7th Marine Mammal Student Symposium

Exploring the Digital Deep: Technologies Shaping Marine Mammal Research and Management

Program

10:00 - 10:05 Welcome and introduction

10:05 - 10:30 NAMMCO, NCLOS & Arctic and Marine Biology (AMB) Presentations

10:30 - 11:00 Session 1: Student talks

1. Julien Fetet
   (miRNA-155 profiles in the supernatants of killer whale (Orcinus orca) primary fibroblasts exposed to an environmentally relevant organic pollutant mix)
2. Agnieszka Starczewsja
   (The Underwater Data Centres – A Threat or a Solution to the Climate Change)

11:00 - 11:15 Coffee break

11:15 - 12:00 Session 2: Student talks

1. Azin Vedadi
   (Harnessing AI to Reduce Bycatch: A Sustainable Future for Fisheries)
2. Faith Cunningham
   (Movements, diving behaviour and group fidelity of long-finned pilot whales in Northern Norway)
3. Louise Fargette
   (Morbillivirus Prevalence and miRNA Expression in the blow of Norwegian cetaceans)

12:00 - 13:00 Lunch break with pizza

13:00 - 13:45 Session 3: Student talks

1. Lucie Laporte-Devylder
   (In the Tracks of a Whale: Thermal Drones for Non-invasive Marine Mammal Monitoring)
2. Noor Elias
   (Establishing a Baseline for Detecting Anthropogenic Impacts on Bottlenose Dolphins (Tursiops truncatus)
3. Veslemøy Mantor
   (Development and use of an ex vivo adipose-tissue based model on cetaceans: Effects of stress hormones on the expression of key immunity genes)

13:45 - 14:00 Coffee break

14:00 - 14:40 Session 4: Keynote speakers

1. Bastiaan Klerk
   ((PhD student, Norwegian Centre for the Law of the Sea, UiT)
2. Konstantinos Deligiannis-Virvos
   (PhD student, Norwegian Centre for the Law of the Sea, UiT)

14:40 - 14:50 Coffee break

14:50 - 16:00 Session 5: Keynote speakers

1. Camilla Brattland
   (Associate Professor, Sami cultural studies, UiT)
2. Audun Rikardsen
   (Professor, Arctic and Marine Biology, UiT)

16:00 Wrap-up followed by informal networking

NCLOS
NORWEGIAN CENTRE FOR THE LAW OF THE SEA
A UiT Aurora Centre

NAMMCO

UNIVERSITY OF TROMSØ

7th MARINE MAMMAL STUDENT SYMPOSIUM PRESENTERS

1. Julien Fetet (NORD University) 1

miRNA-155 profiles in the supernatants of killer whale (Orcinus orca) primary fibroblasts exposed to an environmentally relevant organic pollutant mix 1

2. Agnieszka Starczewsja (PhD, University of Warsaw) 1

The underwater data centres- a threat or a solution to the climate change 1

3. Azin Vedadi (Independent Researcher) 2

Harnessing AI to Reduce Bycatch: A Sustainable Future for Fisheries 2

4. Faith Cunningham (Arctic and Marine Biology, UiT) 3

Movements, diving behavior and group fidelity of long-finned pilot whales in Northern Norway 3

5. Louise Fargette (NORD University) 3

Morbillivirus Prevalence and miRNA Expression in the blow of Norwegian cetaceans 3

6. Lucie Laporte-Devylder (PhD, University of Southern Denmark) 4

In the Tracks of a Whale: Thermal Drones for Non-invasive Marine Mammal Monitoring. 4

7. Noor Elias (Marine Biology, Bangor University) 4

Establishing a Baseline for Detecting Anthropogenic Impacts on Bottlenose Dolphins (Tursiops truncatus) 4

8. Veslemøy Mantor (Arctic and Marine Biology, UiT) 5

Blubber under stress: Impacts of stress hormones on the expression of immunity genes in an cetacean ex vivo model. 5

1. JULIEN FETET (NORD University)

MIRNA-155 PROFILES IN THE SUPERNATANTS OF KILLER WHALE (ORCINUS ORCA) PRIMARY FIBROBLASTS EXPOSED TO AN ENVIRONMENTALLY RELEVANT ORGANIC POLLUTANT MIX

