis.

Prevalence of *Anisakis simplex*, *Pseudoterranova decipiens*, and *Contracaecum osculatum* in Danish Harbour Seals (*Phoca vitulina*) and Grey Seals (*Halichoerus grypus*)

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The conflict between seals and fisheries has become increasingly relevant, due to the recent recovery of seal populations. Fish predation and transmission of anisakid nematodes by grey seal (*Halichoerus grypus*) and harbour seal (*Phoca vitulina*) have been suggested as a main factor affecting the condition of Baltic and North Sea fish stocks. The present study aims to assess the prevalence of intestinal parasites *Anisakis simplex*, *Pseudoterranova decipiens*, and *Contracaecum osculatum* in harbour seal and grey seal scat samples. Specifically, we use molecular identification of parasites in 332 seal scat samples, collected over the period from 2005 to 2019 at eight haul-out sites in the North Sea and Baltic Sea region. Since this non-invasive method of utilising seal scat for parasitological screening has not yet been published, the significance of these results could give a better understanding of the parasitic burden of Danish seals and provide a new direction for sustainable monitoring of fecally transmitted parasites.

Prevalence of killer whale (*Orcinus orca*) “rake mark” scars on Icelandic humpback whale (*Megaptera novaeangliae*) flukes

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Rake mark scarring on humpback whale (*Megaptera novaeangliae*) flukes indicates that they are targets of killer whale (*Orcinus orca*) attacks. How frequently these predatory events occur and if humpback whales present an important prey source for killer whales remains unclear. For this study, humpback whale fluke photographs collected in three regions in Iceland between 2001-2021 were examined for the presence of rake mark scarring to assess the prevalence of non-lethal killer whale attacks. Three main research questions were investigated: (1) What percentage of humpback whales photographed in Iceland show rake mark scarring on their fluke? (2) How severe are rake marks on scarred individuals? (3) Has the proportion of rake mark scarred humpback whales increased over time? Fluke photographs that met specific quality criteria were assigned to one of six categories created based on presence and severity of rake mark scars. Results showed that 7.82% (n=38, 95% CI: 5.43 – 10.21%) of 486 individuals had rake marks on their fluke. Only 15.79% of these individuals (n=6, 95% CI: 4.19 – 27.38%) possessed severe scarring. When comparing the scarring frequency over the years, results showed that the number of flukes with rake marks increased over time, and the proportion of rake mark scarred individuals ranged between 3.57% and 14.63% over the 21 years. The results show that rake mark scar prevalence on Icelandic humpback whales is low which could indicate that humpback whales travelling to Icelandic feeding grounds are not exposed to a high number of predatory attempts by killer whales. However, it must be considered that the results could also signify that predatory events are often lethal and only a low number of Icelandic humpback whales survive killer whale attacks.

Prevalence of viral skin lesions in two different dolphin species in the Western Ligurian Sea, Italy

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Information about the spread and pathogenicity of emerging viruses in marine ecosystems is fundamentally important for understanding potential risks to both animal and human health. Coastal dolphin species represent excellent sentinels of environmental health due to their exposure and susceptibility to anthropogenic and environmental threats. This study aims to expand our knowledge of skin diseases of viral origin type and prevalence, in common bottlenose dolphins (*Tursiops truncatus*) and striped dolphins (*Stenella coeruleoalba*) in coastal waters of the Western Ligurian Sea (Northwestern Mediterranean Sea). Analyses were performed on 2562 high-quality photographs, collected from January 2021 to August 2023 during 189 boat-based surveys with 87 and 13 sightings of bottlenose and striped dolphins, respectively. Applying the photo-ID technique for bottlenose dolphins only, the minimum prevalence (MP) of lesions was calculated overall, for each category and for sex and age class to evaluate any possible differences. Of the 168 identified dolphins, 88 showed skin lesions at least once in the study period with a MP of 52%. A total of 5 lesion types, previously described in literature, were identified and associated with the main viral agent. Poxvirus lesions were observed in 60 individuals (68%) (Tattoo, n=28; Dark Fringe, n=32) while Herpesvirus lesions in 75 individuals (85%) (White Amorphous, n=15; White Spots, n=5; White Fringe, n=9). Males showed a higher prevalence of marks (86%, n=6) than females (47%, n=24), while juveniles showed higher MP (68%, n=15) than adults (53%, n=57) and calves (45%, n=17). In addition, Poxvirus and Herpesvirus lesions were also observed in 14 and 1 striped dolphins, respectively. These findings support that visual analysis of skin lesions can be an effective way to monitor the health status of free-ranging dolphin populations and their habitats in an area where the detection of viral agents associated with skin lesions from stranded animals is limited.

Protecting Mediterranean sperm whales: AI powered identification and insights

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The International Union for Conservation of Nature ranks Mediterranean sperm whales as endangered due to the decline in mature individuals. To recover from ongoing threats and provide effective conservation strategies, it is fundamental to understand sperm whales' behaviours and habits. This can be achieved by tracking individual whales' movements. However, non-invasive techniques to track individuals require photographic identification of single subjects, a time-consuming process that requires manual curation. This research has developed tools using machine-learning techniques to identify and locate sperm whales in the Mediterranean Sea. Photographic identification of cetaceans is often achieved by implementing artificial neural networks. However, little work has been done to adapt these techniques to sperm whale identification. This project utilised two Residual Neural Network models, trained to identify sperm whale individuals from images of either their fluke or flank. The models, trained using a contrastive learning process, capture important image features representing each whale as a point within a 128-dimensional latent space. Whales can then be quickly re-identified within this space by comparing this point to those of previously identified whales.
We evaluate our models on the Oceanomare Delphis Onlus (ODO) dataset. ODO is a non-profit organisation that collects photographic, acoustic and contextual data for sightings of cetaceans in the Mediterranean Sea. We find that our networks achieve 78% accuracy in identifying subjects from a single fluke image, 78% accuracy from a single flank image, and 93% accuracy from a prediction combining both images. A user-friendly computer interface simplifies the use of these tools, providing predictions of known and new subjects. This tool can be easily adapted to incorporate new individual whales or re-trained to other cetacean species.
Our future research aims to integrate sperm whale identification with photographic meta-data and behavioural data collected during sightings to further understand pods' dynamics over time and space.

Relationship between bycatch and biological traits of small cetaceans in Galicia (NW Spain, 2021-2023)

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Bycatch is one of the main causes of mortality of small cetaceans worldwide and, in north-western Iberian waters, there is a significant commercial fishing activity. The Galician fleet alone is made up of more than 4,000 fishing vessels, mainly small-scale artisanal fisheries (e.g. gillnets, trammel-nets) but also commercial fisheries (e.g. trawls), which may interact negatively with cetaceans to a greater or lesser extent. Stranded cetaceans represent a unique opportunity not only to investigate certain aspects of their biology and ecology, but also to determine the cause of their death. In this study we characterise bycaught individuals of common dolphins (*Delphinus delphis*) and harbour porpoises (*Phocoena phocoena*) in terms of their biological traits (e.g. sex, length). The aim was to identify the groups most vulnerable to being bycaught in Galician waters (NW Spain), as well as to identify where and when most of the stranded cetaceans with bycatch compatible lesions were recorded. A total of 193 common dolphins and 19 harbour porpoises were necropsied between 2021 - 2023. Of these, 54% of common dolphins (n = 105) and 58% of harbour porpoises (n = 11) presented evidence of death in fishing gear. Results showed that bycaught common dolphins stranded more frequently in the north-western part of the study area (67%), while there is no pattern to the stranding location of harbour porpoises. The seasons with higher bycatch incidence were winter (46% of the annual total) for common dolphins, and summer (36%) for harbour porpoises. Finally, preliminary analyses showed no significant difference in size or sex ratio between bycaught individuals (Student t-tests: $p > 0.05$). To date our results do not suggest that any particular part of the population is more vulnerable to bycatch than others. The analysis is ongoing and will also be extended back in time.

Research trends and knowledge gaps in the impact of vessels on cetacean species: a Systematic Map

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Cetaceans face a multitude of well-recognized anthropogenic threats, many of which can be attributed to the activities of marine vessels, which are present and increasing in number throughout all the world's oceans (Williams et al., 2014). This study undertakes a systematic literature review to better understand the current state of knowledge relating to vessels impacts on cetaceans and to identify specific data gaps, with particular focus on geography, nature of impact, vessel types and recipient species. Inclusion/exclusion criteria were defined to target only studies relating to the impacts of vessel operation (e.g. vessel strike; vessel-related oil spills; noise from engine, disturbance, sonar, echosounders, seismic surveys; interaction with fishing gear that remains attached to the vessel during operations) and not secondary impacts (like effects of pile driving, entanglement in ghost gear). In addition, only studies on wild, extant populations of marine cetaceans were included (excluding captive studies). Therefore search terms included a combination of cetacean-related words (i.e. whale, dolphin, species and common names) and vessel-related terms (i.e. "vessel" synonyms, fishing gear-related terms, noise, sonar). Searches were conducted in January 2023 in three databases (Scopus, Web of Science, ProQuest) and yielded 39274 records, which reduced to 20715 after removal of duplicates. After title and abstract screening, 1961 records were kept for the next phase of full-text screening. In this poster, I will present the results from the screening stages and preliminary results on the assessment of knowledge gaps.

Residency patterns and site fidelity of the common bottlenose dolphin (*Tursiops truncatus*) in the coastal waters of Montenegro

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The Mediterranean Sea, a biodiversity hotspot, faces harmful changes due to anthropogenic factors, including habitat loss, pollution, overfishing, and climate change. The Adriatic region, within the Mediterranean, witnessed a 50% decline in bottlenose dolphin populations in the latter half of the 20th century, possibly linked to habitat degradation and overfishing. This study aimed to uncover the site fidelity and residency patterns of bottlenose dolphins in Montenegro. Photo-identification data collected between September 15th, 2016 and March 19th, 2023, identified 78 distinct dolphins, with 34 appearing only once and 44 being re-sighted. The dolphins showed a mean group size of five individuals, with subadults present in 51.1% of sightings. Residency rates ranged monthly from 0.02 to 0.2, with a mean of 0.0496 (±0.044), seasonally from 0.042 to 0.375, with a mean of 0.095 (±0.081) and a yearly range from 0.125 to 0.75, with a mean of 0.222 (±0.147). The site fidelity index ranged from 0 to 0.5, with an average value of 0.0531 (±0.139). Montenegrin waters revealed three distinct dolphin groups: “Transient” (40 individuals), exhibited the lowest averages in the residency and site fidelity rates. “Visitors” (30 individuals) displayed low monthly, seasonal, and site fidelity rates with an intermediate yearly residency rate. “Residents” (7 individuals) demonstrated the highest average residency patterns. The observed group size aligns with reported Adriatic sizes. High subadult presence suggests Montenegro may serve as a breeding or nursing ground. Montenegro exhibits lower site fidelity and residency rates than other Mediterranean regions, potentially associated to the dolphins' larger home range extending beyond the Montenegrin coast. Future research should explore anthropogenic impacts, dolphins’ habitat use, and cross-country collaborations for management strategies containing the entire home range. This study revealed diverse residency and site fidelity patterns, and distinct groups among bottlenose dolphins in Montenegro, highlighting the complexity of their ecological dynamics.

Risso's dolphin (*Grampus griseus*) occurrence and site fidelity in continental shelf and slope waters of SW Portugal

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Risso's dolphin (*Grampus griseus*) is a widespread species occurring in both pelagic and coastal habitats of tropical and temperate waters. Knowledge on this species is scarce in Portugal mainland, where it's considered resident, holds an 'unknown population trend' status, and very recently became classified as a Vulnerable species. This work investigates how the population of Risso´s dolphins occurs in the coast of SW Portugal through photo-identification. The study area comprises mostly continental shelf and slope habitats, but also the entrance of a submarine canyon. Data (geographic location, group size, composition and images of individual animals) was collected by one qualified observer onboard of platforms of opportunity (dolphin watching) between 2005 and 2021. A total of 144 encounters allowed 93 photographic surveys. A catalogue with 1352 images was built up. Examination of images resulted in the identification of 251 dolphins through their natural marks (63 of both flanks, 164 of left flank, 150 of right flank). Individuals were recorded from 1 to 11 different times. Approximately half (49.80%) of the dolphins were sighted in more than one occasion and 38,65% in more than one year, up to as much as 7 different years. New individuals are still being identified indicating that the population is larger than the one photographed so far. The presence of the species in the area was irregular, both seasonally and annually. These results strongly evidence that Risso's dolphins occurring in the region show a high degree of site fidelity and residency. Their home range, however, should be much larger than the study area facing the low sighting frequency observed. This study contributes significantly to the knowledge of this species in continental shelf and slope areas, and for this region in particular, with relevant implications for management of the species in this habitat type.

Risso's dolphins invading Arctic waters: increasing evidence of multiyear site fidelity following range extension in the North Atlantic

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Risso's dolphins (*Grampus griseus*) are common in waters from 45°N to 30°S. In some regions they also appear further north up to 64°N, with typical habitats being continental shelves along slopes from 400 to 1,000 m water depths. Within the last few years they have been observed outside of this range in several regions, one of them being Northern Norway. Here, a collaborative effort between whale-watching companies and research organizations was initiated in 2022 to photo-document the apparently increasing presence of the species in the Bleik Canyon located at 69°N. The number of days with Risso's dolphins sightings in the area between June and September has increased from 3 in 2017 to 19 in 2023, although the number of whale watching trips have been in a similar order in this time frame. A total of 11,243 photographs collected during the study period resulted in a total of 143 individuals photo-identified. Individual dolphins were seen in 1 to 3 years. 5 individuals returned to the area in at least 3 different years and the maximum between the first and the last sighting of a specific individual was 6 years. Steeply increasing number of observation days each year throughout the study period, increasing number of new individuals identified and multi-year resight of individuals strongly suggest seasonal site fidelity rather than dolphins only being visitors to the area. Comparisons of the catalogue made from the Risso's dolphins seen at the Bleik Canyon to other catalogues from Scotland, Ireland as well as the north of France have not shown any matches. Reasons for their increasing appearance in the area could be due to the presence of newly available prey species owing to climate change and distributional shifts. The increased presence of Risso's dolphins could impact other species and these interactions should be monitored.

Robust real-time detection of right whale upcalls using neural networks on the edge

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Animals worldwide are facing increasing ecological pressures that can impact populations and potentially drive species extinction, in particular from global climate change and increasing anthropogenic activities. To transition to a renewable energy future, extensive offshore wind development is planned globally. In the Northeast of the United States and Canada, future development sites overlap with the migratory range of critically endangered North Atlantic Right Whales (NARW) and will lead to increased risk of ship strikes, pile driving impacts, and other noise exposures. New methods to accurately and efficiently detect and localize whale populations and provide real-time feedback for mitigation will be increasingly important to facilitate the recovery of the NARW and ensuring sustainable development of crucial offshore wind farms. Recent developments in acoustic event detection made possible by deep learning have shown significantly improved detection performance across many different taxa, but tend to be too computationally expensive to run on existing wildlife monitoring platforms. Here, we use model compression techniques combined with an acoustic recording platform integrating an ESP-32 microprocessor to bring real-time detection with deep learning to the edge. We propose a novel data augmentation technique which significantly improves performance in unseen acoustic environments without the need for large hand labeled datasets, demonstrating robust performance throughout the entire migratory range of the NARW. Using full-integer quantization, we achieve a 10x reduction in model size with no drop in accuracy, resulting in 4-5 inferences per second when running on an embedded microprocessor. Our compressed model demonstrates improved performance across all tested recording sites in the Western North Atlantic Ocean and facilitates large scale NARW monitoring efforts throughout their migratory range. We demonstrate that deep learning powered wildlife monitoring solutions can provide reliable real-time data for mitigation of human impacts and help ensure a sustainable green energy transition.

