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of the Society for Marine Mammalogy



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Sea Mammal
Research
Unit



Irish Whale
and Dolphin Group



Sea Mammal
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Instrumentation



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Physiology and Genetics

1

Understanding marine predator habitat use in the Mediterranean through eDNA

Elizabeth Boyse,

Maria Berger, Elena Valsecchi & Simon Goodman

University of Leeds

eDNA, referring to genetic material collected directly from the environment without isolating target organisms, has the potential to offer a fast, cost-effective method for monitoring species richness which is necessary for large scale biodiversity monitoring. The Mediterranean is a hotspot for marine megafauna biodiversity, including 10 resident species of cetaceans, 6 of which are listed as threatened by IUCN. Additionally, it is experiencing habitat degradation stemming from human activities and climate change. Therefore, it is important to improve understanding of marine biodiversity distributions to support better spatial conservation planning. Surface water samples will be collected on regular transects using ferry routes throughout the Mediterranean and marine vertebrate presence will be evaluated via DNA metabarcoding. eDNA derived marine megafauna presence will be compared against current species distribution models, including cetacean distributions derived from telemetry and marine mammal observers. These data will be used to better understand where areas of overlap exist between marine megafauna biodiversity and anthropogenic impacts, and to evaluate how eDNA surveys can enhance marine conservation management planning.

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Physiology and Genetics

2

Genetic variation of wild dolphins facing Morbillivirus infection: an immunogenomic approach

Cátia Silva,

André E. Moura, Sara C. Novais & A. Rus Hoelzel

Durham University

Top predators such as marine mammals are particularly prone to perturbations in the ecosystem due to their longevity and low fecundity rates. Adaptation to environmental change is thus crucial and strictly dependent on genetic diversity. Considered to be a significant mortality source in wild animals and being constantly introduced into host populations, pathogens represent a strong selective pressure for their hosts, which make host-pathogen dynamics particularly good models to study adaptation. Being a primary mass mortality agent in marine mammals worldwide, Morbillivirus has been the cause of severe outbreaks over the past 30 years in the Mediterranean Sea. Although major epizootic events are well documented, information regarding species susceptibility and possible prevention strategies towards disease outbreaks are still scarce. Taking into account the susceptibility hypotheses suggested in the literature, as well as the importance of using cetaceans as models for human and other animal diseases, this project aims to investigate how the interaction between an extrinsic environmental challenge and functional genetic variation, at the immune system level, affect the long-term viability and evolutionary potential of striped dolphin (*Stenella coeruleoalba*).

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Physiology and Genetics

3

Characterising grey seals' blubber structure

Laura Oller,

Joel Rocha, Mark Dagleish & Kimberley Bennett

Abertay University

Accurate regulation of energy stores is linked to reproductive success and survival. Fat deposition and mobilisation has been associated with changes in adipocyte size and number, extracellular matrix deposition, vascularity among other adaptations in other mammals. How seals' blubber adjusts with rapid body composition changes is unknown. Biopsy samples from mother and pup pairs ($n = 6$) were collected at early, late and pup's early weaning lactation. Samples were processed and stained with Masson's Trichrome. Biopsies were divided in three sections: inner, middle and outer blubber. Five microphotographs of each section were taken to be averaged. Adipocyte size/ number, collagen area and blood vessels were measured with Image J and Adiposoft plugin. Linear mixed models were used to investigate variation in relation to weight, depth and metabolic state with in each age class and comparison between fasting mums and pups. Preliminary results showed that, consistently with other mammals, adipocyte size increased with weight as adipocyte number per picture is reduced. Collagen area decreased in late lactation and weaning in pups, but not mum. Vascularity was not significantly associated to any measured variable. According to preliminary results, grey seals' blubber structure is not stratified and only adipocytes vary with weight changes.

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Physiology and Genetics

4

Blubber heat shock protein and redox enzyme mRNA abundance, and oxidative damage in female grey seals (*Halichoerus grypus*): support for the life-history-oxidative stress theory from an animal model of simultaneous lactation and fasting

