MARINE MAMMAL STUDENT SYMPOSIUM

MAKING A DIFFERENCE, AS A SCIENTIST, IN A CHANGING ARCTIC

Tentative Program

9:00-9:15: Welcome and Introduction

9:15-10:45: Student Presentations on Marine Mammal Research

Anna Cecilia Jucksch Ellendersen

Genetic Monitoring of Killer Whales (*Orcinus orca*) and Humpback Whales (*Megaptera novaeangliae*) Populations in Northern Norway

Abstract

Based on our archive of individual biopsies (>100/species) collected previous years (2014-2018), we will build a database of complete mitogenomes of humpback and killer whales and include mitogenomes and partial mtDNA gene sequences (e.g. the control region) from online databases (e.g. NCBI). We will obtain the full mitogenomes using an in house developed high throughput protocol for next generation sequencing. The 300 bp paired-end sequencing will be performed on our Illumina MiSeq sequencer. Sequence data will be analysed on already developed bioinformatic pipelines. Nucleotide variation and phylogenomic inference analysed using e.g. Geneious. We will use the OBITOOLS (Boyer et al. 2016) environment to asses unique individual genetic variation.

eDNA has successfully been used to identify population specific mitochondrial DNA (mtDNA) haplotypes in other large vertebrates, e.g. whale sharks (Sigsgaard et al. 2016), and have also been used to detect and differentiate whale species (Foote el al. 2012).

In addition to the sequencing of the mitogenomes, the full nuclear genome of a white humpback whale will be sequenced as well, which opens possibilities in research concerning it's unique pigmentation and other related genetic characteristics.

Emma Vogel

Migration of Killer Whales Toward the Herring Spawning Grounds

Abstract

Killer whales *(Orcinus orca)* are a widely distributed marine mammal. These toothed cetaceans are top predators that typically specialize on specific prey types. While Antarctic and Pacific killer whale prey has a strong influence on their respective movement patterns, little is known about the seasonal movements of the North Atlantic killer whales off the Norwegian coast. Visual observations and photo identification have been used to track the movements of Norwegian killer whales, but effectively limit monitoring to near-shore and inner-fjord behaviors. Telemetry has the potential to reveal offshore behaviors and has been successfully used to track these whales. Along the Norwegian coast killer whales are believed to be strongly associated with the Norwegian Spring-Spawning (NSS) stocks of herring (*Clupea harengus*). To evaluate the impact of herring spawning events on Norwegian killer whale behavior we analyzed data from 38 individuals tagged with ARGOS transmitters from December

to March at two different herring overwintering areas; 2015-2016 outside Tromsø and 2017-2019 outside Skjervøy. Annual standardized NSS herring stock assessment data was modeled using Integrated Nested Laplace Approximations (INLA), allowing us to extrapolate herring biomass over the entire spawning area using the survey point values. We used mixed effects models to explore environmental covariates influence on the move persistence. The most parsimonious model suggests that both sun angle and herring biomass influence whale behavior. It also indicated that there is an individual level response to herring biomass. After the spawning events, most killer whales followed the herring to their summer feeding grounds in the Norwegian Sea, while others entered the Barents Sea, reaching as far as the ice edge off Novaya Zemlya. Our results confirm the importance of NSS herring and its phenology for Norwegian killer whales, as well as indicating that killer whales exhibit individual variability in behavioral response to herring biomass.

Theresia Ram

ID-Identification of Humpbacks Whales in the Barents Sea and the Troms stop-over Areas