Anthropic pollution is a major threat to marine mammals, which are long-lived and have low reproductive rates. Persistent organic pollutants (POPs) accumulate in top predators like cetaceans, leading to endocrine, reproductive, immune, and neurological disturbances, especially at high concentrations. The BLOWOMICS project, in collaboration with the SLICE and Mama-Detox project, investigates the impact of POPs on microRNA (miRNA) expression using fibroblast cell cultures derived from Norwegian killer whale (Orcinus orca) skin biopsies. This study focuses on miRNA-155, a key regulator of immune responses, to assess its expression levels in fibroblast cells exposed to a mixture of the ten most abundant POPs found in killer whale blubber. These findings will help determine whether fibroblasts are a suitable model for studying pollutant-induced alterations in miRNA expression in cetaceans and will contribute to characterising the biomarker potential of miRNAs for pollutant exposure in whales.

2. AGNIESZKA STARCZEWSJA (PhD, University of Warsaw)

THE UNDERWATER DATA CENTRES- A THREAT OR A SOLUTION TO THE CLIMATE CHANGE

The rapid advancement of technologies—especially Artificial Intelligence and social media—has driven demand for data centres, intensifying the need for effective cooling solutions. Underwater Data Centres (UDCs), such as Microsoft's Project Natick in the North Sea, offer a potential remedy. These experimental centres are being evaluated for durability, energy efficiency, and environmental impact, with the hope of offering a more climate-friendly alternative to land-based centres.

This paper first explores the legal status of UDCs, questioning whether they should be treated as submarine vessels (despite lacking a state flag) or as seabed infrastructure similar to submarine cables, given their likely permanent placement. It also examines the implications of their physical presence on marine ecosystems.

Secondly, it addresses liability in the event of malfunction, referencing the Nairobi International Convention on the Removal of Wrecks. While UDCs do not meet the Convention's Article 1.2 definition, they may qualify under Article 4(c), potentially bringing them within its legal framework.

Thirdly, the paper analyses environmental concerns, particularly in areas beyond national jurisdiction. Although UDCs are often described as eco-friendly due to low cooling energy needs and reliance on solar and offshore wind, critics warn they may shift environmental burdens to the ocean. Key risks include nitrogen leakage, electronic waste, heat emissions (especially at large scale), susceptibility to sound attacks, and effects on marine life.

Finally, the paper evaluates UDCs under the 2023 Agreement on the Conservation and Sustainable Use of Marine Biological Diversity of Areas Beyond National Jurisdiction (BBNJ Agreement). It highlights the urgent need for international legal frameworks to govern UDC deployment, ensuring they serve climate goals without introducing new threats to ocean ecosystems.

3. AZIN VEDADI (Independent Researcher)

HARNESSING AI TO REDUCE BYCATCH: A SUSTAINABLE FUTURE FOR FISHERIES

Fishing plays a critical role in global food security and economic stability, especially for coastal communities. However, one of the greatest challenges in the industry is bycatch—the unintentional capture of non-target species like marine mammals, seabirds, and sea turtles. Bycatch can be classified into legal and illegal categories. Legal bycatch refers to unintended catches that are reported and managed within regulations, while illegal bycatch occurs when fishermen deliberately fish in pristine, protected areas, often ignoring environmental safeguards. This issue is closely linked to Illegal, Unreported, and Unregulated (IUU) fishing, which severely impacts marine biodiversity and sustainable fisheries. With traditional bycatch reduction methods proving insufficient, artificial intelligence (AI) is emerging as a game-changing solution.

AI offers creative methods to reduce bycatch. Machine learning models can process vast amounts of data to predict high-risk areas for bycatch, allowing fishers to modify their routes. Computer vision technology integrated into onboard cameras and underwater drones can automatically identify and classify species, enabling fishers to release non-target species promptly. AI-powered acoustic sensors can detect marine mammals near fishing gear, sending real-time alerts to prevent entanglements. Satellite-based AI systems also monitor fishing vessels, tracking unusual patterns linked to illegal activities such as IUU fishing.