Satellite tags used to investigate importance of a potential wind farm area for harbour and grey seals

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A large-scale offshore area with multiple wind farms (3GW) is planned in the Danish part of North Sea. There are two Danish areas with haul-out sites for both grey and harbour seals within 150 km from the area. To investigate habitat importance of the investigation area for the two species, 27 harbour seals and 15 grey seals were captured and equipped with Argos/Fastloc GPS transmitters in 2022 and 2023. Tags were glued on the fur and remained on harbour seals up to 149 (mean: 63) days and grey seals up to 167 (108) days. State space models (SSM) were fitted to fill empty parts of tracks allowing prediction of hourly positions along the movement tracks to calculate time spent in the investigation area. Animal movements were characterized based on residence time. Lastly, we built a habitat suitability model on input from five environmental variables that best informed the model. The analysis of tag data suggest that the future offshore windfarm area is of low importance to the two seal species. Grey seals spent 0.2% of the time they were tagged in the area and harbour seals 0.1% of the time. Harbour seals spent most time close to shore and their haul-outs, where the deep water of the Norwegian Trench seemed to form a northern barrier. Grey seals spent more time offshore and used most of the North Sea during foraging trips. Some individuals even went to Scotland, Norway, Sweden and inner Danish waters. Habitat suitability was mostly determined by distance to haul-out and oppositely predicted the windfarm area to be of little-medium importance for grey seals and medium-high importance for harbour seals. Tagging proved to be a valuable tool for analysing importance of a future wind farm area for seals.

Seasonal habitat preferences and use of prey-dense areas by foraging minke whales (*Balaenoptera acutorostrata*) in the southern outer Moray Firth with implications for spatial management

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Effective conservation of highly mobile marine predators such as cetaceans requires understanding of the underlying ecological drivers of their distribution. These drivers can be investigated with habitat models using environmental variables, but inclusion of prey data can greatly improve such models and their interpretation. This study assessed the preferences of minke whales for various physiographic and dynamic oceanographic conditions as well as prey density and temporal patterns of distribution from long-term sightings of minke whales in the Moray Firth in northeast Scotland using a presence-absence generalised additive model. Whales showed significant preferences for deeper waters, lower chlorophyll concentrations and areas with sandy and muddy seabed. A significant tensor smooth interaction between sandeel density and month was further observed, with far greater occurrence throughout May and June in areas with high sandeel density, which rapidly decreased over the foraging season into the autumnal months. There was also a significant tensor product smooth interaction between frontal activity and month with minke whale occurrence increasing from May into the summer months but decreasing sharply in the Autumn in areas with higher frontal activity. As sandeels return to their burrows in the summer, minke whales are thought to shift their diet towards sprat and herring that become more available, and the whales may use fronts where aggregations of these prey can be exploited. The findings of this study highlight the importance of considering seasonal changes in habitat use arising due to seasonal dietary changes and further demonstrates the importance of prey data in habitat modelling.

SHORE: EmpOweR Students as the agents of cHangE

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The escalating threats to the health of the marine environment, stemming from human activities, pose and will continue to pose a significant impact on the well-being of European citizens. Consequently, it is imperative to empower the public, particularly the youth, with accurate knowledge about the marine ecosystem, its significance, their individual contributions to its well-being, and reciprocal effects on their lives. Recognizing the pivotal role of childern as agents of change, ocean literacy campaigns should seamlessly integrate dissemination initiatives into school curricula, fostering water literate citizens for conservation. EmpOweR Students as the agents of cHangE (SHORE) is a collaborative European project funded under European Union's Mission Ocean, committed to increase ocean literacy in schools by engaging students and educators to fulfill its objectives through school community activities. The project specifically targets primary and secondary schools, recruiting them to the European Blue School network (8-14 years old). It provides funding of up to €10,000 for water literacy projects through three Open Calls over the next 30 months, across five distinct water basins: Mediterranean Sea, Black Sea, Baltic Sea, Danube and Rhine River. 7 Country Hubs will be guiding schools in the submission process and provide a Blue Curriculum to teachers, open-schooling opportunities, along with a platform to share their activities and engage with stakeholders. The marine mammal community can actively contribute to at least three directions: providing information for the Blue Curriculum to teachers; participate as evaluators in the calls for project proposals; and co-develop projects that can contribute to the well-being of marine mammals and marine and riverine ecosystems. Overall, the SHORE project will help communities to become aware of the water environment around them and its concrete role in their life. This will increase consideration of the local ecosystems to navigate solutions to future challenges in conservation.

Short-beaked common dolphin sightings in the Tagus Estuary: what can environmental variables tell us about it?

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The Tagus estuary, in Portugal, is one of the largest estuaries in Europe. This biologically productive estuary is surrounded by a highly populated area and harbours the Lisbon Port. Despite the numerous human pressures in this area, dolphin sightings have been informally reported through time. However, until recently, a scientific background on this matter was lacking. In 2022, a land-based monitoring program was implemented in the lower section of the estuary to collect information about these occurrences on a regular basis. From March 2022 to December 2023, 140,85 hours with sightings were recorded over 241 days (1503 hours of sampling effort). Short-beaked common dolphins (*Delphinus delphis*) were the most frequently sighted species, 88,82% of the sighting time. This species was observed in the lower section of Tagus estuary throughout the year, except in October (2023), November and December (2022 and 2023). A generalized additive model (GAM) was used to assess eventual relationships between these sightings and environmental factors. The model with the best fit was the one that included water temperature, salinity, pH, total dissolved solids, chlorophyll, dissolved oxygen, and the lunar phase, tides (neap and spring) and season. Low salinity has a negative effect on sightings. This model suggests that the Tagus Estuary, currently, offers a combination of features that make it a suitable habitat for common dolphins. Shifts in environmental conditions are likely to influence these occurrences. Therefore, further monitoring effort and conservation measures should be considered for this area.

Should I stay or should I go? Different occurrences of six bottlenose dolphin groups identified in the Azores

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Bottlenose dolphin *(Tursiops truncatus*) is one of the most observed cetacean species, sighted year-round, in the Azores archipelago. As they may be frequently encountered close to the islands, their susceptibility to local impacts (e.g. tourism boats, fishing activities or habitat shifts due to climate change) requires a comprehensive understanding of their social structure, habitat use, and temporal distribution. This information supports effective conservation and management plans, also according to the European regulations' legal framework. The key objectives of this research are: (1) to analyse the social structure of bottlenose dolphins around São Miguel and (2) to investigate the temporal distribution of identified social groups. Throughout the study (2003-2020), a comprehensive photo-identification catalogue was developed, based on data collected from platforms of opportunity (whale-watching vessels from several companies of São Miguel Island, Azores). This catalogue includes 1144 individuals of an open population, so new identifications are expected with the increase of data available. Social analyses revealed a dynamic and flexible fission-fusion society, with associations between the individuals identified, revealing six potentially stable groups. Notably, a high association index among some individuals, sighted ten or more times, indicated the presence of long-term and stable associations. The temporal distribution showed individuals that were observed until 2016 and 2017, while some groups were more regularly sighted until the end of the study. These findings emphasise the importance of long-term data series obtained from opportunistic platforms and make an important contribution to assess baseline conditions of the population for the preservation of this species.

Signature whistles as a tool to estimate dolphin population size from a single fixed hydrophone

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Reliable estimations of animal populations size are needed to properly plan conservation strategies. Even if a great potential for acoustic identification of individuals has recently been recognized for marine mammals, sounds has been barely used as a specimens mark. Here, we estimated the bottlenose dolphin population size in the North-Western sector of the Sicily Strait by signature whistles. Overall, 326 days of recordings were collected form January 2015 to February 2016 by a fixed autonomous acoustic device. 80 signature whistles from free-ranging dolphins were identified through the SIGID method, as long as their stereotyped fundamental frequency contours were repeated in bout in which at least 6 renditions were separated by an interval of less than 10s more than the 75% of times. The Jolly–Seber model (with POPAN formulation) in Mark software was applied to estimate population size, basing on the signature whistles encounter history. The selected models allowed the estimation of a total population size of171 individuals (95% CI = 137-215). Even if the signature whistles identification, the site location of the hydrophone, and the recording timing required crucial precautions, the estimation resulted comparable with the one previously obtained through physical marks over ten years data. These outcomes demonstrated that the use of signature whistles can be considered an efficient tool that can be applied to free-ranging animals. The complementarity of these different methods might be a powerful tool to obtain accurate estimates of demographic parameters.

Skin marks analysis to assess bottlenose dolphin anthropogenic threats in the Roman seas (central Mediterranean)

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The common bottlenose dolphin (BD) is a key apex predator in the marine environment, inhabiting a high diversity of habitats, from highly-urbanised coastal and estuarine settings to more pelagic ones. BDs accumulate on the skin signs of the interaction with the surroundings (e.g., presence of parasites, hints of changes in environmental parameters), including human activities (e.g., fishing gear-related injuries), through which the health status at both individual and population level can be assessed. Here, the analysis of skin marks on high-quality pictures of a BD population living at the Tiber River estuary (central Mediterranean Sea, Italy) was conducted, to investigate interactions with trawling fishery, skin diseases and nutritional status of individuals of different sex. The study area is heavily affected by trawling, enhancing the risk of overfishing and prey depletion, and other anthropogenic pressures (pollution and disturbance), with significant concern for the local BD population. Photographic data collected during 206 BD sightings in presence and in absence of trawlers between 2017 and 2023 were used to characterise and quantify cutaneous lesions of different origin and signs of emaciations in 38 animals. Fishing gear related injuries affected the entire population, and marks possibly ascribable to associations with trawling were found in >50% of the analysed individuals (more than 2/3 of males and 1/3 of females). This result seems to highlight gender-driven differences in interaction modes with the nets, with males potentially engaging in higher-risk interactions than females. High level of emaciation (evident in >70% of the individuals) and significant prevalence of skin diseases (97%) suggest both a possible reduction of prey access/availability due to intense fishing, and the exposure to multiple stressors like pollution and human disturbance affecting the area. This study strengthens the use of mark analysis as a cost-effective, powerful tool to monitor BD populations under anthropogenic pressures.

Socio-economic impact of whale-watching in Madeira

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In Madeira, previous studies showed that the whale-watching activity grew from 10 boats carrying 58,000 passengers and yielding 1.5 million€ in 2007 to 20 boats carrying 130,000 passengers and yielding 4.2 million€ in 2015. The maximum number of licences, 42, defined by the Regional legislation, was reached in 2019 for all Madeira. Questionnaires were sent to all licensed whale-watching companies in Madeira requesting information about their activities in 2019 or 2021 (2020 was excluded due to COVID). Number of trips, passengers, direct income, maximum capacity and occupancy level from tickets were compared annually or monthly to characterise the activity. We received information for 32 out of 42 licensed vessels, including 8 catamarans, 4 large monohulls, and 20 RHIBs/small monohulls, while 9 vessels had no or very limited activity. The activity was highly seasonal; the months of June to September concentrated about 50% of the trips and 60% of the passengers and direct income, while December to March showed the lowest activity. The annual vessel occupancy was about 60% and varied monthly from 49% in January to 74% in August. Considering that licensed vessels can perform a maximum of three trips per day, the annual percentage of trips undertaken was about 43% and ranged from 30% in January to 64% in August. Ticket prices ranged from 25 to 60€ for adult and 12.5 to 48€ for children. RHIB trips were generally more expensive than other vessel types. The direct income was estimated at 4,753,018€ for the 19 companies that replied. Previous studies relied heavily on extrapolations so that their values cannot be directly compared. However, the socio-economic impact seems to have increased together with the number of licensed vessels. However, vessel occupancy never reached 100% even in the busiest month, suggesting there is space for growth in the present situation.

Spot the Monk as promoter of “Open Science”: everybody is welcome to its Observatory!

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The distribution range of Mediterranean monk seal, the only pinniped found in the Mediterranean, has suffered a drastic reduction in the last few decades. Although its occurrence is not rare in the Aegean Sea, where the species reaches its demographic peak within the Mediterranean, the data on its status in the adjacent marine districts are scattered due to both its rarity and evasiveness. However, in the last few years, occasional, mostly coastal, sightings are becoming more frequent in waters surrounding the Italian peninsula. Nowadays molecular techniques allow to detect minute amounts of DNA traces released into the environment (eDNA) by any organism. A species-specific molecular assay has recently become available for detecting biological traces of a recent passage of the monk seal in the surrounding water column through the analysis of sea-water samples collected from the sea surface. The project “Spot the Monk” uses this non-invasive molecular tool to monitor monk seal occurrence in Mediterranean waters by means of eDNA analysis. The simplicity in the acquisition of samples together with the need to collect samples in multiple points simultaneously made the project well suited to the involvement of the general public. Up to today about 400 samples, have been collected and analysed in the central-western Mediterranean by researchers and a multivarious range of citizen scientists. This work announces the launch of an open-source Observatory where the project outcomes are publicly accessible as soon as they are produced. Embracing the principles of Open Science, we believe that such an approach can contribute to filling the knowledge gap about the distribution of this charismatic species in our seas, providing at the same time a proof of concept on how data collected by a variety of actors can be returned to the scientific and non-scientific communities in an innovative format for immediate consultation.

Static and dynamic acoustic monitoring of cetaceans at a future off-shore wind farm site in the central Mediterranean Sea

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In European countries, offshore wind energy is becoming an important sustainable power solution. Nevertheless, offshore wind farms (OWFs) are among the human activities contributing to the rapid expansion of underwater noise. There is still a limited understanding of the impact of this activity on species that are sensitive to sound, such as cetaceans, particularly with the new "floating" platforms. The aim of this study was to characterize species diversity in the Strait of Sicily (central Mediterranean Sea) prior to the deployment of an OWF, using two different acoustic monitoring instruments: seafloor mooring and wave glider. The static device (SoundTrap ST600) acquired data from 18th February to 27th April 2022, at 192 kHz sample rate with 50% duty cycle (~ 1 TB). The dynamic device (towed recorder with a single hydrophone, Porpoise, RS Aqua) acquired data continuously from 10th to 25th October 2022 (~360 GB). Primarily, spectrogram visualization and audio listening (manual analysis) were applied to a subsample of the datasets in order to detect cetacean vocalizations and anthropogenic activities. Then, customized algorithms developed in MATLAB were applied on both datasets to detect the echolocation signals of odontocetes (delphinids, sperm whales) and fin whale calls, and to estimate ambient noise levels. Results showed acoustic presence of fin whales, sperm whales and different species of delphinids, with an increase in the ambient noise due to human activities (e.g., marine traffic, fishery, military exercises). The diversity of cetacean species found in the area highlights its importance as a potential hotspot and key region between the eastern and western Mediterranean basins. In addition, this study provides an assessment of underwater noise in a poorly investigated area, where a sustainable OFW development needs to be addressed. Finally, improvements in large-scale monitoring of cetaceans were demonstrated through the complementary use of static and dynamic acoustic devices.