Holly Armstrong,

Ailsa Hall, Simon Moss, Paddy Pomeroy & Kimberley Bennett

University of Plymouth

Life-history-oxidative-stress theory predicts that elevated energetic costs during reproduction increase oxidative stress because investment in defences is reduced, particularly when resources are limited. Reproducing female grey seals fast throughout lactation, providing a natural system in which to test these predictions. We measured mRNA abundance of key cellular defences, heat shock proteins and redox enzymes, during the lactation fast ($n = 17$) and in blubber of pre-breeding ($n = 13$) wild, adult female grey seals. We used malondialdehyde (MDA) concentration as an index of lipid peroxidation to investigate tissue-level trade-offs. We investigated whether maternal performance was affected by oxidative stress or investment in cellular defences in blubber. Cellular defences and MDA levels did not change during lactation. Nox4, a pro-oxidant enzyme, decreased late in lactation, which could reflect changes in cell populations, or insulin sensitivity, rather than altered redox status. Maternal performance during lactation was not affected by oxidative stress or investment in cellular defences. Pre-breeding females had lower mRNA abundance of redox enzymes and reduced MDA concentrations compared to lactating females. Fasting-lactating females thus experience greater oxidative stress compared to pre-breeding individuals and divert their limited resources into pup-rearing at the expense of blubber tissue damage.

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Physiology and Genetics

5

Using a UAS to track variation in body condition in maternal female humpback whales over the breeding season provides a useful tool to assess the quality of nursery grounds

Charlotte Dempster,

R. Cartwright, A. Venema, A. Jaeger, S. Garlington, S. Yarborough & N. Shapiro

The Keiki Kohola Project/ California State University Channel Islands

As capital breeders, maternal humpback whales utilize stored energy reserves to support the late stages of fetal development and the crucial early periods of lactation while effectively fasting. Consequently, energetic reserves are finite, conservation of available energy reserves is essential and high levels of disturbance during the earliest periods after parturition may impact both the immediate and future fitness of offspring. In this study, we used aerial photogrammetry, gathered using a small UAS to track changes in maternal body condition relative to the age of the calf. Initial analysis indicates a significant decline in body condition in maternal females between two calf stages, from a mean body condition index of 1.56 (s.d. 1.5) for mothers with neonate calves to 1.43 (s.d. 0.7) for mothers with non-neonate calves ($p = 0.029$). As body condition details for the Hawaii Distinct Population Segment have yet to be compiled, these details provide an initial baseline that could be applied to track variations between seasons and, with further refinement of this protocol, potentially between different nursery regions that are used by maternal humpback whales.

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Physiology and Genetics

6

Seals as sentinels of antimicrobial resistance: mapping antimicrobial resistance genes in UK waters

Lauren Arkoosh,

Debbie Russell, Kimberley Bennett & Scott Cameron

Abertay University

Antimicrobial Resistance Genes (AMRG) are a pressing concern to human and animal health. These genes are ubiquitous in the environment, and can spread rapidly because of human and industrial waste, agriculture, and aquaculture. Many of the waste products from these processes eventually make their way to ocean waters, providing AMRG ample opportunity to disseminate. Pinnipeds are apex predators in UK waters, sampling the entirety of the water column when they forage. Previous studies have examined a limited and biased number of known pathogens for AMRG, resulting in a poor understanding of which specific AMRGs are prevalent in non-pathogenic strains. This work has developed a medium-throughput screen to test for the presence of AMRG in seal scats, independent of the bacteria they are found in to characterise the seal gut resistome. Seal telemetry data will be overlaid with AMRG profiles from grey seals from different regions to produce a predictive map of AMRG spread by seals in UK waters that can be used to model transmission risk, as a basis for monitoring environmental AMRG, and as a tool for evaluating mitigation strategies.

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Physiology and Genetics

7

Estimating the prevalence of common skin diseases in a population of harbour porpoise (*Phocoena phocoena*) off the coast of North West Pembrokeshire

Sarah Dickson,

L. M. Smith, H. Dunn & L. M. Collins

University of Leeds

Harbour porpoises (*Phocoena phocoena*) are one of the most commonly sighted and widely distributed species of marine mammals in the waters around the British Isles. There is a lack of published literature providing population size and disease prevalence estimates for this species. Baseline estimates of these measures are essential in being able to predict and monitor future changes in a population and analyse these changes in relation to a dynamic environment, be that natural or anthropogenic driven changes. Estimates of disease prevalence and how prevalence changes temporally can provide insights into the effects of changing environmental variables such as temperature, salinity and pollution. Using three years of citizen science porpoise photo ID data across four sites in North West Pembrokeshire, we conduct a mark-recapture analysis to estimate the local harbour porpoise population size. Alongside this, we estimate the prevalence of common skin diseases, in particular pox virus, through visual analysis of the photographic data. The data will be analysed to identify temporal or spatial patterns in prevalence, as well as associations to marine pollution (heavy metal levels). In this presentation, we will discuss initial results of our study and describe future analyses.