Successful examples of AI applications in fisheries management can be seen in countries like Norway, where AI-driven satellite monitoring and onboard surveillance systems help reduce bycatch and improve regulatory enforcement. However, for AI to reach its full potential, governments, international organizations, and the fishing industry must work together to invest in these technologies, making them more affordable and accessible.

The purpose of this article is to demonstrate how artificial intelligence (AI) can be used to minimize bycatch and improve sustainable fishing methods. AI's benefits in promoting ethical fishing and safeguarding marine ecosystems are undeniable, despite certain obstacles, such as expenses and data security concerns.

4. FAITH CUNNINGHAM (Arctic and Marine Biology, UiT)

MOVEMENTS, DIVING BEHAVIOR AND GROUP FIDELITY OF LONG-FINNED PILOT WHALES IN NORTHERN NORWAY

Long-finned pilot whales (Globicephala melas) are widely distributed and abundant throughout the North Atlantic, but sightings have appeared to increase in coastal areas in northern Norway over the past decade. However, little is known on the dynamics and ecological drivers of their movements in this region. Therefore, during March-August from 2023 to 2024 we equipped 11 long-finned pilot whales with satellite-linked tags off Andenes, northern Norway. The tags providing location and some dive information and transmitted data for 8-114 days (mean = 44) with movement ranging between 63 and 71°N. We identified areas of restricted search using first passage time and explored seasonal and diel patterns. The whales utilized mostly the continental shelf and the corresponding shelf break, but also periodically specific large and deep fjord systems. Two-third of their time were used in the upper 10 m of the water column, while most of their dives were within the 200-350 m range and rarely passing 600 m. Most deep dives ranged between 5 -10 minutes and rarely passing 12 minutes. Movement data suggest that individuals tagged within the same group systematically remained close together, providing insights into the social behaviour and stability of individual associations. Furthermore, individuals tagged in "super groups" appeared to have an association as they were periodically traveling together. Although individuals in these super-groups were mostly separated, they sometimes displayed the same overall movement directions. This study provides novel, important information on the movements of long-finned pilot whales at the current northern limit of their range in the North Atlantic. Our work also highlights the need for more coordinated efforts to monitor the movements of long-finned pilot whales, particularly in the northeast Atlantic, where their population structure is poorly understood and the whales likely exposed to increased anthropogenic treats.

5. LOUISE FARGETTE (NORD University)

MORBILLIVIRUS PREVALENCE AND MIRNA EXPRESSION IN THE BLOW OF NORWEGIAN CETACEANS

This research explores the prevalence of morbillivirus, a virus infecting cetacean respiratory systems, and its association with microRNA (miRNA) expression profiles. Specifically, the study targets humpback whales (Megaptera novaeangliae) and orcas (Orcinus orca) sampled in Kvænangen, a fjord in Skjervøy og Kvænangen, Troms, Norway in January 2025. The study employs non-invasive techniques, utilizing drones to collect blow samples from cetaceans in their natural habitat. Morbillivirus prevalence will be determined via q-PCR and miRNA expression will be sequenced. These analyses aim to uncover patterns of miRNA expression linked to viral infections, offering insights into immune responses and interspecies variations. Ultimately, the research seeks to identify miRNA biomarkers that could revolutionize the non-invasive monitoring of cetacean health.

6. LUCIE LAPORTE-DEVYLDER (PhD, University of Southern Denmark)

IN THE TRACKS OF A WHALE: THERMAL DRONES FOR NON-INVASIVE MARINE MAMMAL MONITORING.