Stomach contents of small cetaceans stranded on the south-western coast of the Black Sea near Zonguldak

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Over the past 6 years, analyses of the stomach contents of Black Sea cetaceans have been carried out in the waters of Zonguldak province. The material was collected along the study area, which covers a total of about 22 km, and included 45 strandings. 24 stomachs were analysed, with the best represented species being the common dolphin (*Delphinus delphis*). A total of 8 fish species from 6 families were identified in the stomachs analysed. Most common dolphins fed on horse mackerel (*Trachurus* sp.) and European anchovy (*Engraulis encrasicolus*); horse mackerel was also the favoured prey species for the harbour porpoise (*Phocoena phocoena*). A single stomach of the bottlenose dolphin (*Tursiops truncatus*) contained the remains of 4 prey species: whiting (*Merlangius merlangus*), horse mackerel, picarel (*Spicara smaris*) and mullet (*Mugil* sp.). The species composition of the harbour porpoises may reflect the switch to a diet of mesopelagic fish species along the study area. The first information obtained on the stomach contents of the common dolphin during the winter season in the south-western Black Sea indicates that anchovies and horse mackerel are the main food items. A comparison of stomach contents with published literature for other regions of the basin showed differences in food preferences along the various coastlines. The unidentifiable species of some available otoliths found in the stomachs during analysis suggest a wider range of food sources and emphasise the need for further research.

Stomach contents of stranded Cuvier's beaked whales on the Turkish Aegean Sea and Northern Cyprus (Eastern Mediterranean Sea) coasts

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Cuvier's beaked whale, *Ziphius cavirostris*, is a cosmopolitan toothed whale species and one of the regular species of cetaceans found in the Mediterranean Sea. This species is also teuthophagous, feeding exclusively on cephalopods. The study was based on the stomach contents of one individual from Seferihisar, Aegean coast of Türkiye in 2016 and five Cuvier's beaked whales stranded in February 2023, on the northwestern Cyprus Island coast during a multiple stranding event in which at least 13 individuals were affected. A total of 1448 lower beaks were found in six stomachs and 16 cephalopod species were identified. Among these species, six species (*Octopoteuthis sicula, Ancistrocheirus lesueurii, Histioteuthis reversa, Chtenopteryx sicula, Chiroteuthis veranii*, and *Todarodes sagittatus*) were found in all stomachs examined and were determined to be the dominant species for the diet of *Z. carvirostris* sampled in the eastern Mediterranean. Four species; *Loligo forbesii, Pyroteuthis margaritifera, Pterygioteuthis giardi* and *Brachioteuthis riisei* were reported for the first time in Cuvier's beaked whale stomach in the Mediterranean Sea. There are differences in the species composition of the stomach contents between the western Mediterranean and eastern Mediterranean, which may be due to the differences in the cephalopod fauna characterized by sea bottom features and other oceanographic peculiarities. A plastic package was found in one individual in Cyprus. This is the first study on the stomach contents of Cuvier's beaked whale for the Aegean and eastern Mediterranean Seas and reveals basic features of their diet.

Stranded perchance: how well do ocean currents explain cetacean mortality patterns in the actively fished waters of Goa, India?

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Understanding the direct impact of human activities on cetaceans is crucial for their conservation but is challenging in tropical countries due to limited resources and complicated logistics. Technological advances and open-source data can, however, help overcome these challenges to understand broad-scale patterns of cetacean mortality and to infer the effect of fisheries on them. We collated data over the past five years on dead cetacean strandings from the state of Goa, India using citizen science platforms and a reporting network. Following this, we estimated spatio-temporal particle stranding probabilities using Lagrangian advection with ocean circulation data and used GLMs to understand the factors explaining stranding rates. We found that stranding patterns varied across years and were influenced significantly by ocean currents. Stranding rates were also higher than expected during the summer/pre-monsoon season which could have resulted from increased overlap between dolphins and fisheries (due to a reduction in fish prey), as also suggested by signs of bycatch on carcasses. This project is a first attempt to understand cetacean mortality/bycatch patterns by combining citizen science and oceanographic data in Indian waters and will be scaled up to the country level. Our results can serve as baselines to guide further research/conservation actions for the endangered yet little-known cetaceans of India.

Stranding data as precious source of information to better address field research on cetaceans

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Although stranding data may suffer of several sources of uncertainty, such as influence of environmental factors on the stranding dynamics, if analysed in a systematic way it may provide indicators of cetacean populations, as well as information on their biometric traits. Particularly, estimations of food consumption rates by cetaceans can be obtained through biometric traits. A methodological approach to the analysis of stranding data is proposed for the estimation of length-weight relationships and consumption rates of different odontocete species in the Mediterranean and its subregions (sensu SPAMIs identification in UNEP-MAP-RAC/SPA, 2010). Starting from a stranding data collection built by consulting open databases and scientific literature of the period 1983-2021, a preliminary data selection was carried out to exclude duplicate records and integrate incomplete biometric data, obtaining a consistent database for the analysis of biometric traits of striped, common bottlenose and Risso's dolphins. Considering only records in which the decomposition state ranges from fresh to moderate, the length-weight relationships were calculated at Mediterranean and subregion scale, when data were available. Successively, a bootstrap method was applied to estimate the mean body weights, the mean daily ingested biomass by means four scaling equations, and annual food consumption (AFC) rates for three species. AFC rates estimated for the striped, common bottlenose and Risso's dolphins at the Mediterranean scale, were 1118 kg (CI, 531-1570), 2571 kg (1372-3963), and 3913 kg (2469-5306). Length-weight relationships and consumption rates obtained for investigated species represent the first estimations calculated using a large dataset, through a robust method able to quantify values of the uncertainty intervals, at Mediterranean and subregional scales. Results showed the lack of biometric measures for some odontocetes species, the absence of stranding information in some subregions, highlighting the need to improve the monitoring of stranding events, especially in the southern Mediterranean areas.

Strandings of small cetaceans on the Moroccan coasts between 2015 and 2022 - *Delphinus delphis* and *Stenella coeruleoalba*

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1. INRH. Morocco.

Monitoring cetacean strandings has been part of INRH's activities since its creation. From 2015, it became an activity structured as a national Stranding Monitoring Network SMN, made up of INRH scientists, in close collaboration with the various stakeholders in strandings, in particular public administrations and civil society associations concerned with monitoring marine environment. This work provides an overview of the strandings of small cetaceans, notably the common dolphin *Delphinus delphis* and the striped dolphin *Stenella coeruleoalba*, which occurred on the Moroccan coasts between 2015 and 2022. In total, 516 individuals stranded during this period, consisting of 266 common dolphins (52%), 200 Stenella (39%) and 52 unidentified dolphins (9%). Common dolphins were more present on the Atlantic coasts (59%) while the opposite for Stenella, 72% of strandings of which were recorded on the Mediterranean coasts. The average annual number of strandings was 34 for the common with a peak of 48 in 2020 compared to 25 for Stenella with a peak of 37 strandings in 2015. The sex ratio was 36% males for common compared to 35% females, 29% remaining unidentified due to the advanced state of decomposition. For Stenella, females made up 38%, males 31% and 32% unidentified. Over the entire period, the SMN teams traveled for 27% of the strandings. 43% were handled remotely as part of the collaboration procedure with local authorities, while 30% were not recorded by the SMN. The high number of remote interventions was mainly due to restrictive measures linked to the COVID-19 crisis. Around 37% of stranded cases could be associated with an interaction with fishing (animals trapped in fishing gear, severed fins or typical injuries). For the rest, it was difficult to comment on the cause of death, either carcasses in an advanced state of decomposition or no particular signs.

Strandings of the Cetaceans in the Moroccan mediterranean and it's north atlantic adjacent waters between 2015 and 2022

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1. National Institute for fisheries research

Between 2015 and 2022, 235 cetaceans belonging to 14 different species stranded in the Jebha-Larache region. These strandings belong to 6 families: Balaenopteridae, Delphinidae, Globicephalinae, Kojiidae, Phocoenidae and Ziphiidae, and 9 groups: beaked whales, toothed whales, baleen whales, sperm whales, dolphins, pilot whales, porpoises, orcas and rorquals. 85% of strandings occurred on the Mediterranean coast, compared with only 15% on the Atlantic coast. These strandings occurred in the Larache-Jebha region were observed on more than 70 different beaches.

Strandings were observed in every month of the year. The highest number of strandings was recorded during the months of April, August and February, which accounted for 17%, 13% and 11% of strandings respectively. Analysis of the data from the various strandings recorded in the region shows that the blue and white dolphin (*Stenella coeruleoalba*) is the most stranded species, accounting for 34% of all cetaceans stranded. The common dolphin (*Delphinus delphis*) ranks 2nd with 24%, followed by the bottlenose dolphin (*Tursiops truncatus*) with 15%. The minke whale (*Balaenoptera acutorostrata*) ranks 4th with 7% of strandings. Short-finned pilot whales (*Globicephala melas*), northern bottlenose whales (*Ziphius cavirostris*), killer whales (*Orcinus orca*) and harbor porpoises (*Phocoena phocoena*) each contribute 2% of the latter. The remaining species are poorly represented in strandings, each accounting for no more than 1% of strandings. Females account for 34%, while males make up 28% of strandings. However, due to their advanced state of decomposition, the sex could not be identified for 38% of cases. The size of the individuals stranded ranged from 1m to 19.50m, while their weight varied from 20kg to 1500kg.

Strength in collaboration; making data FAIR

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We all know the challenges with gathering adequate marine mammal data for research and conservation. A resourceful way to improve our knowledge of these cryptic species is the repurpose and reuse of existing data. Therefore, collating high quality hard-won data through collaboration and openness offers exponential benefits to the marine mammal science community. But this is not easily achieved; requiring data to be managed using standardised formats and procedures, rigorous quality assurance and willingness to share. Coordination and cooperation are essential.

The Joint Cetacean Data Programme (JCDP) is an international initiative working to achieve FAIRness for cetacean data collected through effort related survey from ship and aerial platforms. The FAIR principals provide a guide for making data Findable, Accessible, Interoperable and Reusable (Wilkinson, et al. 2016). The JCDP makes these types of data findable through online data portal and accessible using interactive maps and search criteria to filter and download datasets. All the data submitted to the JCDP adhere to an agreed data standard using internationally set vocabularies, with each dataset linking to INSPIRE compliant metadata records making these data interoperable and reusable. To ensure the data hosted by the JCDP is of high quality, the submission process has in-built data quality checks as well as a feedback process for data users to report errors or other issues back to the original data owner. The JCDP data portal and a series of published resources are freely available for the cetacean science and conservation community to use, for all our shared benefit.

Using data already submitted to the JCDP, a number of unrestricted access data products have been developed by the ICES working group for the JCDP, demonstrating the potential of this resource.

Joint Cetacean Data Programme (JCDP). 2022. ICES, Copenhagen. https://cetaceans.ices.dk

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Streptococcus phocae septicaemia in two stranded common dolphins (*Delphinus delphis*) from Cornwall, southwest England – evidence for grey seal interactions?

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Streptococcus phocae was first isolated and identified in harbour seals (*Phoca vitulina*) that died during the phocine distemper virus outbreak in northwest Europe in 1988. Since that time, it has been isolated from a wide range of pinniped species and, less frequently, in cetacean species, with associated clinical disease occurring in both taxa. In 2023, *S. phocae* was isolated from two common dolphins (*Delphinus delphis*) that stranded on the coast of Cornwall and were examined under the aegis of the UK Government funded Cetacean Strandings Investigation Programme. In both animals, there was pyogranulomatous dermatitis with involvement of adjacent soft tissues and *S. phocae* was isolated both from the lesions and in septicaemic distribution. In the first dolphin, the right fluke appeared 'fractured' and a series of irregular, discrete, infected wounds were present on both surfaces of the fluke, with necrosis of adjacent subcutis. In the second dolphin, there were multifocal to coalescing areas of raised pale skin and extensive areas of skin loss on both sides of the dorsal fin with associated panniculitis. There was also extensive, pyogranulomatous myositis overlying the left scapula, ventral to the last four left ribs and in the muscles overlying much of the right thorax, with an abscess found deep to the right scapula. In both cases, it was likely that infection had occurred following trauma. In the first dolphin, the lesions appeared consistent with bite wounds probably caused by grey seals (*Halichoerus grypus*) and, as *S. phocae* has been found as opportunistic commensal flora in the oral cavity of grey seals and in bite wounds of harbour porpoises (*Phocoena phocoena*), it is suspected that this was the route of infection in this animal. The origin of the skin and soft tissue lesions in the second dolphin is less clear.

Striped dolphin (*Stenella coeruleoalba*) population size fluctuation among the second and the third period of the Habitat Directive

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The striped dolphin (*Stenella coeruleoalba*) is the most abundant species of the Gulf of Corinth, a Protected Area of the Mediterranean Sea that belongs to the European Network "Natura 2000", and it is also classified as an Important Marine Mammal Area by the IUCN IMMA Task Force. Starting from the summer of 2009, boat surveys were regularly carried to investigate the species population size for conservation purposes, employing the photo-identification technique. A catalogue of 447 identified individuals was created over the years. The software Mark was employed to analyse mark-release-recapture seasonal data to assess the population size within the following two periods of the Habitat Directive (HD): HD-II: (2007-2012); HD-III (2013-2018). The mean population estimate was 961 individuals for period HD-II, and 1052 for period HD-III, indicating a slight increase of individuals in the area. Nevertheless, the annual difference of population size in both HD periods suggests that some population fluctuation is still present. It is not clear if this is due to immigration-emigration factors or to demographic dynamics internal to the population, as number of births and deaths. Moreover, the analysis of population data for HD-IV (2019-2024) would shed light on long-term population trends, providing feedback about the efficacy of current conservation measures set in place in an area increasingly impacted by marine traffic, aquaculture and fishing activities.

Structural and ultrastructural (Electron microscopy) contributions to the dolphin's hypophysis

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The growing scientific interest in the health and welfare of cetaceans, as important species both in the context of ecosystem balance and environmental indicators and as animals kept under human care, has given rise to a myriad of studies in different veterinary fields. The main component in the regulation and development of the stress response system, among many other physiological and behavioral processes, is the Hypothalamic-Pituitary-Adrenal Axis (HPA Axis) in the neuroendocrine system. This often-forgotten system is made of a set of neurons, glands, and non-endocrine tissues that play a critical role in the adaptation processes an animal undergoes, therefore being potential indicators of both health and welfare.

As a first step to set light on the intrinsically complex HPA Axis, better understand its functioning and improve its evaluation, we need to deepen the study on its poorly understood chore components. Through the present work, we have taken a closer look into the organism's master gland, the hypophysis; by firstly standardizing a post-mortem methodological assessment for cetaceans; secondly studying its morphological, histological and immunohistochemical characteristics with light microscopy; and thirdly having a closer look into the ultrastructural characteristics of the gland and its different cell types using electron microscopy in two pituitary glands from two dolphin species (*Tursiops truncatus* and *Stenella coeruleoalba*).