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Physiology and Genetics

8

Wearable near-infrared spectroscopy as a tool to monitor safe levels of anaesthesia

Eva-Maria Bønnelycke,
Chris McKnight & Gordon Hastie
University of St Andrews

Ketamine and midazolam are two drugs that are commonly used for sedation and anaesthesia in a range of pinnipeds. While these are routine procedures in research, there are inevitable risks associated with chemical immobilisation. Such risks could potentially be alleviated through technology providing real-time physiological measurements, which can be relayed to researchers administering the drugs. Wearable near-infrared spectroscopy (NIRS) systems provide a non-invasive method for real-time monitoring of hemodynamic changes within specific tissues. This study will use existing NIRS data from 14 grey seals with prolonged anaesthesia induced through ketamine and midazolam. The aim is to understand the effects of each compound on heart rate, cerebral blood perfusion and arterial oxygen saturation. If these three parameters provide useful information on the effects of ketamine and midazolam, then NIRS systems can be used in future research in order to indicate safe levels of anaesthesia.

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Physiology and Genetics

9

Harbour seals (*Phoca vitulina*), grey seals (*Halichoerus grypus*) and the 3R's: Rescue, Rehabilitation and Release

Inês Catarina Fonseca Madeira Costa

Galway-Mayo Institute of Technology

Marine mammals' populations are threatened by anthropogenic activities, such as chemicals, marine litter and effects of fishing and habitat destruction (directly or indirectly). These can increase the number of seals admissions in rehabilitation centres in compromised health conditions. Besides, phocine distemper virus outbreaks that occurred in European waters cause the death of 23,00 and 30,000 harbour seals in 1988 and 2002, respectively. It was suggested that grey seals could have acted as a reservoir for the virus, spreading it. However, the impact of these two outbreaks in Irish harbour seal population is unknown, mostly due to the absence of pre-epidemic population data. This study aims to undertake a meta-analysis of the data collected by rehabilitation centres in Europe to evaluate health conditions of animals in rehabilitation, condition prevalence, age class sex composition, admission seasonality and hospitalization time. Assess techniques/procedures employed and survival rates after treatment, as well as temporal trends in diseases and traumatic conditions in both species. The incidence of observed conditions will be compared with other published data for both species. To assess expected diseases/ conditions in these seal in European water, which will aid rehabilitation centres in their work.



Marine Mammal and Human Interactions

1

Ship strike in the North-East Atlantic: Investigating the occurrence of whale collisions and near-misses

James Robbins,

Lucy Babey, Alex Ford & Sarah Marley

University of Portsmouth

There is increasing concern regarding the impact of shipping on marine megafauna. However, there is limited information on the prevalence of whale-vessel collisions and the responses of animals to near-misses. To narrow this knowledge gap, we aim to: 1) Quantify spatio-temporal patterns in vessel traffic in the North-East Atlantic; 2) Investigate overlap, collision risk, and probability of fatality of large baleen whales; 3) Determine the behavioural response of cetaceans to an oncoming vessel; 4) Incorporate the opinions and experiences of vessel crews regarding mitigation strategies. These aims will be achieved through analysis of existing datasets combined with fieldwork that utilises innovative technology. Vessel positions will be obtained from AIS data, whilst whale occurrence will be assessed using citizen science datasets collected from platforms of opportunity. In the field, high-tech camera systems will record fine-scale behavioural responses and questionnaires will be used to investigate crew opinions and suggestions. Overall, these results will help inform appropriate mitigation measures to reduce collision risk for whales in the North-East Atlantic.

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Marine Mammal and Human Interactions

2

Balancing the risk: Harbour porpoises respond to piling and vessel activities during offshore windfarm construction

Aude Benhemma-Le Gall,

Isla Graham, Nathan Merchant & Paul Thompson

University of Aberdeen

Offshore windfarm (OWF) developments are expanding, requiring assessment and mitigation of construction activities. Typically, this focuses on pile-driving, as intense impulsive noise elicits adverse behavioural responses in marine mammals. However, other construction activities can change acoustic habitats through increased vessel activity. We quantified variation in harbour porpoise occurrence and foraging activity over the two-year construction of Beatrice OWF in Scotland and related this to changes in vessel activity and the acoustic environment. Following a BACI design, arrays of echolocation click detectors were deployed in 25km by 25km impact and reference blocks throughout construction. Echolocation clicks and buzz inter-click intervals were used to investigate porpoise occurrence and foraging activity during different construction works. In parallel, deployments of acoustic recorders enabled us to measure broadband noise levels in different construction phases. AIS vessel-tracking data were used to characterise vessel activities at the site. Porpoise occurrence decreased during piling and vessel activity. Higher probability of buzzing further away from construction activities suggests that porpoises fleeing exposed areas maximised their foraging activity. Assessments should therefore account for all construction activities that may result in variation in local soundscapes, particularly where efforts to mitigate one noise source (e.g. piling) may increase other vessel-based activities.