Monitoring marine mammals is critical for their conservation, yet traditional methods can be invasive and limited in scope. Recent technological advances, particularly in infrared (IR) imagery and drone technology, offer innovative, non-invasive solutions for marine mammal detection and monitoring. IR imagery enables both direct detection, using the thermal signatures of warm-blooded, surface-breathing animals, and indirect detection, such as identifying thermal cues from flukeprints and water movements. While these approaches show promise, knowledge about the mechanisms behind the formation of thermal cues, their environmental dependencies, and their utility for species identification, age-class discrimination, and behavioral tracking remains limited. To address these gaps, we conducted preliminary field trials during the 2024 humpback whale (Megaptera novaeangliae) breeding season in La Reunion Island. Using a quadcopter drone equipped with IR cameras, we assessed the reliability of thermal cues, such as flukeprints, for detecting marine mammals, identifying species, and tracking movement dynamics. Flights targeted multispecies waters and intraspecific groups, including mother-calf pairs, to evaluate the potential of IR imagery in capturing relevant parameters and assessing their applicability for monitoring purposes. Moving forward, we are extending this research to Arctic waters to explore how environmental factors, including temperature gradients in contrasting coastal environments (subtropical vs. Arctic), influence the formation and characteristics of thermal cues. Additionally, we seek to investigate the underlying mechanisms of flukeprint formation, as well as the scope and limitation or their use under varying conditions. This research is part of 'WildDrone', a multidisciplinary EU MSCA project leveraging drone technology to address biodiversity challenges. As part of this initiative, cutting-edge machine learning techniques are being developed to automate detection and analysis, enhancing efficiency and scalability. By integrating drone technology, machine learning, and IR imaging, this study advances non-invasive marine mammal monitoring, unlocking the potential of recent innovations to support global conservation efforts.

7. NOOR ELIAS (Marine Biology, Bangor University)

ESTABLISHING A BASELINE FOR DETECTING ANTHROPOGENIC IMPACTS ON BOTTLENOSE DOLPHINS (TURSIOPS TRUNCATUS)

Ethograms are essential tools in the study of animal behaviour and provide valuable baseline data for monitoring potential impacts of human activity. This study presents the first detailed ethogram of wild bottlenose dolphins (Tursiops truncatus) inhabiting Cardigan Bay, Wales, and examines activity state budgets over a 9-year period (2011–2019). The ethogram consists of six activity states and 47 behavioural events. Travelling was the dominant activity, accounting for 85% of observed behaviours, with feeding observed in 7% of sightings. No significant changes in activity budgets were observed over time, between group sizes, or with the presence of calves. These findings establish a behavioural baseline for the population and underscore the ethogram's utility in detecting future behavioural changes potentially linked to anthropogenic impacts.

Cardigan Bay is an area of increasing human use, with activities such as marine tourism, vessel traffic, and fishing potentially influencing dolphin behaviour (Gregory & Rowden, 2001; Evans, 2020). Establishing a behavioural baseline is therefore essential to detect sub-lethal effects of these disturbances over time. By comparing these results with data from the Shannon Estuary, Ireland, we further explore the value of comparative ethology in evaluating anthropogenic influences across different European coastal regions.

8. VESLEMØY MANTOR (Arctic and Marine Biology, UiT)

BLUBBER UNDER STRESS: IMPACTS OF STRESS HORMONES ON THE EXPRESSION OF IMMUNITY GENES IN AN CETACEAN EX VIVO MODEL.

Marine mammals face multiple stressors i.e., pollution, disturbance and climate change, increasing circulating stress hormones. Yet their impacts remain largely unknown as traditional ecotoxicological studies are neither feasible nor ethical. Precision-cut adipose tissue slices (PCATS), initially developed using Northern Elephant seal blubber, offer a promising alternative. This master's thesis applies the PCATS model to Humpback and Sperm whale blubber biopsies. Viability was confirmed by quantifying the releaze of an intrinsic enzyme or by measuring consumption of oxygen. Furthermore, the potential of using RNA from PCATS to study effect on gene expression was investigated. Those results indicates that this approach is feasible for pilot, killer, humpback, and fin whales, but not for sperm whales.

The model was used to investigate the effect of stress hormones and identify key immune biomarkers, which have been studied in literature using a correlative approach. Humpback whale PCATS were cultured for 48 hours with 400 nM cortisol introduced every 12 hours, and 10 µM epinephrine added in the last 12 hours to mimic an acute stress response. RT-qPCR analysis showed cortisol alone and with epinephrine upregulated PPARG and downregulated TNFα and TLR4, indicating altered inflammatory and immune responses. These findings display a novel tool to investigate effects of stressors on cetaceans. Additionally, the changes in expression caused by cortisol emphasizes PPARG, TNFα and TLR4 as biomarkers of stress hormones with a cause-effect relationship.