Suitability of tissue imprints on FTA®cards for dolphin morbillivirus and herpesvirus detection: comparison with gold standard frozen tissue

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Stranded cetaceans are important resources for epidemiological investigations; however, the biomolecular detection of common pathogens requires well-preserved samples, whereas carcasses are often retrieved in advanced decomposition state. Moreover, setting and maintaining a rigorous cold chain can be difficult in field conditions, therefore, it is important to have alternatives that can guarantee sample preservation. This research aims at evaluating FTA®card tissue imprints as an alternative sampling method to the gold standard freezing of tissues for virological diagnosis. In fact, nucleic acids can be fixed on FTA®cards and stored at room temperature preventing degradation. Cetacean morbillivirus (CeMV) is a burdening RNA virus with high prevalence rates, and it is frequently found in co-infection with DNA viruses like herpesviruses, thus stranded dolphins on Italian coastlines were screened by nested RT-PCR for dolphin morbillivirus (DMV) and nested-PCR for herpesvirus. Samples were collected in parallel by freezing and imprinting tissue aliquots on FTA®cards. Five individuals belonging to *Stenella coeruleoalba* species and two *Tursiops truncatus* were sampled, and their decomposition carcass category (DCC) ranged from 2 to 3. A housekeeping gene (GAPDH) was tested as internal control to confirm the extraction of nucleic acids. Only one animal was positive for herpesvirus, both on FTA®cards and frozen tissues, although the low prevalence prevented further considerations on DNA yield on FTA®cards. All animals were positive for DMV, both on FTA®card imprints (28/53, 53%) and tissue samples (18/53, 34%). In DCC 3 carcasses, DMV was detected slightly more frequently on FTA®card imprints than on frozen tissues. Thus, tissue imprints on FTA®cards appear a promising alternative to frozen tissues for biomolecular diagnosis, especially when extreme field conditions hamper the prompt freezing of tissues and advanced decomposition would affect pathogen detection in frozen-and-thawed samples.

Summer spatial distribution of cetaceans in the high seas of the Eastern North Atlantic region and evidence of possible distribution shifts

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Working with data collected from opportunistic platforms is one of the most efficient ways to create databases on cetacean distribution in areas where there is no significant effort dedicated to cetacean monitoring. From 2012 to 2019, a total of 2926 sightings on 28 species and 6 families have been recorded within the CETUS Project along the routes between mainland Portugal, the Spanish west coast and the Macaronesian archipelagos. These data allow the creation of a consistent database, discovery of different cetacean communities and assessment of their distribution, with a special focus on offshore international waters. Between August and October 2023, visual monitoring data were collected on board a cargo ship making linear transects between Lisbon, the Azores and Madeira archipelagos. During this period, the presence of 4 families (Balaenopteridae, Delphinidae, Physeteridae and Ziphiidae) and 9 species was confirmed through 110 sightings. We assessed the differences between the habitat of Delphinidae (n=62) and Ziphiidae (n=16) families (over 10 sightings). For this purpose, we performed pairwise comparisons for latitude, longitude, distance to the coast, average surface temperature and bathymetry, recorded at the geographical positions of the sightings, using Mann-Whitney U tests. The only significant differences found in the habitat were for distance to the coast, with Ziphiidae being distributed in areas further from shore ($p=0.033$). When comparing data collected in 2023 with historical records (2012-19), significant differences were found in the geographical position of the sightings for both families (Delphinidae: $p=0.008$ and $p<0.0001$; Ziphiidae: $p=0.030$ and $p=0.002$; for latitude and longitude, respectively) which may evidence shifts in cetacean habitats in the area. Long-term datasets are fundamental for assessing species distributions and detecting early-warning signs of habitat and distribution shifts. Such knowledge is essential for an efficient management and protection of marine species, especially considering global changes.

Survival rates of long-finned pilot whales in southeastern Spanish waters

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Long-finned pilot whales (*Globicephala melas*) of the inner Mediterranean Sea were classified as an endangered subpopulation by the IUCN in 2021. This assessment was based on the high mortality mainly caused by a Morbillivirus epizootic that affected this subpopulation in 2006-2007 and during the following 3 years. This study aimed at estimating survival rates during the following decade to understand if the subpopulation has recovered since then. Various photo-identification surveys targeting pilot whales took place off Murcia, southeast Spain between 2003 and 2023 to identify individuals based on their dorsal fin features. Cormack-Jolly-Seber mark-recapture models were tested in the software MARK to estimate annual survival rate of pilot whale in that region. Goodness-of-fit (GOF) tests were first performed using U-Care to detect problems of transience and trap-dependence in the dataset. Although the general GOF test (Quadratic Chi2= 62.13, df = 53, p = 0.18) was not significant, some transience was detected and included in the modelling process. The best model found a low constant survival rate of 0.929 (SE= 0.020; 95% CI: 0.878 - 0.960) between 2003 and 2023. However, the time-varying model estimated even lower values for certain periods. Lower survival rates were first found in 2006-2007, which matches the morbillivirus epizootic previously described both in the nearby Strait of Gibraltar and Alboran Sea that caused mortalities of 20% and up to 37% for some social groups respectively. Low values were also observed in 2010-2011, 2015-2017 and 2020-2022. Their causes are currently unknown but could be due to new or recurrent epizootics or a combination of high levels of pollutants, an observed increase in maritime traffic overlapping with their distribution, disruption of the social network that could reduce the survival of dependent individuals or a general reduction of carrying capacity in the western Mediterranean Sea.

Suture ossification in cetacean skulls is delayed and shows strong phylogenetic signal

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The skeleton of extant cetaceans is characterized by numerous developmental transformations, including heterochrony in the development of bone sutures and therefore delayed skeletal maturation. Among other structures, the cetacean skull is supposed to show delayed or incomplete postnatal ossification of sutures. This study explores phylogenetic tendencies in cranium ossification throughout major lineages of extant cetaceans. We assessed states and patterns of suture closure on the example of 23 best visible cranial sutures in skulls of physically mature or ontogenetically old specimens of 37 species of extant cetaceans (members of families Balaenidae, Neobalaenidae, Balaenopteridae, Physeteridae, Kogiidae, Ziphidae, Iniidae, Pontoporiidae, Monodontidae, Phocoenidae and Delphinidae) and 5 outgroup species of terrestrial even-toed ungulates (Hippopotamidae, Suidae, Bovidae, Camelidae) and calculated an average number of fully closed sutures. Then we tested whether the differences between species reflect phylogenetic signal. Two measures, Bloomberg's K and Pagel's λ, were calculated using the 'phylosig' function implemented in the phytools library in R. Both metrics indicated consistently strong phylogenetic signals, thus showing more similarity in ossification patterns between closely related species. Overall cetaceans showed significantly lower scores of suture closure (2-17) than terrestrial artiodactyls (18-23). Also, the number of sutures closing in odontocetes (6-17) was, in overall, greater than in living mysticetes (2-4), and among odontocetes, the most mature crania were found in Ziphiidae (14-17), whereas the least mature ones were in Physeteroidea (6-8) and Phocoenidae (6-9). Also, variation in the ossification sequence was observed across phylogenetic lineages. These patterns concurred with records of paedomorphosis of other skeletal traits by taxa and were independent of body size. Thus, suture ossification in cetacean skulls shows the complexity of their heterochrony and reveals its phylogenetic development.

Teeth as indicators of past and present cetacean ecology

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Whales are heavily affected by anthropogenic influences such as pollution, overfishing and bycatch. To evaluate the long-term human impacts on modern whales and to implement effective conservation policies, it is crucial to establish baselines for past and present populations. While modern whale populations can be monitored with a wide array of direct methods, historical data on whales is often scarce or incomplete due to a lack of documentation.
In order to gain insight into the ecology of historical whales, we analyzed teeth from sperm whales (*Physeter macrocephalus*) and harbor porpoises (*Phocoena phocoena*) from 1890s until 1990s. Due to its chemical stability, tooth enamel can capture ecological information and is often well preserved.
We performed comparative analysis of light microscopy and SEM-BSE (Backscatter Electron Microscopy) to examine growth layers, with the aim to assess if the findings could be used to reconstruct individual age and growth dynamics. We further reviewed if chemical changes in teeth composition could be correlated to specific life stages of our specimens. Establishing the reliability of these proxies in modern specimens is the first step to applying them to fossils and thus reconstructing past cetacean ecology.

Teleost diet of harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) in the North and Baltic Sea

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Harbour seals (*Phoca vitulina*) and grey seals (*Halichoerus grypus*) are top-predators in the North Sea and Baltic Sea. Their recovery from historic hunting is expected to change the dynamics of the marine food web, and is already causing conflicts with fisheries. This study aims to thoroughly assess the diet of seals found in Danish waters and to test for patterns in teleost prey species composition in relation to factors such as seal species, season, geographical region and prey availability. This will be achieved by analysing fish DNA metabarcoding data from 500 seal scat samples, collected in the period 2005-2019 at 8 different haul-out sites in the North Sea and Baltic Sea. The results of this work will increase our understanding of seal foraging behaviour and be valuable in the debate on seal and fish management and conservation.

Temporal acoustic occurence of *Odobenus rosmarus* in Svalbard islands (Norway)

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The Artic Ocean is changing due to global warming, causing the decrease in sea ice extend and seasonal persistence. This is a threat for ice-obligated fauna, like Atlantic walrus (*Odobenus Rosmarus* Rosmarus) impaired by habitat loss and by the increased anthropogenic disturbance. This work aims to provide new information on the acoustic presence and behavior of walrus in the Svalbard Islands (Norway). Data were collected in Kongsfjorden, from May 2014 to July 2016, with an autonomous acoustic recorder, set at a 192 kHz sampling rate, for 2 minutes/hour. A total of 491.1 hours were analyzed with an automated detector developed to detect walrus pulse train. Data were analyzed to assess annual occurrence and seasonality, dial and light patterns, and the relation with the Sea Surface Temperature (SST). Presence Rate (PR) as the presence over recording time, and Train Rate (TR) as the number of vocalizations over recording time were assessed. Results showed that PR and TR increased across the years, with the major part of the emissions from December to May. During the period of light and dark alternation, emissions were prevalently recorded during dusk. Both PR and TR increased when SST decreased. Furthermore, train duration (D) and the number of impulses per train (N) were described and analyzed in relation to the same temporal and environmental variables.D and N increased from December to February-March and decreased again in April-May, and were not related to the SST and the light pattern. Finally, the possible changes in all parameters were evaluated in relation to the occurrence of vessel noise. Results showed that while PR and TR decrease, the D and N did not change. These outcomes provide a crucial baseline for the current knowledge of the marine mammal community, to support conservation strategies in a fast changing arctic region.

The cause of death as a source of bias in stomach content analysis of stranded cetaceans: an exploratory analysis in Mediterranean striped dolphins, *Stenella coeruleoalba*

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Dietary data for cetaceans is often based on stomach contents analysis of samples obtained opportunistically from stranded carcasses. However, the extent to which the information gathered from these samples is biased is an open question. Here we compared stomach contents of 60 striped dolphins, *Stenella coeruleoalba*, that were found stranded along the central Mediterranean coast from Spain during the period 2011-2020 and died from (i) fishery interactions (n = 11), (ii) aggressive interactions with bottlenose dolphins, *Tursiops truncatus* (n = 8) and (iii) infectious diseases (n = 41). PERMANCOVA modelling using 'cause of death' and 'dolphin length' as predictors failed to detect significant differences in prey composition between the three samples. However, Kruskal-Wallis test with post hoc comparisons showed significant differences in the overall number of prey taxa between dolphin groups. Interestingly, the differences were not detected for cephalopod prey, but were for fish prey, with dolphins killed by infectious diseases having less fish taxa in their stomachs. We hypothesize that more time had passed since these dolphins fed, thus differential digestion of fish remains had already occurred. However, the influence of other factors cannot be ruled out (e.g., the inability of ill dolphins to capture certain prey or an increased consumption of fish in dolphins from group (i)). Our results suggest that care must be exercised when pooling heterogeneous samples of stranded dolphins in stomach content analysis, particularly when inferences rely on relative numerical estimations of consumed prey.

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The effectiveness of the low-cost acoustic recorder “HydroMoth” in cetacean research: preliminary results of the presence/absence of the bottlenose dolphin (*Tursiops truncatus*) in the Aeolian Archipelago (Sicily, Italy)

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Passive acoustic monitoring (PAM) is used in cetacean research to detect and track animals based on their vocalizations. However, due to the high costs associated with acoustic devices, PAM is applied by only a few research groups. This limitation determines big data gaps, complicating the development and continuity of protection and conservation measures. In this context, HydroMoth represents a new low-cost acoustic recorder created by modifying the open acoustic device “AudioMoth”, broadly used to study terrestrial environments. Because of encouraging preliminary results and its low price (~150€), we tested the usefulness of HydroMoth in the study of the bottlenose dolphin (*Tursiops truncatus*) in the Aeolian Archipelago (Sicily, Italy). First, we deployed one HydroMoth device on trammel nets placed around Filicudi Island as part of the LIFE Delfi European Project. Then, the same hydrophone was attached to a buoy anchored in Malfa’s harbor in Salina Island for monitoring dolphin activities. Via the free “AudioMoth Configuration App”, we set a sampling rate of 250 kHz to record both whistles and clicks. Whistles were used to determine the presence of dolphins in the wider vicinity of the study area, while clicks were used to determine if animals approached deployed fishing gear or entered the harbor despite human activities. Sampling around Filicudi was continuous, whereas around Salina it was discontinuous, with 5 minutes of recording every 30 minutes. We obtained a total of 456 hours of acoustic data, of which 336 hours (14 days) recorded around Filicudi and 120 hours (over 30 days) around Salina. We used the PAMGuard software for data analysis, saved automatically as WAV files in the internal SD card of the HydroMoth. Our results suggest using HydroMoth can effectively evaluate bottlenose dolphin presence/absence. Future studies are needed to test its effectiveness in giving insights to more complex research questions.

The effects of environmental and socio-behavioural factors on the structure of signature whistles in common bottlenose dolphins (*Tursiops truncatus*)

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Animal acoustic signals have evolved to be adapted to specific environments, ensuring efficient transmission of information between individuals. The common bottlenose dolphins (*Tursiops truncatus*) use a unique form of acoustic signals, called signature whistles, to identify the emitters through the specific and individual frequency modulation patterns of the signal. Even though the signature whistle remains approximately the same after the initial development, it can still be modified. This variability is crucial, as dolphins inhabit environments with different ecological and social contexts. However, to what extent dolphins can adapt their signature whistles to changing environments is still unclear. This study investigated the influence of water depth, habitat type, boat presence, group size, calf presence and sea-surface behaviour on the fundamental frequencies and duration of signature whistles within a bottlenose dolphin population living the north-west coast of Sardinia (Italy). Acoustic recordings and surface behavioural data were collected between 2013 and 2023. While depth did not influence any of the signature whistle variables, boat presence did: dolphins produced signature whistles with higher frequencies and longer durations while being in the presence of boats. Furthermore, in habitats with harder and rocky substrates, highest frequencies and longest durations were found compared to habitats with soft sediments, while lower minimum and maximum frequency and shorter duration were found in larger groups. Lastly, an upward shift in minimum frequency was found in feeding behaviour compared to socializing and travelling, though only in the absence of calves. These results confirmed that bottlenose dolphins adapt their signature whistles to different habitats, anthropogenic noise levels, behaviour, and social interactions. Understanding the factors that shape dolphin sounds is not only of scientific interest but also have important implications for their conservation.

The enigmatic bumpback whales of the Pitcairn Islands

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The Pitcairn Islands, located in the south-central Pacific Ocean, are one of the most remote places on earth and are calving grounds to an enigmatic subpopulation of humpback whales, *Megaptera novaeangliae*, first observed in the area in 1990s. The islands are surrounded by an 836,108km2 exclusive economic zone (EEZ) and an 834,334 km2 Marine Protected Area (MPA); one of the world's largest. The subpopulation of humpback whales is believed to be part of the French Polynesian F2 breeding substock, as classified by the IWC, but the links are undetermined due to a lack of current migratory and connectivity studies. It is part of one of only two endangered populations of humpback whales globally, due to their slower recovery from whaling. Over the course of 9 weeks between July and September 2023, we collected visual, acoustic, and photo-ID data on humpback whales around Pitcairn Island, supported by the local community. Sighting effort was carried out over 40.5 hours from land-based observation points and from a boat, with ID photographs and information on surface behaviour collected opportunistically. 396 hours of recordings were collected via passive acoustic monitoring in order to establish song structure and population connectivity. A total of 33 humpback whale sightings were recorded. Of these sightings, a total of 14 different individuals have been identified so far from a combination of fluke and dorsal fin photographs. These included 3 mother-calf pairs; all 3 appeared to be young calves, likely born around Pitcairn. From the ID photographs taken, 35 have been uploaded to HappyWhale.com with 3 new individuals identified using the website's WhaleID, powered by automated image recognition using artificial intelligence.