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Marine Mammal and Human Interactions

3

Estimating seal bycatch from limited observer coverage

Cian Luck,

Michelle Cronin, Oliver Tully, Emer Rogan & Mark Jessopp

University College Cork

Bycatch, the incidental catch of non-targeted animals by fisheries, represents the dominant anthropogenic threat to many marine species worldwide. To identify populations that may be at risk, scientific observer programmes are used to estimate the total number of individuals being removed from a population as bycatch. As observer programmes rarely include more than a small proportion of total fishing effort within a fleet or management area, a range of methods have been developed to extrapolate observed bycatch levels to account for unobserved fishing effort. However, the majority of these methods have been applied to fisheries with long-running observer programmes, and considerable data gaps exist where extensive observer coverage is lacking. In this study we apply a range of published methods for estimating total bycatch to observed bycatch data of grey seals (*Halichoerus grypus*) in Irish static net fisheries. These data are the result of non-continuous observer programmes and are indicative of what may be available to marine nations without well-established observer programmes. Estimates of total seal bycatch are discussed in the context of the underlying assumptions of each method and compared to sustainable limits based on Potential Biological Removal (PBR).



Marine Mammal and Human Interactions

4

Investigating the response of mother-calf pairs of Bottlenose dolphins to small-craft noise

Aimee Kate Darias-O'Hara

University of St Andrews

Mother-calf relationships are imperative for the social development of young individuals. With the ever-growing usage of the ocean as a means for recreational boat use, little is known on the direct effects of small-craft noise on mother-calf pairs of Bottlenose dolphins. Sarasota Bay, Florida, is home to a well-studied population of bottlenose dolphins which reside within close vicinity to areas which are popular for small-craft recreational use. Over the last decade, D-Tags have been placed on these individuals, the aim of this study is to determine if rising levels of boat noise have an impact on the rate of whistling and behaviour of mother-calf pairs.



Marine Mammal and Human Interactions

5

Mitigating Small-Scale Fisheries Bycatch: Assessment of existing approaches for marine mammal and sea turtle conservation

Rita Meireles de Castro

IMBRSea

Small-scale fisheries (SSF) often are perceived as individually sustainable but comprise 95% of global fishers and cumulatively represent marine ecosystem threats. Marine mammals and sea turtles are particularly vulnerable to SSF bycatch and have been the focus of several conservation strategies. However, in many cases, such strategies have fallen short of objectives and effectiveness. This study aimed to elucidate the associated issues by conducting interview surveys with traditional SSF communities of Paraná coast (Brazil), and by compiling global mitigation measures among SSF, identifying: (i) successful measures and their influencing factors; (ii) information deficits; and (iii) a coherent approach to success. Among 150 peer-reviewed articles (1994–2019) there was exponential temporal output, and while most studies proposed mitigation measures (71%), only 43% provided effectiveness feedback. The rate of latter studies has recently declined, implying less time is being spent progressing improvements. Community engagement was largely disregarded from strategies but has been increasingly considered in the past decade. Opinions collected from the 35 interviewees corroborated literature findings: options are available to mitigate SSF bycatch, but these require impetus for adoption, which is best done via community engagement. Suggested guidelines can be used to improve global effectiveness of future mitigation strategies.

Acoustics

1

Exploring habitat use of bottlenose dolphins in the Shannon Estuary Special Area of Conservation (SAC) through visual and acoustic monitoring

Morgane Pommier

Galway-Mayo Institute of Technology

Static Acoustic Monitoring (SAM) is used extensively in cetacean research and can provide unique insights into ecological patterns undetected by visual surveys alone. As our understanding of cetacean bioacoustics grows and available analytical tools widens, scientists have started to investigate the possibility of inferring an animal's behaviour based its call characteristics. In this study, records from simultaneous visual and SAM techniques were explored to characterise bottlenose dolphin fine-scale habitat use near Moneypoint in the Lower River Shannon Special Area of Conservation (SAC). Whistle duration, modulation degree and shape were successfully correlated with simultaneous surface behaviours reported by observers, while modelling of acoustic data demonstrated significant temporal trends in dolphin occurrence across tidal cycle, diel cycle and tidal phase. Visual observations confirmed the importance of Moneypoint for foraging activities but the absence of clear relationship between whistle properties and environmental cycles limited our ability to identify other behavioural drivers behind dolphin site fidelity. Nevertheless, our findings provide a preliminary bases for the use of whistles as habitat-use monitoring tools. This work pursues the characterisation of Shannon dolphin vocalisation repertoire and contributes to our understanding of acoustic data collected in the area, supporting future interpretation of acoustic datasets when informing conservation plans.