Abstract

Since 2010, a seasonal humpback whale feeding aggregation has been observed in the near-shore waters of northern Norway, driven by wintering Norwegian spring spawning herring. Extensive photo-ID effort of these aggregations in northern Norway has allowed for the establishment of the North Norwegian Humpback Whale Catalogue (NNHWC). The Norwegian Sea is thought to be used as a migration corridor during the annual movement from the summer feeding ground in the Barents Sea to the winter breeding grounds. The main aim of this study is to investigate this movement of individual humpback whales by photo-identification analysis. To date, 889 individuals found in north Norwegian waters are registered in the NNHWC. Photo- identification data from the Barents Sea was gathered during a research cruise in September 2018. Both collections provide the basis to search for photographic matches between humpback whales in the two areas. One week of photo-ID effort in the Barents Sea resulted in the identification of 276 individuals, including two mother-calf pairs. Twenty-seven matches were found between this Barents Sea feeding aggregation and the NNHWC. While migrating south-bound, eight of the 276 identified humpback whales were re-sighted undertaking a feeding stop-over in northern Norway during the winter of 2018-19. The secondary aim will be to investigate site fidelity, the rate of seasonal return by individuals to northern Norway and to assess their arrival and residence times in the area. Differences in site fidelity and residence patterns may indicate varying foraging needs of individuals. These differences could be related to sex and/or reproductive status. Therefore, this study contributes to further understanding migratory habits of eastern North Atlantic humpback whales.

5 minutes break

Camille Saint-Andre

Institute of Marine Research

The Feeding Ecology of Harbour Porpoise in Norwegian Coastal Waters

The harbour porpoise is an abundant top predator in Norwegian coastal communities; as such, it is important to understand its ecological role. To this end, the diet of 134 harbour porpoises bycaught in Autumn 2016 (n = 61) and Spring 2017 (n = 73) in Norwegian coastal waters and fjords was investigated. Both stomach contents and stable isotopes (δ15N and δ13C) from muscle tissues were used to obtain a more complete picture of the diet. This study confirms harbour porpoises in

Norwegian coastal communities are mainly piscivorous. Demersal gadoid fishes dominated the stomach contents, and saithe (juvenile) was by far the most important prey species. While lipid-rich prey species are thought to be essential for harbour porpoises, due to their high metabolic demands, this study highlights the importance of more available but lean prey in the diet. The analysis of stable isotopes and stomach contents revealed a significant ontogenetic shift as well as spatiotemporal differences, although saithe was dominant in all groups (maturity class, sex, area, sampling period) in the stomach contents. There were no significant differences in the isotopic nor diet composition between male and female porpoises, suggesting they use similar habitats and prey resources. Changes in the diet composition of harbour porpoises in Norwegian coastal systems between 1988–1990 and 2016–2017 were described and suggest that prey availability has changed. The results support previous studies that found harbour porpoises to be generalist predators that consume a wide variety of prey species and display a flexible foraging behaviour, feeding opportunistically on locally abundant and accessible prey.

Maren Andrea Pedersen
Institute of Marine Research

Foraging Behaviour of Humpback Whales: Automatic Detection of Feeding Lunges from Two-Dimensional Data

Abstract

Rorqual whales forage almost exclusively by conducting so-called feeding lunges, but due to the difficulty gathering information about this behaviour through direct observation, especially lunges carried out deep in the water column. Though this behaviour was known there is still limited studies done on estimating food consumption based on lunge detections over time. Understanding whale foraging behaviour is an important tool in informing conservation and management of these animals, as well as mitigating potential effects of anthropogenic disturbance. The introduction of high-resolution digital tags recording 3D acceleration has allowed for the collection of complex movement data and increased our understanding of how whales feed. Specifically, lunges can be detected from specific movement signals in the 3D acceleration data. However, these tags are quite expensive, and there are still datasets obtained using simpler tags that have yet to be analysed. Therefore, we are developing an automated algorithm, for detecting lunges from 2-dimensional depth-time diving profiles. This algorithm has been tested on a dataset consisting of high-resolution data from 16 humpback whales (*Megaptera novaengliae*) tagged with high-resolution dataloggers, recording depth, 3D acceleration and sometimes 3D magnetometer data. The tagging took place in Kaldfjorden and surrounding areas from 2013 to 2016. The lunges marked from the 3-dimensional detector were used to validate the output from the 2-dimensional algorithm while optimising it. Additional validation was done by manually, through looking at the diving profiles and annotating where lunges might have taken place. The aim with the optimisation was to minimise the false positive detections, while maintaining or increasing the true positive detections. At this point in time this optimisation has shown a high degree of individual variation in what parameter modifications improves the lunge detection, but there are some general settings that can be used.

Bas Klerk and Davinio Dwarkasing
Law of the Sea

Noise Pollution - Seismic Airgun Surveys and their Harmful Effect on Marine Mammals.