The importance of public engagement within an island community

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1. Manx Whale and Dolphin Watch

Manx Whale and Dolphin Watch (MWDW) is a cetacean research group based on the Isle of Man (British Isles). The island is 30 x 15 miles with a population of 85,000. Before MWDW was set up in 2006, there were almost no records of cetaceans in Manx waters. However, was this a case of absence of evidence or evidence of absence, since there was no means to report sightings? In 2019, MWDW secured a shop in the main shopping street of a popular coastal town. We branded the shop as a Visitor Centre, installing display boards that detail our local species, spotting tips and coastal vantage points. A young scientist's area provides engagement for children and a selection of bones forms a mini museum section. A small selection of merchandise keeps funds coming in and rent is covered by funders or local companies. Since opening the Visitor Centre, we have gone from being a relatively unknown group, to a recognised name within our community. We have seen a dramatic increase in public awareness and people wanting to conserve local cetaceans. The centre provides an important platform for people to report sightings, drop off footage and photographs and speak to our knowledgeable team. This has resulted in a huge increase in opportunistic sighting reports which form a large part of our knowledge of relative abundance and distribution of cetaceans around the Isle of Man. It is imperative that research work be disseminated to the public, especially within a small coastal community. We hope this example can inspire other groups to consider a similar project. It doesn't have to be large or full of technology at great expense, just a simple shopfront or somewhere people can pop in to find out more.

The importance of the biological collections: an assessment of the biological reference collection of cetaceans of the Macaronesia (CBRCM)

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Biological collections play a vital role in the acquisition and validation of data, serving as indispensable tools for advancing conservation science and offering essential insights for safeguarding endangered species. Specifically, cetacean populations face imminent threats due to anthropogenic activities, thus, urgent conservation efforts are needed. The Canary Archipelago holds one-third of known cetacean species. Therefore, crucial research has been carried out by the Society for the Study of Cetaceans in the Canary Archipelago (SECAC). Since 1983, SECAC has collected and preserved biological data from 28 different cetacean species. This extensive effort has culminated in the establishment of the Biological Reference Collection of Cetaceans of the Macaronesia (CBRCM). The CBRCM serves as the foremost representation of the cetaceans from this region, and it incorporates data from stranded individuals, including a biological tissue bank, parasite samples, stomach contents and an osteological collection. The collection includes a diverse array of cetaceans with particular emphasis on some rare and less known species as the Kogiidae (Kogia sima and *Kogia breviceps*) and Ziphiidae family. It includes specimens of Cuvier's beaked whale (*Ziphius cavirostris*), Brainville's beaked whale (*Mesoplodon densirostris*), True's beaked whale (*Mesoplodon bidens*) and one of the world's most extensive collections of Gervais's beaked whale (*Mesoplodon europaeus*). Our primary objective is to underscore the role of this collection in the current context of rapidly environmental degradation, assuming to be a crucial source of scientific data for biodiversity conservation, retrospective studies and dissemination activities.

The integration of 3D Printing in skeletal musealization: advancements, applications, and implications for heritage conservation

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The musealization of skeletons is a vital aspect for preserving and promoting cultural and scientific heritage. In recent years, the impact of three-dimensional (3D) printing technology has introduced a new era for the replication of skeletal specimens, offering unique precision and detail, and mitigating the sanitary risks associated with handling genuine bones. Museums and educational institutions can easily adopt 3D printing to develop interactive exhibits, promote a deeper understanding of historical and cultural contexts related to skeletons, as well as to replace broken or missing bones in its collection. These replicas can derive from models already scanned, present in online databases, or by scanning the contralateral bone, followed by post-process editing using specific software to achieve a remarkable level of precision. The choice of the printing material is a critical consideration, often leaning towards plastic-based options for their cheap cost relative to their performance in resistance and durability, ensuring the longevity of the replicated skeletal elements.
For educational purposes, at the Department of Comparative Biomedicine and Food Science (UNIPD), bones were printed to complete whales' skeletons and to create ex-novo dolphins' skulls. First, with a relatively low cost, high-quality whalebone preparations were easily obtained, providing a practical and accessible alternative to other less feasible materials, such as plaster molds, in cases where some bones were lost during post-mortem procedures. Secondly, the plastic composition of 3D-printed dolphin skulls added a layer of convenience, allowing them to be handled without personal protective equipment and transported without any particular permissions or certifications. This portability contributes to a more flexible and dynamic educational experience for different stakeholders, such as children, middle school and university students, and museum visitors. In conclusion, the applications of 3D printing in skeleton preparations are wide-ranging, including technological advancements, educational benefits, and contributions to heritage conservation.

The intestinal microbiome of a stranded killer whale: insights into cause of death and anthropogenic pollution

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Infectious diseases stand out as the predominant cause of death among stranded cetaceans in the Southern North Sea. Although most infections are caused by host-associated pathogens, some studies reported on infections with human pathogens through contamination from land and river runoff. The exceptional depth of current sequencing technologies allows for an accurate and high-resolution identification of pathogens from human origin and a thorough profiling of whole microbial communities providing valuable insights into cetacean health and disease. However, investigations into the intestinal microbiota of stranded cetaceans, specifically for studying the cause of death and assessing anthropogenic impact, remain limited. This study represents a pioneering effort to explore the intestinal microbiome of a stranded killer whale (*Orcinus orca*) using a comprehensive whole metagenome sequencing approach. The goal was to understand if the intestinal microbiome of a diseased killer whale - strayed in the contaminated coastal waters of Belgium - could yield insights into cause of death and serve as an indicator of anthropogenic pollution. Samples of gut content were collected from the stranded specimen to identify bacterial pathogens with human origin, antibiotic resistance genes (ARGs) and pathways reflecting exposure to anthropogenic pollution. Contaminant DNA was removed and bacterial DNA was isolated for Nextera XT library preparation. The subsequent whole metagenome sequencing on the Illumina NovaSeq platform generated 22 million bacterial reads. Rarefaction curves demonstrated that the entire bacterial diversity was captured. Sequences were taxonomically classified using Kraken, aligned against genomes of both marine, as well as human pathogens and annotated using the comprehensive antibiotic resistance database (CARD) and using a custom database for microbial biodegradation of pollutants. This research establishes baseline knowledge on the killer whale intestinal microbiome and opportunistic pathogens, and proves that the microbiome can give essential clues into cause of death and anthropogenic impact in stranded cetaceans.

The Mediterranean Marine Mammal Tissue Bank: a tool for biodiversity conservation and management

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As stated by ACCOBAMS guidelines and best practices, Tissue Banks should promote non-invasive or post-mortem collection of samples from cetaceans living in the Mediterranean, Black Seas and adjacent waters, prepare those samples for long-term storage, and distribute them to the community of marine mammal researchers.
With this aim, the Mediterranean Marine Mammal Tissue Bank (MMMTB, CITES authorization IT 020) was formally established in 2002 and hosted at the Department of Comparative Biomedicine and Food Science (University of Padova, Italy). From the origins, the MMMTB collects and preserves biological samples from marine mammals stranded along the Italian coasts of the Mediterranean Sea, in cooperation with the Italian Ministry of the Environment and Energy Security, the Institutes for Animal Health, and several non-profit Italian organizations.
Furthermore, it catalogues and distributes paraffin-embedded and frozen tissues samples free of charge, upon motivated request and positive opinion of the technical-scientific committee of more than 650 cetaceans, belonging to 21 different species, for a total of 7465 samples (5522 paraffin embedded, 1943 frozen).
In recent years, also immortalized cell lines from cetaceans became available to promote the use of alternative methods to minimize the use of animals in scientific experimentation, as stated by the Legislative Decree n. 26 of 4 March 2014.
Within the global evolution of the concept of environmental biobank and a new biobanking storage and traceability tool, the future goal of the MMMTB will be to maintain quality controlled tissues, link to all the information belonging to the donor. That will permit retrospective analyses to determine environmental trends of contaminants and other analyses of interest with new and innovative techniques, such as the ones already ongoing in the context of the National Biodiversity Future Centre, funded by the National Recovery and Resilience Plan (PNRR), and the Horizon Europe ONE BLUE project.

The most frequently injured body parts and organs during dolphin-fisheries interactions in the Croatian part of the Adriatic Sea

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Dolphin-fisheries interactions may result in injuries that can lead to severe disabilities, impaired health or even death of the affected dolphin. Here we analyse the most frequently injured body parts and organs of bottlenose dolphins (*Tursiops truncatus*) involved in dolphin-fisheries interactions in the Croatian part of the Adriatic Sea between 1990 and 2023. The data were reviewed using necropsy protocols kept at the Faculty of Veterinary Medicine, University of Zagreb, Croatia. During the studied period, 403 bottlenose dolphins stranded dead. Of these, 99 (24.6%) showed signs of dolphin-fisheries interactions, of which 43 dolphins (43.4%) had multiple injured body parts and organs. The lungs were the most affected organ with lung oedema recorded in 27 dolphins due to drowning. Ingested fishing gear in the stomach was recorded in 22 dolphins and larynx strangulation in 19 dolphins as the result of depredation from fishing nets and hooks. Escape attempts from fishing nets caused intermandibular haemorrhage in 18 dolphins, in three specimens superficial skin lesions and three showed skull and teeth fractures. In 16 entangled dolphins, the fluke was amputated post-mortem and incisions were made in the body cavities of seven dolphins when fisherman manipulated the entangled dolphin carcasses. In two dolphins, the fishing gear was wrapped around the entire body and in four dolphins around the tail. Our study indicates that the respiratory and digestive systems are most frequently affected in bottlenose dolphin-fisheries interactions in the Croatian part of the Adriatic Sea. In conclusion, several factors influence the type of injuries caused during dolphin-fisheries interactions, such as the anatomy and behaviour of the dolphin species involved, sex and age of the specimen, and finally the type of fishery and fishing gear used in a particular region.

The role of setting cetacean bycatch thresholds to achieve European legal obligations

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Cetacean populations are at risk from high levels of fisheries bycatch in every European ocean basin. There is an increasing focus on setting bycatch thresholds with various regional and global policy requirements.i Where cetacean bycatch thresholds have been calculated, for example the OSPAR assessment, they are exceeded.ii EU expert advisors have stated that thresholds cannot be determined for most populations due to lack of monitoring and inability to calculate bycatch rates.iii Whilst it is important for governments and fisheries bodies to focus on setting a threshold limit not to be exceeded, this should not be seen as an endpoint. In addition to 'red line' thresholds, focused efforts are required below this level, and before reaching this level, towards zero bycatch. This is a legal requirement in EU Member States, iv some national lawsv and a commitment made by Parties to the regional conservation body, ASCOBANS.vi A focus towards zero bycatch will require collection of robust abundance and bycatch monitoring data to be confident in efforts towards zero bycatch, particularly where evidence of bycatch is rare but may still impact small populations (e.g. Iberian porpoise, bottlenose dolphin, Risso's dolphin). Such effort is in the interest of all parties, particularly fishers, where early implementation of robust, scientific measures would prevent the dire situation where population level impacts occur and fisheries closures are required to reduce bycatch below a threshold level. Bycatch prevention is a consumer expectation and is an increasing focus for retailers and ecolabels. Whilst solutions to prevent cetacean bycatch exist, with a number of EU Member States currently facing infringement procedures due to lack of adequate action on monitoring and preventing bycatch, it seems the political will does not.

The use of opportunistic platforms for bioacoustics research in cetaceans in south of Portugal

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Acoustics recordings and analysis offer a valuable means of monitoring the vocal activity of oceanic species, providing insights into species-specific repertoires, behavior, distribution, and geographic variation. As a non-invasive and labor-efficient method, it can serve as a beneficial alternative to other data collection methods. In Portugal, the interest in nautical activities such as dolphin watching has been increasing, currently, hundreds of companies are dedicated to this activity. These phenomena offer significant opportunities for species monitoring and research using opportunistic platforms. However, studies on the acoustics of cetaceans in Portugal are notably scarce, with few published works. This study presents initial results from our ongoing acoustics research using a commercial dolphin-watching vessel as an opportunistic platform in Faro, Portugal. The study integrates visual and acoustic detection methods, aiming to identify species based on their acoustic signals. While the primary focus is on Bottlenose dolphins (*Tursiops truncatus*) and Common dolphins (*Delphinus delphis*), the results also consider records of anthropogenic sounds. The analysis focused on the signals of Bottlenose and Common dolphins' whistles, assessed through visual spectrogram analysis. Various parameters of frequency and time were extracted from each whistle and used to compare the vocalizations of the two species. In total, more than 8 hours of recordings were collected and over 3000 whistles were analyzed. The results revealed wide variability for both species, with overlapping ranges, posing a challenge in their differentiation. Nevertheless, the results are consistent with expectations from previous studies, aligning with values of frequency and time parameters described for the species. In the future, we aim to advance this study and use the data combined with visual observations to understand acoustic variations associated with behavior.

Threats to cetaceans from vessel traffic and litter in Calabrian Ionian Sea

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Marine mammals of the Calabrian Ionian Sea are threatened by diverse human activities. Identifying pressures acting in an area where species of community interest are present is essential to implement correct measures for conservation. The common anthropogenic activities that most impact cetaceans in the study area, from Brancaleone (RC) to Botricello (CZ), include recreational vessel traffic, fishing activities and marine litter. This multi-action research aims to limit forms of pressure on cetacean populations. *Tursiops truncatus* (Annex II, IV of the Habitats Directive 92/43/EEC) are the most vulnerable species due to its preference in coastal waters; local regulation and management for conservation are needed urgently. At first, this study provides results obtained from the marine litter removal campaign in the SACs Fondali di Staletti (2019) carried out during the project regional operational program 2014-2020, funded by EU FESR – FS for the Calabria Region. Through underwater conservation research activities various kinds of waste were subsequently removed (e.g. tyres). In the named area “Vasche di Cassiodoro” several industrial materials were recovered, such as electrical wires and pipes for construction work. A large quantity of used tires have been found, particularly between the “Torrazzo” area and “Vasche di Cassiodoro” area of Staletti (CZ). In the area below the “Coast of Copanello” in Staletti industrial plastics and electronic equipment were recorded. Secondly, space-time analyses connected both to individual species and vessel traffic are recorded (2019-2023). This information aids the discovery of spatiotemporal hot spots of dangerous interactions and associations, using QGIS software. We collect a presence/absence dataset, recording information about type of vessels sighted and impacts on cetaceans in the study area. The goal of the ongoing research work is to improve conservation efforts through knowledge-based management programs.