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Acoustics

2

Habitat modelling of harbour porpoises in South West England using visual and acoustic data

Hayley McLennan

& Clare Embling

University of Plymouth

The harbour porpoise, *Phocoena phocoena*, is the UK's most common and widely distributed cetacean, but is classified as vulnerable in Europe by the IUCN Red List, and five of the seven Special Areas of Conservation in the UK were only officially designated in 2019. From January to September 2020 I will be conducting research on harbour porpoise populations in the South West of England. I will use visual and acoustic data from four previous surveys, and from a fifth survey in June, as well as habitat and satellite data. The aims of the project area as follows: 1. Investigate visual and acoustic detections of harbour porpoises differ and therefore the efficacy of these methods for detection. 2. Model harbour porpoises are found and how this relates to oceanographic drivers such as sediment type, sea surface temperature, and chlorophyll. 3. Discover whether and how abundance and distribution has varied over four years of surveys. This work will build on the framework for study and protection of harbour porpoises across the UK and provide more insight into the South West England population's status and dynamics.

Acoustics

3

Exploring humpback whale (*Megaptera novaeangliae*) acoustic behaviour in the eastern North Atlantic

Catherine Gibson,

Denise Risch & Jon Houghton

Queen's University Belfast

Humpback whales are one of the most well studied cetacean species, known to undertake substantial seasonal migrations between breeding grounds and feeding grounds. Humpback whale numbers were severely depleted by commercial whaling in the 20th century but their numbers are now on the increase in some regions, with data lacking in the Northeast Atlantic. There is a legal obligation to report on the status of these whales and currently there is not enough information on the fine scale spatial and temporal patterns. The project investigated the acoustic presence of humpback whales in the Northeast Atlantic across the seasons and diel cycle as well as describing the song structure using Soundtrap devices as part of the EU COMPASS project. 264 hours of recordings from two study sites (Stanton Banks & Tolsta) were scanned for humpback whale song using the whistle and moans detector in PAMGuard. Humpback whale song was only detected in March-May at both sites producing a highly seasonal pattern with no detections in the autumn. The timing and duration suggested this area is a migratory stopover for humpback whales on northbound migration. The song contained 15 units in six themes.

Acoustics

4

Spatial and temporal trends in habitat usage of Chilean dolphins around Isla de Chiloé based on C-POD data

Freddie Hack

University of St Andrews

Chile is well-known for its expansive aquaculture industry and with further expansion planned, it is important to know how they affect the marine environment. The Chilean dolphin (*Cephalorhynchus eutropia*) is a small cetacean found exclusively in the waters of Chile. Research has been conducted into the distribution of the Chilean dolphin and key habitat areas have been identified around the Isla de Chiloé. However, observation data are limited to days where visibility is good, mainly during daylight hours of the summer months. While current distribution shows no overlap between salmon fisheries and Chilean dolphins, there is still time unaccounted for in current models. To monitor their presence over the whole year, five C-PODs were set up around San Pedro and Yaldad to detect the narrow band, high frequency (NHBF) vocalisations. Evidence in other *Cephalorhynchus* species suggests diurnal movements and seasonal migrations. The analysis will focus on using Dolphin Presence Minutes (DPM) to look for any trends in presence/absence daily and throughout the year, as well as a comparison between the five sites. Results from this study will help to inform potential impacts of expanding aquaculture and improve efforts to protect the small populations of Chilean dolphins.

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Acoustics

5

A multi-method approach to understanding the ecology of harbour porpoise in Irish waters

Nicole Todd,

Mark Jessopp, Emer Rogan & Ailbhe S. Kavanagh

MaREI Centre, University College Cork

Under the EU Habitats Directive, cetacean species must be maintained at favourable conservation status in European waters. Whether this is achieved via protected area designation, curtailment of activities such as fishing or construction, or time restrictions on noise, it is dependent on understanding the temporal patterns in occurrence. Previous research in Broadhaven Bay, Co. Mayo highlighted the importance of long-term acoustic data and showed that clear seasonal patterns existed, with peak occurrence in winter (which would have been otherwise under reported by visual surveys). Applying the same knowledge to the Southwest Irish waters, in Roaringwater Bay SAC could inform mitigation and highlight the movement of harbour porpoise and dolphins along the Irish coast. The acoustic data collected, from previous Broadhaven research and future sites, will also be used to determine the habitat usage of the study sites. By looking at the acoustic characteristics of the data, based on the inter-click interval, it can be determined when individuals are engaged in foraging behaviour. Hence, 'hot spots' for foraging can be identified within the study areas, and the percentage time individuals are engaged in foraging in relation to total echolocation rate can be derived.