Abstract

Due to the depletion of many existing oil and gas deposits, as well as technological developments, the fossil fuel industry is gradually shifting its aim to offshore resources. A method often used to locate such offshore resources are by making use of seismic airgun surveys (henceforth: SAS). The surveys are conducted by trawling arrays of airguns behind a ship which explode every 10-15 seconds. The noise permeates the seafloor and the signal that reflects back is deciphered to portray the substrates below.

Harmful effects

This technique may seem harmless, as it does not involve drilling. However, studies have shown that the noise pollution created by the SAS may have a severe impact on a wide range of marine mammals. The noise can blanket an area of over 300,000 km2, raising background noise levels 100-fold continuously for weeks or months. At least 37 marine species have been shown to be affected by SAS noise. These impacts range from behavioral changes such as decreased foraging, avoidance of the noise, and changes in vocalizations through displacement from important habitat, stress, decreased egg viability and growth, and decreased catch rates, to hearing impairment, massive injuries, and even death by drowning or strandings.

Legal aspects

Due to the multifarious nature of this activity and the scattered nature of international environmental law, the issue can be placed under a number of competing and unrelated treaties. This leads to the potential involvement of several international bodies and organizations, making it difficult to create a comprehensive legal regime to regulate the use of SAS. The call for better regulation of noise pollution has grown stronger in recent years. In 2012, the CBD stated that "...effective management of anthropogenic noise in the marine environment should be regarded as a high priority for action at the national and regional level...". For my thesis I will be examining the existing laws applicable to this issue and explore the possible legal solutions.

Sabine Hansen

Elusive species in the NAMMCO Area

Has there been a shift in distribution for vagrant species within the northeast Atlantic? Using stranding and observation data is there a significant northward distribution shift in striped dolphin, short-beaked dolphin and risso's dolphin.

10:45-11:00: *Coffee break*

11:00-11:30: The Challenges & Opportunities facing Science for Policy in a Changing Artic – Presentation by NAMMCO (North Atlantic Marine Mammal Commission)

Genevievé Desportes / Fern Wickson

11:30-12:00: Facilitated Interactive Discussion - Making a difference, as a scientist, in a changing Arctic

12:00-12:45: Lunch

12:45 – 14:15: Facilitated Interactive Activity with Exercises, Tips and Tricks for:

a) Effective Science Communication (to different types of audiences)

b) Networking to Build Collaborative Teams (at conferences and events)
c) Having Difficult Conversations (with supervisors, colleagues, members of the public)

14:15-14:30: *Coffee break*

14:30 – 16:30: Invited Guest Speakers on Relevant Legislation & New Tools for Performing Research in a Changing Arctic

Vito De Lucia

Law of the Sea, PostDoc Fellow

Vito De Lucia is Associate Professor at the Norwegian Centre for the Law of the Sea (NCLOS), UiT The Arctic University of Norway. His most immediate research interests are located at the intersection of critical theory, law and ecology. His current research agenda focuses on the concept of commons in international law, on the negotiations towards a new global treaty on marine biodiversity in areas beyond jurisdiction (BBNJ) and on Arctic governance. He is author of The Ecosystem Approach in International Environmental law. Genealogy and Biopolitics (Routledge, 2019).

Sofia Aniceto

Norges fiskerihøgskole, VISTA PostDoc

Going far and beyond with autonomous systems

Sofia Aniceto holds a postdoctoral position at the Norwegian College of Fishery Science department. She works on technology development for the environmental sector on a project titled *spatial and temporal analysis of marine mammal vocalizations using unmanned systems*. Her main interests in research is related to survey technologies, anthropogenic effects over marine mammals, species interactions, and behaviour.

Aniceto did her PhD project *"Unmanned aerial vehicles for marine mammal surveys in arctic and sub-arctic regions",* at Akvaplan-niva, on the development and application of unmanned sampling technologies for marine environmental surveys and monitoring activities.

Kim Præbel

Norges fiskerihøgskole, Group Leader

Using eDNA to Monitor Marine Mammals

16:30 – 18:00: Light tapas and Informal Networking.