Three decades of anisakid nematode infections in harbour porpoises of the North- and Baltic Sea: trends and health effects

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Harbour porpoises are infected by anisakid nematodes, which become mature in the stomach of marine mammals after completing a multi-stage life cycle including free-living larvae and crustacean intermediate and fish paratenic hosts. They cause gastritis and ulcerations in their definite hosts and anisakidosis in humans when accidentally ingested with undercooked fish. A stranding network collected harbour porpoises along the coasts of Germany since 1990 and investigated their health status. Necropsy reports and samples from ~1500 harbour porpoises were analysed for prevalence, intensity (none, mild, moderate, severe) and lesions associated with anisakids. A GLM with logistic regression analysed sex and age class differences as well as time trends from 2004-2023. *Anisakis simplex* s.l. is the most common gastric nematode in porpoises in the North- and Baltic Sea and anisakid nematodes were prevalent from 1990 onwards. Prevalence of stomach nematodes increased slightly in the period from 2004-2023 in porpoises from the North- and Baltic Sea. Prevalence was significantly lower in the Baltic Sea (11%) compared to the North Sea (19%). No differences in infection patterns between male and female porpoises were found. In adults prevalence (23%) was significantly higher than in juveniles (11%) while neonates were almost never infected. Intensity of infection did not change over time nor showed differences between North- and Baltic Sea, age and sex of porpoises. Pathological changes associated with stomach nematode infections were correlated to intensity of infection and included chronic ulcerative gastritis of varying severity and characteristics. The striking differences in infection patterns observed between North- and Baltic Sea and between age classes reflect ecosystem characteristics, diet as well as life history of porpoises. Environmental conditions may drive prey species composition and the viability of larval stages and intermediate hosts. The epidemiology of this generalist, trophically transmitted nematode with zoonotic implications needs to be monitored closely.

Towards safer waters: a multidisciplinary approach for minimizing orca-vessel interactions in the Strait of Gibraltar

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In the last few years there have been some reports of interactions between Iberian orcas (*Orcinus orca*) and sailing boats in the coast of Spain and Portugal. This fact has aroused the interest of both the scientific and sailing communities. Because of that, the aim of this study is to analyze these interactions in order to reduce their frequency and to ensure a safety area to be used by the vessels that sails close to the orcas. To achieve that, satellital tags were deployed in some orcas, allowing to track them and to craft accurate presence maps with the data obtained historically in other sightings. Additionally, orca.pt, a Telegram portal, was used to report real-time encounters between killer whales and sailing boats. This interdisciplinary approach has been crucial in defining the safe navigation zones. Our results suggest that keeping sailing routes in 20 meters deep waters significantly reduce the probability of interactions, due to the low likelihood to find orcas in 30 meters deep waters or sallower. This also highlights the importance of collaboration between different sectors and the use of high technology, as well as an effective communication in the management of marine ecosystems.

Trace elements and emerging contaminants in an isolated population of highly vulnerable marine predators

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The Mediterranean monk seal (*Monachus monachus*) stands out as one of the most vulnerable marine mammal species globally. In the European Atlantic, the Madeira archipelago serves as the last stronghold for M. monachus, with an estimated population of less than 30 individuals. Anthropogenic pollutants can significantly impact immune and endocrine systems, elevating the risk of epizootic disease and stochastic mass mortality events. This study explores contaminant exposure in this highly vulnerable colony, analyzing trace elements (Hg, Cu, Zn, Ni, As, Fe, Mn, Cr, Se, Pb) and widespread chemical additives such as phthalates and UV filters. Tissue samples from two deceased adult females were collected in 2021 during necropsies. Potentially harmful elements like Pb, Hg, and Cu were detected, with the highest levels in the liver of one individual, although concentrations remain below recognized toxicity thresholds. Additionally, chemical additives were found in the muscle tissue. This study provides the first baseline information on contaminants in tissue samples from this isolated population of *M. monachus*. The detection of heavy metals and emerging contaminants in individuals from this highly vulnerable population is of particular concern. Further investigations are imperative to understand the effects of these potentially toxic contaminants on the population and their implications for future recovery efforts. Given the critical status of *M. monachus* in Madeira, we recommend the implementation of pollutant monitoring protocols to support ongoing conservation endeavours for this species.

Twenty six days in the Ligurian Sea: the longest permanence of a young humpback whale in the Pelagos Sanctuary

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Humpback whale is classified as Visitors species within the Mediterranean Sea. To date, 45 records have been registered as sighting, stranding and entanglement events but none of them revealed a long permanence in a restricted area. Here, we report the case of a young humpback whale that stayed in an area of about 200 nautical miles square for 26 days in the Northern of the Pelagos Sanctuary. The whale rowed in a coastal area close to the Marine Protected Area of Bergeggi Island and has been easily observed from land by researchers and people of the public. It exhibited several aerial behaviours such as breaching, tail slapping and flucking. Body length (between 8 and 10 m) has been assessed visually once the whale approached the research boat and corresponded to a juvenile. The whale looked in good body condition. Photo ID matching revealed negative results when performed with the Northern Atlantic Humpback Whale Catalogue. During an acoustic record of CLIC (Cetacean Listening Investigation and Conservation) project, we registered the sounds classified as megapclicks, so far rarely detected. They appear as broadband clicks with frequency peaks between 300 Hz and 1200 Hz. The pulse trains have a duration of a few tens of seconds and the average interval between two consecutive clicks is approximately 0.1 s. It is known that humpback whales rarely occur in the Mediterranean but it is still not clear the pattern of such occurrence. In this case, as the sighting was in spring time we cannot exclude some feeding activity as we know from other baleen species. However, this is the first confirmed record of an individual that stayed in the Pelagos Sanctuary for about one month and the first recording of megapcliks sound within the Mediterranean Sea.

Uncovering environmental DNA potential as a complementary cetacean monitoring technique in the north coast of continental Portugal

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Environmental DNA (eDNA) is emerging as a promising monitoring tool in the marine conservation framework, for its potential to collect data on the occurrence of biological communities with insufficient knowledge and/or difficult access for sampling. Advances in Next-Generation Sequencing techniques, such as DNA metabarcoding, result in a new approach to studying complex biological communities, such as oceanic ones, by enabling multi-species detection in environmental samples. With that in mind, this innovative sampling method was tested on the northern continental Portuguese coast for cetacean species identification. Within the scope of the ATLANTIDA Project, seasonal monitoring campaigns were carried out between June 2021 and March 2023, with seawater samples collected at pre-defined sampling stations along the established transect. A total of 64 environmental samples were taken, filtered, extracted and then sequenced in an Illumina platform. The subsequent bioinformatic analysis resulted in 5 different cetacean species identified by molecular detection - common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), Risso's dolphin (*Grampus griseus*), harbour porpoise (*Phocoena phocoena*) and fin whale (*Balaenoptera physalus*). In summary, it was possible to obtain data similar to that recorded by visual monitoring, not only in terms of occurrence, but also regarding the distribution of the aforementioned species in the study area. In addition, the positive detections of *Balaenoptera physalus* are relevant results in our work, since this is a species with almost no visual record available in the studied region, although with known reported occurrence in the adjacent areas. Thus, while this technique remains in its development stage, this work provides a clear insight into the benefits of using eDNA as a complementary tool in cetacean monitoring.

Understanding simultaneous detections in harbour porpoises

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Harbour porpoises (*Phocoena phocoena*) are marine mammals whose behaviour and communication are difficult to study due to their inconspicuous appearance and small size. While passive acoustic monitoring has proven to be a valuable tool for studying occurrence and detailed echolocation behaviour linking echolocation and visual observations is still a weak link. The literature mentions for instance potential simultaneous acoustic detections of harbour porpoises. In this work, such potential simultaneous detections were analysed in more detail to determine whether they could be related to the presence of more than one animal. For this purpose, F-POD data collected during summer 2022 off the coast of Fynen, Denmark, were compared to visual data in the form of drone images and visual coastal observations. The work focused on identifying and describing potential simultaneous detections, so called overlapping amplitude curves (OAC), and check whether they occur more frequently in the presence of two animals. The data showed that these OACs occur more often in the presence of two animals (11 vs. 3 OACs) and are characterised by two independent amplitude progressions. To compare the OACs with individual click trains, distributions of various parameters (amplitude, ICI, number of cycles), shape of the amplitude curves and differences between the amplitude values of successive clicks were analysed. Despite more frequent occurrence of OACs in the presence of two animals, no significant differences were detected between simultaneous detections and single recordings. If it were possible to distinguish these specifically and draw conclusions about the number of animals, this could be used for a more precise analysis of habitat utilisation based on long-term passive acoustic data.

Underwater detonations: mitigation measures to prevent injury of harbor porpoise (*Phocoena phocoena*)

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In the process of establishing an offshore wind farm, historical ordnance discoveries from the First or Second World War are frequently encountered during site preparation surveys. Subsequent examinations of these findings determine their condition and suitability for transportation. If the ordnance is considered intact, it is “controlled” detonated using a method referred to as "high order clearance" with the aim of completely removing the remains of the explosives. The significant expansion of offshore wind energy in the German North and Baltic Seas has led to a rise in both historical ordnance discoveries and controlled detonations. These detonations cause considerable underwater noise, which can potentially injure or even kill harbour porpoises due to the high impulse-like energy input. Various deterrent measures are implemented to minimize or eliminate sound-induced injuries/killings as far as possible. This study provides an overview of the mitigation measures currently used in German waters and discusses the monitoring of the effectiveness of these measures.

Underwater sound modelling of floating offshore wind farms in the Strait of Sicily

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Underwater operational noise generated by floating offshore wind farms (FOWFs) has the potential to affect marine animals. The extent of this impact, however, has yet to be investigated. It is therefore important to understand how these new constructions could impact the marine ecosystem. Currently, there are several projects planned to install FOWFs in Italian territorial waters, comprising just a few to hundreds of turbines. In this study, we evaluate the noise produced by three FOWFs that are planned to be built in the Strait of Sicily, an area of particular interest for such developments. The selected FOWFs differ in their sizes, in terms of number of turbines, and in the environmental characteristics of the areas, in terms of bathymetry and seabed substrates. The propagation losses were modelled in decidecade bands using JASCO's Marine Operations Noise Model (MONM) based on the parabolic equation method for frequency bands from 10 to 800 Hz, combined with BELLHOP beam-tracing model from 1 to 25 kHz. The bathymetry and geoacoustic profiles were taken from EMODnet. The February sound speed profile from Copernicus datasets was applied as this is representative of the expected worst-case scenario (longest propagation ranges) for impacts on marine life. After having modelled the propagation losses, source levels were applied that correspond to the operational noise generated by two aerogenerator flotation types: spar and semi-submersible. Results showed that the sound fields originated by the operating wind farms exceed behavioural disturbance and auditory threshold shift criteria, only within a few hundred meters from the turbines, for all the considered hearing groups. The outcomes are discussed considering the background sound levels and the most up to date marine mammals' behavioural disturbance and injury thresholds, in the light of the current European guidelines and National regulation.

Unusual stomach contents in a Black Sea harbour porpoise found dead after the Kakhovka disaster

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On June 6, 2023, Ukraine's Kakhovka Dam, located on the Russian-occupied part of the Dnipro River, was blown up, and river water flowed downstream to the Black Sea: 14.4 km³ of water discharged for 9 days. Once it got into the sea, such a large amount of freshwater led to consequences for the biota; numerous effects include mussel die-off, algal bloom, chemical and bacterial pollution, and transfer of aquatic organisms. On June 13, 2023, a stranded porpoise (*Phocoena phocoena relicta*), a mature male in normal body condition, was found 40 km south of Odesa (150 km from the Dnipro mouth). There were also many artifacts of river origin near the carcass. No significant macro pathological signs or bycatch marks were observed during the gross necropsy. However, terrestrial plant seeds and bones and otoliths of freshwater fish were morphologically identified in the stomach contents. From otoliths, at least five fish taxa were suggested, and at least two new freshwater prey species for the harbour porpoise were recorded, *Aspius aspius* and *Silurus* sp. The number of otoliths found: 11 - representatives of the family Gobiidae, 5 - *Aspius aspius*, and one *Silurus* sp. Also, at least twenty fish bodies were found, indicating a short interval between the last meal and death. Also, many seeds were found: all of them, according to the preliminary identification, belonged to Lithospermum officinale. There were no signs of seed digestion. As the seeds belong to herbaceous plants that typically grow in open areas, this suggests that the seeds and new prey species were introduced with freshwater that reached the open sea. A possible connection between the last meal and the cause of death is to be further investigated, and the whole fact of porpoises feeding at sea on freshwater prey is unusual.

Unveiling the brotherhood: social lives of Gibraltar's sperm whales

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This study challenges the prevailing notion that male sperm whales lack social structures, in contrast to their female counterparts who reside in more equatorial regions. Spanning from 1999 to 2023 in the Strait of Gibraltar, our research employed photo-identification methods to delve into the social dynamics of these elusive giants. A thorough analysis of over 10,000 photographic data was conducted, allowing for comprehensive cataloguing and identification of over 80 individual sperm whales, with more than 50% sighted across multiple years, suggesting a potential long-term association.

Modelling and examining social structures, our findings reveal the existence of some form of social organisation among male sperm whales in this region. Statistical analysis indicates a significant social structure ($p<95\%$), contradicting the assumption of male dispersion being random and solitary. Further, the type of structure identified aligns with 'casual acquaintances and constant companions' ($p>95\%$). This suggests that the dispersion processes of male sperm whales are not entirely random, indicating the potential for a more complex social framework than previously understood.

Our study challenges established paradigms, offering a glimpse into the intricate social structures of these oceanic giants. The need for ongoing monitoring and in-depth analysis becomes evident, offering opportunities to unravel these associations to a deeper extent. The implications extend beyond species-specific behaviour, potentially influencing conservation strategies and prompting further investigations into the social dynamics of marine mammal communities.

Unveiling unprecedented insights: a pioneering long-term examination of cetacean strandings in Romanian waters of the Black Sea

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Monitoring top predators is a key factor in determining the environmental status of an ecosystem and the extent of anthropogenic pressures. The study presents the abundance and distribution of stranded cetaceans along the Romanian Black Sea coast during the period from 2010 to 2022. This dataset could be the largest collected within a standardized and continuous monitoring effort of its kind within the Black Sea basin. Stranded cetaceans were examined and photographed to collect natural history data and determine the potential cause of death. The collected data included species, sex, body length, state and number of strandings, geographical position, meteorological conditions, and time. Over the last decade, the Mare Nostrum monitoring program recorded 1,217 cases of stranded cetaceans. The most commonly stranded species was the Black Sea harbour porpoise, with a total of 943 individuals (78%), followed by the Black Sea bottlenose dolphin with 185 individuals and the Black Sea common dolphin with 65 stranded individuals. The remaining 24 individuals were not identified at the species level due to various reasons. Despite cetacean strandings occurring year-round over the 12-year period, most cases were recorded between April and September each year. This is significantly correlated with fishing activities, where most bycatch goes unrecorded, irrespective of the legality or illegality of fishing practices, being unreported, and unregulated (IUU). Among the observed results, we can mention the two highest peaks of strandings recorded within the mentioned period, in 2012 and 2022, which well reflect the presence of a Morbillivirus epizootic and the war, respectively.