Identifying the foraging habitat of Scotland's bottlenose dolphins using Passive Acoustic Monitoring

Megan Ryder,

Luke Rendell & Ross Culloch

University of St Andrews

Identifying foraging habitat in marine mammals often involves tagging, which provides fine scale information about movement and prey-capture attempts, but only for individuals at small geographic scales. Obtaining broad-scale information on feeding areas for Scotland's East coast population of bottlenose dolphins will help to inform management decisions, by identifying areas of critical habitat for these animals. Bottlenose dolphins use echolocation clicks to detect prey, which increase in frequency as they approach their target. Prior to a capture attempt, the rate of clicks drastically increases, these are referred to as 'feeding buzzes'. Passive acoustic devices, such as CPODs, record these clicks, which can then be filtered based on the inter-click interval to identify foraging events. In 2013, the ECoMMAS project was developed to monitor Scotland's East coast bottlenose dolphin population through the installation of 30 CPODs. Using the data collected from 2013-2015, I will identify foraging areas along the East coast of Scotland by obtaining probabilities of feeding buzzes for each pod location. Spatial analysis and GEE-GAMs will then be used to identify important environmental and temporal covariates associated with feeding for this population.

Foraging Ecology & Population Biology

1

Long-term trends in diet of Moray Firth harbour porpoise (*Phocoena phocoena*) under threat from bottlenose dolphin attack: insights from stable isotope analysis.

Thomas Bean,

Andrew Brownlow, Nicholas J. Davison, Jean-Pierre Lacaze, Jason Newton, Fiona L.
Read, Conor Ryan, Mariel T.I. Ten Doeschate & Graham J. Pierce

University of Aberdeen/ Icelandic Orca Project

Harbour porpoise (*Phocoena phocoena*) have high daily energetic demands and are vulnerable to prey depletion. Stable isotope analysis of skin tissue from stranded animals ($n = 175$) from within the Moray Firth between 1992-2015, provided new insights to diet representing a longer timeframe (~ 30 days) than previously available from studies of stomach contents. Porpoise skin $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values were in the range -19.7 to -15.7‰ (mean $-17.6 \pm 0.8\text{‰}$) and 12.1 to 17.7‰ (mean $14.1 \pm 0.8\text{‰}$), respectively. Both male and female adult porpoises had higher mean $\delta^{13}\text{C}$ and lower mean $\delta^{15}\text{N}$ values than juveniles. Generalised additive models (GAMs) identified significant inter-annual variation in porpoise $\delta^{13}\text{C}$ values, which were highly correlated with the abundance of sandeel (*Ammodytes* spp.), and whiting (*Merlangius merlangus*) at a one to two-year time lag. In contrast, $\delta^{15}\text{N}$ values remained stable through time, and were lower in larger porpoises.

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Foraging Ecology & Population Biology

2

Comparison of humpback whale (*Megaptera novaeangliae*) habitat use in two major feeding areas of the western North Atlantic Ocean

Maeva Terrapon,

Jooke Robbins, Christian Ramp, Kevin D. Friedland, Stéphane Plourde, Caroline
Lehoux & Philip S. Hammond

University of St Andrews

The Gulf of Maine (GOM) and Gulf of St Lawrence (GOSL) are two geographically close but environmentally distinct feeding areas for humpback whales (*Megaptera novaeangliae*) in the Northwest Atlantic. Individual animals display high site-fidelity to each region but low connectivity and differences in diet between areas suggest different cues may be used to find prey. Generalised Additive Models were applied to humpback whale sightings from non-systematic, photo-identification surveys to identify the best predictors of habitat use in each area. Two types of models were fitted at two spatial scales (5 and 10 km): a proxy model, which investigated the relationship between whale relative abundance and a combination of bathymetric and dynamic environmental variables; and a prey model, which used modelled schooling fish occupancy probability (GOM) or krill biomass (GOSL) instead of the proxy variables. The best model fits were obtained with the 10 km proxy models and the retained proxy variables differed between each area. Thus, it appears that in the absence of in situ prey data, proxy models provide the best predictions of humpback whale distribution, which can be used in concert with other information to contribute to the spatial management of humpback whales in these regions.



Foraging Ecology & Population Biology

3

Competitive seals: How do we measure competition in a wild population?

Izzy Langley,

Gordon Hastie, Andrew Brownlow, Paul Thompson & Debbie JF Russell

Sea Mammal Research Unit, University of St Andrews

Wild populations do not exist in isolation, but in complex webs made up of many organisms. This gives rise to the potential for individuals of different species to interact, and these interactions can drive the structure of ecological communities. Harbour seal (*Phoca vitulina*) populations on the north and east coast of Scotland have suffered declines of up to 85% since 1997. In contrast, the UK population of grey seals (*Halichoerus grypus*) has reached carrying capacity, implying some causal relationship between these population trajectories. The species likely interact and compete for resources through exploitative and interference competition, along with recent evidence of asymmetric intraguild predation, with adult male grey seals reported to predate on both grey and harbour seals. This study will use a pre-existing dataset of movement and behavioural data collected from animal-attached telemetry devices, along with long-term population, diet and strandings data, to investigate the role of grey seals in the harbour seal decline.

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Foraging Ecology & Population Biology

4

Dolphin gone missing – Estimating mortality in Bottlenose dolphins based on photo-ID records

Kim Ellen Ludwig

Galway-Mayo Institute of Technology

In the Shannon Estuary in Western Ireland, a resident population of Bottlenose dolphins has been studied using photo-identification since 1993, making this one of the longest running dolphin projects in Europe. Longevity in bottlenose dolphins is an important parameter, and accurate estimates are essential to model population viability. While up to 145 dolphins inhabit the Shannon Estuary, strandings are rare and stranding rates cannot be used to assess mortality. Instead, photo-ID might present an opportunity to do so. With almost thirty years of data, sighting histories of well-marked dolphins can be established and help to delineate average sighting frequencies as well as outliers. That is, if an individual hasn't been recorded for a given number of years, this goes with a certain probability that the dolphin has died. The question that I will try to answer in this project is how many years without a recording have to go by before a dolphin is considered dead. Because migration can be another reason why individuals disappear, the Shannon dolphin catalogue will be compared with other dolphin catalogues established around Ireland to minimize bias through emigration.

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Foraging Ecology & Population Biology

5

Assessing survival and mortality rates of small cetaceans

Olivia O'Connor,

Sinéad Murphy & Cóilín Minto

Galway-Mayo Institute of Technology

The life history of the harbour porpoise, *Phocoena phocoena*, has been understudied and its mortality risks have not been assessed. As the harbour porpoise as an Annex II species, these factors are required to manage the population accurately and effectively. Since population data is difficult to gather for wide-ranging cetaceans, one of the main sources of this kind of information arises from the observed age-structure of dead animals (i.e. stranded and bycaught cetaceans). To aid this approach, a freely accessible package strandCet was created for cetaceans in the statistical software R. The software can be used to estimate both natural and non-natural mortality-at-age from age-structured strandings, based on the Heligman-Pollard mathematical model of mortality, as well as perform life tables and assess population projections using the Leslie matrix. This study will test this software under different scenarios using simulated data from an operating (underlying) model where all vital rates are known. Then StrandCet will be applied to age data from over 600 harbour porpoises that stranded along the UK coastline between 1990 and 2012, to estimate natural and non-natural mortality as well as life tables and assess population projections to determine population growth and generation time.

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Seasonal and diurnal variation in Irrawaddy dolphin behaviour and distribution

Amy Laura Jones

University of Cumbria

This study aims to build on the limited behavioural and distribution knowledge of Cambodian Irrawaddy dolphins in the Gulf of Thailand. Behaviour was recorded using focal scan sampling and distribution was recorded by collecting GPS coordinates of dolphins from both land and boat. Seasonal and daily distribution were mapped using GIS software, while chi-squared contingency tables tested for significance between behaviour and season/time of day. Findings are intended to inform conservation strategies and legislation.

Posters

2

Humpback whale song variations in Reunion Island from 2016 to 2018

Sara Viera

University of Nantes

Sexually mature males produce complex and highly structured songs which are shared at the population level. Song patterns are culturally transmitted and have been described to evolve progressively with time, both over the breeding season and among years. Acoustic monitoring (June-October) was conducted for 3 consecutive years (2016-2018) around Reunion Island, to assess temporal variation in song structure and in humpback whale occurrence. A total of 46 samples containing high-quality song sequences from the early, mid- and late season were selected, representing 2 640 minutes of recordings. The analysis of song structure resulted in the description of 11 phrases and their variants. Low level of temporal variation was observed over the breeding season, with songs recorded in June being very similar to the one recorded late in late September-early October. Higher variations were observed between years, with some phrases from 2018 that may have evolved from phrases from 2017. In 2017 and 2018, more variants were described for each phrase type compared to 2016, in consistency with humpback whale occurrence. Very low number of humpback whales were observed around the island in 2016, which might have resulted in a lower diversity in song pattern.