Update on Harbour porpoise status in Portuguese waters: abundance, distribution and strandings data

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In Portugal, the harbour porpoise population is currently classified as critically endangered. The abundance of this porpoise population is low showing high bycatch removal rates (estimated from strandings). A systematic monitoring of the harbour porpoise population is fundamental to guide any future conservation measures. In 2023, an airplane census allowed estimating the harbour porpoise population at 1995 individuals (CV = 46.45%) in Portugal. On the other hand, the largest number of stranded porpoises ever recorded was registered in 2023 (58 individuals, in the north coast alone). Considering only fresh and moderately decomposed porpoises, post-mortem exams revealed bycatch and probable bycatch rates of 52% and 32%, respectively. Also, bycatch evaluated from strandings produced an estimated minimum mortality of 187 porpoises (CI: 80-480) for 2023, which is over 10-times higher than the respective Potential Biological Removal estimate (17 porpoises, CI: 7-41), which corresponds to a 9% removal of the population. The estimated potential distribution of the porpoise population in 2023 showed that the habitat suitability remains higher in the northern area of mainland Portugal. The identified areas of high habitat suitability for porpoises largely overlap with the recently proposed sites for the deployment of offshore marine renewable energy offshore infrastructures in Portuguese waters. In order to halt the Iberian porpoise population decline, a reliable and transboundary conservation action plan (covering the Atlantic Portuguese and Spanish coasts) is urgently needed. This action plan should address the bycatch issue as well as the cumulative effects of other threats arising from the emergent blue economy activities, which might threaten the already fragile porpoise population connectivity, particularly between Portuguese and Spanish coastal waters.

Update on mercury concentrations in harbour porpoises (*Phocoena phocoena*) stranded in the Portuguese Coast

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Anthropogenic activities have increased contaminants in marine ecosystems up to harmful concentrations. Some toxic elements, such as mercury (Hg), can bioaccumulate on long-lived top predators. In marine mammals, Hg contamination can cause immune suppression, endocrine disruption and neurotoxicity. In the Iberian Peninsula, the harbour porpoise (*Phocoena phocoena*) population is small, genetically isolated and under several anthropogenic pressures, such as fisheries bycatch and pollutants. We evaluated Hg concentrations in the skin and liver samples of 46 porpoises collected by the strandings network team in the north coast of Portugal in 2014 and in 2023. Overall, the mean Hg concentration in skin samples in 2014 (2.27 ± 0.36 mg/kg dry weight) and in 2023 (3.29 ± 0.57 mg/kg dw) were similar. The same occurred for liver Hg concentrations in 2014 (11.66 ± 4.13 mg/kg dw) and in 2023 (10.58 ± 3.93 mg/kg dw). It is important to note that for the liver concentrations, only juveniles were analyzed. Liver contamination was also comparable to a previous study (juveniles = 7.47 mg/kg dw) that evaluated mercury concentration in porpoise livers collected between 2005 and 2013 for the same study area. A broader study will be done to improve the ecotoxicological evaluation of harbour porpoises in the Portuguese coast and to assess possible effects of biological variables such as sex, maturity and particularly age of the individuals. A co-relation between skin and liver samples will be established to allow for future ecotoxicological biomonitoring of this population. The harbour porpoise is included in the Annex II of the Habitats Directive (92/43/CEE) and an exclusively marine Site of Community Importance (PTCON0063) dedicated to porpoises was already defined in Portuguese waters. This preliminary evaluation corroborates that Hg concentrations remain high in porpoises and supports the need for a conservation strategy for this species in the Iberian coast.

Use of aerial and lateral photogrammetry for gender morphometric identification of free-ranging short-finned pilot whales (*Globicephala macrorhynchus*)

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Sex ratio is an important aspect in the study of population dynamics. However, the absence of calves, or the presence of young individuals in certain groups of cetaceans, makes it difficult to sex individuals. Here we develop a non-invasive technique based on aerial and lateral photogrammetry for sex determination in short-finned pilot whales (*Globicephala macrorhynchus*). Data were collected in the Azores and Canary Islands, using drones and reflex cameras. Individuals were sexed using: photo-identification catalogue, total length and presence of associated calves. Aerial images were collected from 62 individuals (37 females and 25 males), and lateral images from 21 individuals (16 females and 5 males), previously unequivocally sexed. Significant differences were obtained in the relative width ratio of the dorsal fin apex (H/A) (males: 0.749 ± 0.078, females: 0.655 ± 0.036); relative width of the rostrum (U/Z) (males: 0.067 ± 0.084, females: 0.128 ± 0.01); and relative dorsal fin position (X/W) and (J/A) (males: 1.127 ± 0.196, females: 1.426 ± 0.41) and (males: 0.842 ± 0.115, females: 1.063 ± 0.145). These results indicate that males have a dorsal fin with a larger base and surface area, and a narrower rostrum than females. Both tools provide an alternative to identify the sex of short-finned pilot whales with minimal impact and expand our knowledge of the population dynamics and conservation status of this species.

Use of coproparasitological methods for gastrointestinal and respiratory parasites identification in stranded cetaceans within Central and Northern Portugal's coast

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Parasites significantly impact the ecosystem, influencing the health of organisms and food chains. However, there is still limited knowledge about parasitism in cetaceans inhabiting Portuguese waters and its effect on stranding behavior. This project aims to report data on the prevalence of gastrointestinal and respiratory parasites in stranded animals along the Portuguese coast. A total of 75 fecal samples from stranded cetaceans were analyzed, including *Delphinus delphis* (n=50), *Phocoena phocoena* (n=18), *Stenella coeruleoalba* (n=3), *Tursiops truncatus* (n=2), *Balaenoptera acutorostrata* (n=1) and *Globicephala melas* (n=1), using quantitative and qualitative methods, such as Mini-FLOTAC, flotation, sedimentation, modified Ziehl-Neelsen stain (MZN), and a direct immunofluorescent antibody (DFA) test for Cryptosporidium sp. and Giardia sp. Also, samples were screened for the presence of macroscopic parasites. A total of 61% of the animals (46/75) were positive for at least one parasitic taxon, and 23% (17/75) showed co-infection for at least two parasitic taxa. Of the three techniques used, Mini-FLOTAC detected the most parasites, with 55% of the samples being positive, followed by flotation (45%) and sedimentation (43%). The most prevalent parasites were from the Phylum Nematoda, with the family Anisakidae and Order Ascaridida each having a prevalence of 36%, and Pseudolidae larvae with 5% prevalence. The Class Trematoda was identified through the presence of indeterminate eggs at 8%, *Odhneriella* spp. (5%), *Nasitrema* spp. (3%), *Zalaphotrema* spp. (3%), and *Synthesium* spp. (1%). Additionally, non-identified egg-shaped structures were found in 76% of the samples. However, all samples tested negative for Cryptosporidium sp. (MZN and DFA) and Giardia sp. (DFA). The present results may be used as a baseline for future monitoring studies targeting the impact of parasitic diseases on cetaceans' health and ecology and, therefore, contributing to the conservation of cetaceans by implementing management and conservation plans.

Use of photo-identification data to define female reproductive parameters of bottlenose dolphins (*Tursiops truncatus*) in the Tiber River estuary (central Mediterranean Sea, Italy)

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The assessment of female reproductive parameters is pivotal to determine the viability of bottlenose dolphin (*Tursiops truncatus*, BD) populations, especially those living in highly urbanized coastal areas. This study is focused on the analysis of these parameters in the BD population living in the Roman seas at the Tiber River estuary (central Tyrrhenian Sea, Italy), which is extensively exposed to commercial fishing, marine traffic and pollution. More than 450,000 photographs taken between 2017 and 2023 were analyzed using the photo-id technique to measure 6 parameters related to the population reproductive status (inter-birth-interval IBI, birth rate BR, calving rate CR, fecundity rate FCR, fertility rate FRR and calves' mortality rate MR). The analysis revealed that females tend to give birth on average every 3 years during the summer season, with a peak in June. Some of the calves die before the estimated weaning age of 2.8 years, with an overall MR of 14%. An unusual peak in MR was recorded in 2021, when 50% of newborn died. All other reproductive parameters showed bi- to triennial cycles over the 7-year study, with higher values in 2019-2020 and lower ones in 2021. Overall, the estimated BR is 6.6%, the CR 0.09, the FCR and the FRR 0.08. These rates are similar or slightly lower than other populations inhabiting anthropized estuary areas around the world, possibly indicating that BD at the Tiber River estuary is able to coexist with local human pressures. This hypothesis seems in agreement with the stability of the population abundance, estimated in 529 in 2017-2020 vs 525 over the entire study period. However, the high calves' MR in 2021, possibly influenced by the anthropogenic disturbance in June 2020 due to the re-opening after the lockdown period, needs further long-term monitoring to estimate possible effects on the state of this population.

Using a drone for the non-invasive collection of humpback whale blow samples in the breeding grounds of Cape Verde

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A modified drone can be used to collect and sample exhaled respiratory vapour, known as 'blow', of humpback whales (*Megaptera novaeangliae*) non-invasively in the breeding grounds of Cape Verde. This novel technique has potential to improve safety, efficacy, and financial cost of blow collection without forfeiting sample quantity and quality. This allows for sustainable observation and examination of the humpback whale population, as this methodology is of minimal stress to the whales and thus causes little behavioural change from normal cetacean behaviour. As part of a wider study examining viral prevalence in humpback whales throughout migration, comparing Iceland, northern Norway, and Cape Verde, we tested the methodology in the breeding grounds off the coast of Sal Rei, Boa Vista in the Cape Verde Islands from 26th March to the 9th April. A modified DJI Mavic 2 drone apparatus, fitted with ocean floaters and petri dishes, was launched from a boat and flown remotely to collect blows of humpback whales upon surfacing. Four petri dishes were attached with Velcro to the drone and swabbed upon return. Video recording of sampling allows for behaviour analysis and individual identification through unique tail fluke and dorsal fin photos. Unpreventable limitations specific to using this methodology include drone battery capacity restricting flight times to less than thirty minutes, and challenging recovery of the drone from an unstable boat platform. Over twelve days, 16 total drone flights collected 10 blow samples from 27 groups of whales, distinguished by tail flukes and dorsal fin patterns. This study validates the use of a drone for blow collection as a useful and reliable method, beneficial for conditions requiring minimal cetacean stress and allowing for distanced collection. Overall, this method is less restrictive, technically easier and safer, and far less invasive than other blow collection methods.

Using data collected aboard a whale-watching vessel to investigate the habitat preferences of cetaceans off the Southwest coast of Ireland

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This study analyses cetacean sightings collected during coastal whale watching boat trips operating from Baltimore in SW Ireland. A total of 639 sightings were recorded over 7141km of boat track surveys conducted during the summer months between 2021 and 2023. Four species were commonly sighted short-beaked common dolphins (*Delphinus delphis*), minke whales (*Balaenoptera acutorostrata*), harbour porpoises (*Phocoena Phocoena*), and fin whales (*Balaenoptera physalus*). In addition, occasional sightings were also made of humpback whales (*Megaptera novaeangliae*), Risso's dolphins (*Grampus griseus*) and bottlenose dolphins (*Tursiops truncatus*). Platforms of opportunity (PoPs) have proved invaluable for cetacean research and conservation, providing a cost-effective method of data sampling. Observations of species, number of animals, sighting locations, and behaviours were documented during trips. To account for survey bias, sightings rates for each species were calculated in 1km² cells throughout the survey area. The primary objective of this study was to examine changes in species sighting rates in the three-year dataset and determine the role of environmental variables on animal distributions. Environmental variables such as distance from shore, degree of slope, and depth were analysed. Both slope and depth had a significant effect on the species rate of fin whales and minke whales, however, no environmental variable was found to have a significant effect on dolphin sightings rates. Globally, cetaceans are threatened by anthropogenic disturbance, it is therefore essential to identify the primary drivers of habitat preference to apply conservation strategies and management plans effectively. This study's results can contribute to the understanding of species distributions around Irish waters, for example depths between 80-90m had the highest mean species rate for minke whales over the three years and Fin whale encounters occurred at depths between 60-70m each year.

Using whale watching data to explore the habitat preferences of two oceanic dolphins in São Miguel Island (Azores)

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In the Azores Islands, whale watching has become a valuable tool to obtain long-term cetacean data. In the present study, we analyse 11 years of whale watching data from the MONICET platform to explore the habitat suitability of two of the most frequently sighted delphinids in São Miguel Island: common dolphins (*Delphinus delphis*) and Atlantic spotted dolphins (*Stenella frontalis*). For this purpose, we designed Generalized Additive Models (GAMs) that study the relationship between dolphin occurrence and a set of environmental predictors. Candidate variables included depth and distance to the coast as static parameters as well as sea surface temperature (SST) and chlorophyll concentration with a daily resolution. Models were fitted to presence/absence data of each species, using sightings of non-target species as pseudo-absence background. To explore habitat segregation between the two species, we designed an additional GAM comparing presence data of both species collected during the period with the highest spotted dolphin occurrence (from July to September). The best-fitted GAM for spotted dolphin had an overall better performance than the common dolphin's, suggesting a strong preference of the species for SST above 20ºC. Alternatively, common dolphin results indicate a lower suitability for SST above 21ºC and a preference for higher levels of chlorophyll concentration. Modelling also shows that common dolphins favour slightly shallower and more inshore waters than spotted dolphins. Our results suggest a certain degree of spatial segregation, although the greatest differences relate to thermal suitability. Accordingly, a potential ocean warming scenario in the Azores might offer more suitable conditions for Atlantic spotted dolphins and, in turn, less favourable conditions for common dolphins, which could ultimately lead to changes in their occurrence and distribution. Moreover, the present study highlights the importance of using platforms like whale watching as a cost-efficient alternative to gather ecological data.

Variability of signature whistle emission in a bottlenose dolphin unit off the eastern Liguria coast (Italy)

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The common bottlenose dolphin (*Tursiops truncatus*) is a regularly present species in the Mediterranean Sea. Since 2001, the Fondazione Acquario di Genova has been conducting research on the ecology of this species off the eastern Liguria coast, within the Pelagos Sanctuary. The present study aims to investigate the acoustic behaviour of the bottlenose dolphin in this area, focusing on the use of signature whistles and their variability in relation to group composition and context. As a research platform for data collection, we used an inflatable boat (5.10 m long) with 2-4 researchers on board. In the case of a sighting, we collected photo-identification data (Nikon D700, equipped with zoom Nikon 70-200 mm) and acoustic data (Zoom H1n Handy recorder connected to an HTI-96-Min hydrophone). From May to October 2023, 24 diurnal surveys were carried out, resulting in 27 sightings of bottlenose dolphins and 67 uniquely photo-identified individuals. For the analysis of the acoustic data, we used Pamguard to extract the whistle contours and the SIGID (SIGnature IDentification) criteria to identify the signature whistles. In total, 05:53 hours of acoustic trace were analysed, and 1380 whistles were identified and examined through spectrographic analysis. Of these, only 79 met the SIG-ID criteria and were classified as “SIGID signature whistles”. These were further assigned to ten stereotyped classes of frequency modulation (possibly belonging to ten different individuals). A further 155 whistles, which did not meet the SIG-ID criteria, were identified as signature whistles due to the similarity of their frequency contour to one of the previously identified individual signatures. These latter were classified as “NON-SIGID signature whistles”. Our results suggest a large variability in the use of the signature whistle, possibly connected to group composition and context, which the SIG-ID criteria can only partially cover.

WDC Shorewatch: Empowering communities to fill crucial seasonal data gaps for cetacean conservation

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Citizen science offers a flexible, cost-effective, and inclusive approach to address data gaps in challenging locations and time frames. The WDC Shorewatch Programme is a citizen science initiative which since 2007 has been monitoring cetaceans in Scottish coastal waters. Shorewatch trains volunteers to conduct systematic land-based observations of cetaceans using a defined protocol and has traditionally been focused on the summer months when environmental conditions are more conducive to watching. After reviewing over a decade of Shorewatch data in 2021, clear gaps in effort during the winter months were identified. Recognising the importance of maintaining observations year-round, Shorewatch responded with a campaign to encourage data collection throughout the winter. The programme proved well-designed to fill this gap: locally based volunteers are ideally situated to target short windows of favourable local weather conditions and the 10-minute watch protocol is optimised for surveying when cold or daylight might prohibit longer surveys. As a result, the winter campaign doubled the amount of effort conducted over the winter. This demonstrated that by engaging enthusiastic, dedicated volunteers, citizen science can extend research efforts through the winter months, providing critical insights into seasons that are often subject to lower research effort. With standardised training and support, Shorewatch citizen scientists become essential data contributors in their local area. This not only increases temporal coverage but also fosters public participation, creating a dynamic and collaborative partnership between scientific research and community involvement. Shorewatch's transition to a year-round data collection programme showcases its adaptability in addressing winter data gaps, making a crucial contribution towards meeting national and international conservation objectives in monitoring cetaceans in Scottish coastal waters.