Seasonal variation of Short-beaked common dolphins (*Delphinus delphis*) around Samos, Greece

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Understanding habitat use, population trends and distribution of a species is vital for effective conservation and management. The short-beaked common dolphin (*Delphinus delphis*) has undergone a 50% decline in abundance the last 3 to 4 generations in the Mediterranean Sea. Archipelagos Institute of Marine Conservation carried out 128 boat surveys between June 2017 and June 2019. Four boats were used for the surveys; Aegean Explorer (18.5m motor vessel), Pinelopi (15.8m sailing vessel), Naftilos (15.2m sailing vessel) and a 61m public ferry (Nisos Kalymnos, surveyed on during base transfer from the island of Samos to Lipsi). The surveys resulted in 64 sightings of common dolphins. This study aims to examine seasonal variation in group size and distribution of common dolphins around Samos Island, Greece. After normality testing, sightings data for the different seasons will be compared statistically (ANOVA or Kruskal-Wallis test). Seasonal differences of group size and distribution will be visualised using density maps created on ArcGIS. The study hopes to show seasonal differences in group size and distribution of common dolphins around the island of Samos. These results will be used for better understanding of the common dolphin population within the Aegean Sea.

Assessment of anthropogenic disturbances due to ecotourism on a grey seal (*Halichoerus grypus*) colony in the Blasket Islands, SW Ireland

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While ecotourism aims to promote conservation, its actual impacts on wildlife and populations must be assessed, especially during critical stages of the life cycle. The grey seal (*Halichoerus grypus*) is a protected species in Ireland and therefore, its population is subject to monitoring programs. Consequences of anthropogenic disturbances due to ecotourism are being assessed on a grey seal colony over pre-breeding, breeding and mating seasons in the Blasket Islands SAC. Here, the tourist season overlaps with part of the pupping period, and consequently the most sensitive time in terms of potential disturbances. Impacts of ecotourism are being evaluated by investigating differences in the behaviour of grey seals hauled-out on the beach between undisturbed and disturbed conditions due to approaching ferries, powerboats and walking tourists. Preliminary results show a more frequent display of vigilance behaviour and less proportion of resting seals under disturbed conditions and have identified the need for increased conservation efforts as well as a strict code of conduct in the area to reduce the effect of disturbance.

Temporal acoustic occurrence of sperm whales (*Physeter macrocephalus*) and long-finned pilot whales (*Globicephala melas*) off western Ireland

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Long-finned pilot whales (*Globicephala melas*) and sperm whales (*Physeter macrocephalus*) are the most abundant species among the community of deep diving cetaceans occurring off the west coast of Ireland. To address a knowledge gap on these elusive species in an area subject to increasing levels of anthropogenic noise, static acoustic recorders were deployed from 2014 to 2016 at thirteen locations. Acoustic data were collected across 2,400 cumulative days, with 93,600 pilot whale whistles and 1.6 million sperm whale clicks detected. Seasonal, lunar and diel effects on the acoustic occurrence of these species were investigated using Generalised Estimating Equations (GEE-GAMs). Large differences in acoustic occurrence across stations for both species highlighted the existence of more critical locations throughout the year, especially to the north of the shelf edge. Temporally, significant modulations were found for both species at all scales investigated, but the lack of consistency across the study area emphasizes the need to exercise great caution when inferring general tendencies based on local patterns. The variability of spatio-temporal patterns indicates a flexibility of sperm and long-finned pilot whales off the west coast of Ireland, addressing a challenge to establish management and mitigation measures and highlighting the need of long-term, year-round observations.

Tidal drivers of harbour seal *Phoca vitulina* fine-scale movement and behaviour

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Quantifying the effects of environmental conditions on the movement and behaviour of apex marine predators is crucial for understanding their ecology and informing conservation management. Recent evidence demonstrates that marine mammals utilise tidally energetic areas for foraging, however an understanding of how animals respond to tidal conditions remains limited. This information is crucial to improve our understanding of how marine predators exploit energetically challenging conditions as well as to mitigate risks between marine mammals and renewable energy devices. Here, using a hidden Markov model framework, we model the movement and behaviours of 34 harbour seals *Phoca vitulina* from the Wadden Sea in response to tides. Specifically, we quantify the probability for seals to transition between behavioural states, and model how their movement speed and heading varies, in response to both the strength and direction of tidal currents. This framework enables us to quantify within- and between-individual variation, key to obtaining greater understanding of population-level responses. Our results offer novel insights into how apex marine predators utilise and respond to variations in tidal conditions, providing important information towards improving our general understanding of seal ecology and deriving implications for conservation management.