Whales from above: knowledge acquired from long-endurance fixed-wing Remotely Piloted Aircraft Systems (RPAS)

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Long-endurance medium fixed-wing Remotely Piloted Aircraft Systems (RPAS), operating beyond radio line of sight by satellite communication system, and equipped with video cameras allowing for real-time monitoring, are still poorly used for megafauna studies. This is due to their high cost, highly demanding logistics, and the difficult process of getting the appropriate authorisations. In the past two years, the Italian Coast Guard has been using the RPAS TEKEVER AR5 Evolution (AR5e), provided by the European Maritime Safety Agency – EMSA and managed by the REACT Consortium, to investigate its potential for cetacean monitoring, in collaboration with Tethys Research Institute. The 7.3-m wingspan AR5e was used over a small (40 x 37 km) portion of the Pelagos Sanctuary (North-western Mediterranean Sea) during 54 days between July 2022 and June 2023, resulting in 113 hours of observations over 11,430 km. In total, 66 sightings of seven species were made including 24 fin whales, 14 striped dolphins, and seven sperm whales. The study showed that RPAS are an efficient tool for systematic monitoring of cetaceans with several advantages over traditional methods, such as being human-risk-free, non-invasive, and having a small carbon footprint. Moreover, the use of RPAS can help reduce observer fatigue, allow double-checking for missed animals, and provide extended circling above the animals. The study also highlighted some issues that need to be resolved, such as poor satellite signal, low-definition cameras, and limited airbase availability. The challenges of obtaining flight permits for RPAS have been significant, requiring a great deal of attention to administrative and legal details. However, the experience gained through this project has helped to bring people together and develop a workable process among the relevant authorities. It is hoped that the lesson learned from this project will help use RPAS for cetacean monitoring in future missions at a larger scale.

What body condition measurements and blood draws tell us about the vulnerability of harbour porpoise (*Phocoena phocoena*) populations?

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Harbour porpoise populations are vulnerable to human activities. The Baltic population is critically endangered, and the Belt Sea population has decreased substantially in the past years. Many porpoise populations experience increased pressures from anthropogenic activities, and the health status and life expectancy of porpoises has decreased in many populations.
Measurement of age, growth, blubber thickness and serology are important tools for monitoring the status of wild porpoise populations. Data were collected from by-caught and stranded Belt and North Sea harbour porpoises during the past 30 years, and from animals momentarily caught and afterwards released after tagging in Danish waters. Data on wild animals were compared to longitudinal data from monthly measurements of girth, blubber thickness, weight and length collected from trained animals. The combined data sets were used to distinguish between seasonal and health-related issues. There was a strong seasonal influence on the blubber thickness and girth of both wild and trained animals. Therefore, measurements of blubber thickness should be used with caution as an indicator for the health status of individuals and populations.
Our results emphasize the value of collecting morphometric and physiological data on wild and trained animals to better understand the vulnerability of harbour porpoise populations.

Where are you from? The origin of *Pseudorca crassidens* (Owen, 1846) in the Mediterranean Sea explained by genetic analysis on historical and modern samples

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The false killer whale (*Pseudorca crassidens*) is among the largest species of the family Delphinidae and is found with a fragmented distribution in tropical, subtropical and warm temperate waters. Individuals usually form large groups, which inhabit oceanic waters and are rarely observed in coastal areas, and due to their marked social behaviour are often involved in mass strandings. The species is rarely encountered in the wild and information about its abundance, ecology and biology are limited and usually obtained from the study of captive animals, stranded individuals and observations of groups around oceanic islands. In the Mediterranean Sea the species is recorded since historical times, however false killer whales are only considered as "visitors" in this area. Sightings of large groups have recently become more frequent suggesting a re-expansion of its original distribution range or a recent entry from the Red Sea through the Suez Canal. In order to clarify the status of the species in the Mediterranean Sea, modern and historical samples of Mediterranean false killer whales were collected from national and international institutions. Genomic DNA was extracted, the mitochondrial DNA Control Region analysed and our sequences compared with those previously published. Genetic analysis revealed i) the misidentification of two historical samples, ii) the presence of an Indo-Pacific haplotype in a modern specimen and iii) of a new haplotype in all historical samples. These preliminary results support the hypothesis of a recent entry of "lessepsian migrants" while in the past the Mediterranean Sea was probably inhabited by a resident population or was frequented by individuals coming from a single Atlantic population. Information obtained could be useful to expand knowledge about a species that is difficult to observe and sample in the wild, and consequently to help the implementation of conservation plans for false killer whales in highly impacted areas.

Where whales are born

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A group of Southern Right Whales (*Eubalaena australis*) annually travels the migratory route between the Antarctic region and South America. In Brazil, on the south coast of Santa Catarina, comprising the municipalities of Garopaba, Imbituba and Florianópolis. Mostly, pregnant mothers enter the closed and protected coves to give birth and breastfeed. They play a vital role in the health of the oceans, helping to supply oxygen, combat climate change and sustain fish stocks.The way whales feed, poop, migrate and dive between the surface and the depths of the ocean (known as the "whale pump") circulates essential nutrients throughout the ocean, contributing to photosynthesis of plants, algae and cyanobacteria, and consequently contributing as a major source of carbon absorption (carbon sink), which favors planetary balance.
Therefore, it is of extreme educational and cultural relevance to bring to light this topic closely linked to the history and culture of the populations of the coast of Santa Catarina. Southern Right Whales and residents of this region have lived together for hundreds of years. However, a coexistence that was not always peaceful. Hunted for centuries, right whales disappeared from the coast, and currently the Southern Right Whale is in danger of extinction.
In this context, this research has the general objective of generating and disseminating knowledge about the recognition and importance of preserving the Southern Right Whale nursery in Santa Catarina/Brazil. To achieve this objective, the following specific objectives were proposed: (i) understand the challenges that need to be overcome during the migratory journey of *Eubalaena australis* and for its stay in the maternity coves; and
(ii) investigate the perspective of popular leaders, researchers, fishermen, indigenous people, environmental consultants, and local residents, on the importance of producing a documentary and on the possibilities of interaction between *Eubalaena australis* and society.

Whistle characteristics of rough-toothed dolphins (*Steno bredanensis*) in the Madeira archipelago

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Cetaceans rely heavily on acoustic signals for many of their vital and social functions. The vocal repertoire of many delphinid species include narrowband tonal signals, known as whistles, used mainly for communication purposes. The vocal characteristics of rough-toothed dolphins (*Steno bredanensis*) have received relatively little study due to their mainly oceanic distribution. Here we present preliminary results of the first quantitative study of whistles' characteristics of this species in the North East Atlantic. Acoustic data were collected in the waters of the Madeira archipelago between July 2022 and August 2023. During the 302 minutes of recordings, a total of 4785 whistles were recorded, of which 3566 with defined contour and relatively good signal-to-noise ratio, suitable for statistical analyses. Among the six whistle categories defined (i.e., constant, ascending, descending, convex, concave and sine), the ascending was the most common (n = 1622; 45.5 %), followed by the descending (n = 1228; 34.4 %) and by the convex (n = 473; 13.3 %). Whistle fundamental frequencies spanned from 1.09 to 18.09 kHz, with most energy produced between 4.86 and 8.80 kHz. Whistles presented a mean duration of 0.52 seconds, while gaps and steps presence accounted for 80.26 % of the total. Preliminary comparisons with previously studied populations of rough-toothed dolphins reveals differences in frequency range and duration in the North East Atlantic group. Interpopulation variances suggests that specific behaviours and environmental conditions may play a role in shaping the acoustic features of whistles emitted by this species.

Whistles production of common dolphins during specific behavioral contexts in two regions of Portugal (Algarve and Lisbon Coast)

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The common dolphin (*Delphinus delphis*) is one of the most frequently observed cetacean species in the Algarve and Lisbon Coast, Portugal. However, more information is needed on its acoustic repertoire. The present study aims to characterize and compare the whistle emission of this species in these two locations. Data were collected from August to December 2023. The species' whistles were recorded in different contexts and categorized according to the key activities observed at the surface, such as travelling, socialising, and foraging. Based on 19 hours and 28 minutes of effort in the field, the recordings in the Algarve resulted in 2652 whistles counted in 26 recording samples (78 minutes and 25 seconds of sound recordings). Only traveling (1.49 whistles/min/dolphin recorded, 53% of total observation time) and socialising (2.05 whistles/min/dolphin recorded, 47% of total observation time) were observed. In the data collected from the Lisbon Coast, 652 whistles were counted in the 29 recording samples (89 minutes and 02 seconds of sound recordings), based on 19 hours and 28 minutes of field effort. Social behavior presented the lowest whistle emission, followed by traveling (0.40 whistles/min/dolphin recorded; 34% of total observation time) and foraging (0.46 whistles/min/dolphin, 59% of total observation time). In both locations, groups socialising had more individuals and groups travelling featured fewer individuals. In the Algarve, socialising had the highest whistle rate, while at the Lisbon Coast, foraging presented the highest whistle rate. The higher rates of whistles during social interactions (Algarve) and feeding-related behavior (Lisbon Coast) may indicate that whistles are used to coordinate or regulate these activities. The results of this 2023 pilot project provide the first insight into the acoustic behavior of common dolphins in the Algarve and Lisbon Coast and highlight how the production rates of whistles depend on the dominant activity.

Widespread social adaptation to foraging and scavenging behind trawlers: the case of bottlenose dolphins in the NW Adriatic Sea

Bonizzoni, Silvia (1); Bearzi, Giovanni (1)

1. Dolphin Biology and Conservation

The social structure of delphinids has often been found to be influenced by human activities. We investigated the social and community structure of common bottlenose dolphins *Tursiops truncatus* in a 3000 km2 open-sea area off the region of Veneto, Italy, based on six years (2018–2023) of survey effort encompassing 27,667 km of navigation and 1388 km of dolphin tracking. Photo-identification was performed on 132 days (April–October), totalling 60,589 digital photos of single dorsal fins. Based on metadata of geo-referenced identification photographs, individuals were considered as members of the same "group" if photographed within a time-space window of 10 min and 300 m of one another. We considered high-quality photos of well-marked individuals, and restricted our analyses to a subset of 107 adults encountered in five or more years. The mean half-weight association index was 0.05 (SD 0.02), and differentiation analyses evidenced a "well socially differentiated" population (S=0.996). Permutation tests suggested non-random associations, preferred associations, and avoided-associations. Hierarchical cluster analysis (CCC 0.83, modularity 0.45) indicated four main clusters composed of 12–36 individuals. In days of trawling, 106 (99.07%) of the 107 dolphins included in the analyses were observed foraging behind and/or scavenging in the proximity of trawlers. Degree of "affinity" for trawlers was investigated by attributing an index based on the number of photographs of a given individual taken while following/not following a trawler. Social network analyses of dyad-associations in days of trawling revealed 1) within-cluster associations significantly ($p<0.001$) stronger than those between clusters, and 2) a generally high affinity for trawlers for all clusters—indicative of widespread social adaptation to opportunistic foraging and scavenging in the proximity of trawl nets. This information can inform conservation and management strategies within an area known to be among the most intensively-trawled, and having the worst seabed status, globally.

β-amyloid immunohistochemistry in cetacean brains from Italy

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Cetacean brains are uniquely adapted to diving, but can be afflicted by diseases, exposure to contaminants, and noise, triggering neurodegenerative processes that may cause stranding. Some species exhibit a significant post-reproductive life-span (PRLS), increasing the likelihood of observing cumulative and age-related pathology. β-amyloid immunohistochemistry is increasingly implemented to assess Alzheimer's disease-like neuropathology in cetaceans, but inter-population comparisons are lacking. We tested 33 cetaceans' (28 *Tursiops truncatus*—Tt; 5 *Stenella coeruleoalba*—Sc) parietal cortex, our most consistently archived cerebral tissue, in immunohistochemical analyses with a monoclonal rabbit antibody targeting the β-amyloid-(oligomer)-42 (ab201060; Abcam). The freshly-fixed brains originated from under human care (17) and stranded wild (16) dolphins in Italy (28 adults; 5 calves). Dolphins under human care had known ages; wild dolphins' age was estimated using morphometric references. Brain tissue from old dogs with multifocal β-amyloid plaques was the positive control. Secondary antibody specificity was checked in each species by omitting the primary antibody. β-amyloid-42 antibody cross-reacted with both Tt and Sc brains. Plaques were observed in two Tt females—one from under human care (> 59 year-old), and one adult wild dolphin. Generally, young (< 10 year-old) dolphins and calves had a moderate cytoplasmic neuronal signal and cortical background, while this cross-reaction in older (> 30 year-old) adults was more variable and less intense. There were discreet individual differences. Our findings suggest that while β-amyloid-42 is clearly present in the tested cetacean species, it may be more differentially expressed than in terrestrial species with a long PRLS, especially considering their evolutionary adaptations to diving and hypoxia. These results differ from the relatively higher abundance of plaques in a sample of Atlantic cetaceans recently tested with the same antibody. Their significance should be determined in a multidisciplinary discussion, considering individual pathologies, and corroborated by increasing species- and age-specific baseline data.

“Whalecoin”, recovering whale populations as carbon offset credit within extension of the EU Emissions Trading System to maritime transport

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To achieve CO2 reduction, the EU-ETS was introduced in EU (2003/87/CE). ETS aimed to create an european GHG market with cap on emission and free allowances encouraging reduction. CO2reduction, however, is achieved also through sequestration in NBS i.e. restoring terrestrial/coastal forests. Whales have been recognised as contributor of carbon sequestration (through nutrient transfer enhancing phytoplankton and body carbon storage), furthermore researchers, including IMF, have suggested a carbon asset based on whales recovering. Fin whale, e.g., is considered vulnerable globally and endangered in the Mediterranean according to IUCN Red List and population is a fraction of before modern whaling. Among the main anthropogenic threats/pressures to the species there are the shipping-lanes: general vessel disturbance disrupting the habitat for the species (more dangerous in feeding, breeding and nursery grounds and in specific seasons), ship strikes, shipping noise. Shipping-lanes however are essential for human population with sustainable transport of goods, products and people, although affecting marine environment. To reduce such threats/pressures actions are suggested: voluntary shipping measures, relocation of routes, new PAs onboard observers. Measures are however costly, e.g. increase of CAPEX, that the shipping industry cannot afford all on its own especially for the extra cost coming from EU-ETS, for which, from 2024, the maritime transport is subject. Seeing the relationship among “CO2 sequestration-whale recovering -carbon sequestration-ETS” a whale carbon offset credits scheme within ETS could be considered (as for forests), both voluntary and mandatory, as well as auctioning revenues of maritime transport bounded to whale conservation actions. Intricate issues, however, still need to be considered: quantifying value of whales (primarily CO2, but also biodiversity); proper financial mechanism for investors; measuring and certificating CO2 stockage&leakage, ownership and MRV. Nevertheless, such a scheme could increase marine species protection and enhance whale conservation.