NATURAL HISTORY MUSEUM OF DENMARK
UNIVERSITY OF COPENHAGEN

DANSK HAVPATTEDYRFORENING

PROGRAM

The 10th Danish Marine Mammal Symposium
Marine Mammals - from species to management units
Natural History Museum of Denmark, April 19th – 20th 2013

Friday, April 19th		
10:00	**Registration and breakfast**	
10:30	**Carl Christian Kinze**	WELCOME
10:40-11:20. Session 1: Conservation of marine mammals **Session chair: Jonas Teilmann**		
10:40	Ruth Fernández	Predicting the likely effects of climate change on the range of white-beaked dolphins in the ICES area (2000-2009)
11:00	Anders Galatius	Perfluorinated alkylated contaminant profiles of three marine mammal species from the North Sea: a comparative study
11:20-12:20. Session 2: Conservation of harbour porpoises **Session chair: Christian Riisager-Pedersen**		
11:20	Line Hermannsen	Ultrasonic components of vessel noise: Assessment of the potential impact on harbor porpoises (*Phocoena phocoena*)
11:40	Jonas Teilmann	Negative long term effects on harbour porpoises from a large scale offshore wind farm in the Baltic - evidence of slow recovery
12:00	Signe Sveegaard	ASCOBANS Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat – presentation and discussion
12:20-13:20 LUNCH		
13:20-15:00 Annual General Meeting and Coffee **Chair: Should be elected**		

15:00-17:00. Session 3: Theme 'Marine Mammals - from species to management units' with talks and discussion: Species, subspecies, eco-types, populations or management units? **Session chair: Anders Galatius**		
15:00	Carl Chr. Kinze	Marine Mammals and the Principles of Zoological Nomenclature
15:20	Mette Elstrup Steeman	Dealing with marine mammal species

15:40	Morten Tange Olsen	Using genetic data to identify populations and management units – concepts, cases and consequences with focus on Danish marine mammals
16:00-17:00	**Discussion** **Session chair: Morten Tange Olsen**	
18:30-	**Dinner and party**	

Saturday, April 20th		
10:00	Coffee	
10:30-10:50 Session 4: Session 5: Acoustics and sound production **Session chair: Carl C. Kinze**		
10:30	Ole Næsbye Larsen	Sound production in male Pacific walruses
10:50	Mafalda de Freitas	Amazon river dolphin communication and echolocation: The potential consequences of shallow talk
10:50-11:50, Session 5: Behaviour, acoustics and sound production in harbour porpoises **Session chair: Maria Iversen**		
10:50	Lee Miller	Echolocation by the harbour porpoise: Life in coastal waters
11:10	Lara Delgado	Behavioural development of a harbour porpoise (*Phocoena phocoena*) mother-calf pair in captivity
11:30	Lara Delgado	Social interactions in captive harbour porpoises (*Phocoena phocoena*)
11:50-12:20	**Lunch**	
12:20- 13.00 Session 6: Ecology and movements **Session chair: Puk Faxe Sabinsky**		
12:20	Christian Riisager-Pedersen	Seasonal movement patterns for harbor porpoises
12:40	Maria Iversen	Preliminary studies of blue whale (*Balaenoptera musculus*) movements around Iceland
13:00-13:20	Bye and ideas for next symposium	
13:20-	Cleaning	

Predicting the likely effects of climate change on the range of white-beaked dolphins in the ICES area (2000-2099)

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The white-beaked dolphin (*Lagenorhynchus albirostris*) is at high risk of being negatively affected by climate change in the decades to come, most likely through a reduction in range extent, the fragmentation of previously continuous aggregations. In the NE Atlantic, its distribution is limited to waters cooler than ~18ºC and changes in distribution consistent with the effects of climate change have already been observed in some parts of its range, such as western Scotland. Further investigating the habitat preferences of white-beaked dolphins in the NE Atlantic will help making informed conservation decisions, which will be instrumental for implementing ASCOBANS advice that listed the protection of white-beaked dolphin populations as a priority.

In this study, white-beaked dolphin habitat niche models developed by Lambert (2012) for Western European waters have been implemented to estimate changes in white-beaked dolphin likelihood of occurrence over time for the whole ICES Atlantic Area (85N69E, 36N44W). To do this, projected monthly SST data (2000-2099) was obtained from the HadCM3 model under 3 different economic scenarios proposed by the IPCC: A1b, A2 and B1. Monthly SST was averaged during between June and September and per decade. Classification and Regression Trees (CART), based on three fixed environmental variables (depth, seabed slope and standard deviation of slope) were generated. Thermal niche models obtained from SST projections, were coupled with CART outputs to generate predictions of occurrence. The resolution size chosen for our predictions is a 1/4 of the ICES statistical squares. Preliminary analyses anticipate a major retreat of white-beaked dolphins from North Western Europe.

The proposed approach enables us to predict how much climatic change is likely to affect the current species distribution and to identify geographic areas with strong conservation potential as zones that will mainly keep stable during the next decades.

Lambert, E. 2012. The resilience of whale watching tourism to climate change impacts on cetacean distribution. PhD thesis. University of Aberdeen.

Perfluorinated alkylated contaminant profiles of three marine mammal species

Anders Galatius[1] (agj@dmu.dk), Rossana Bossi[2], Christian Sonne[1], Frank Farsø Rigét[1], Carl Christian Kinze[3], Christina Lockyer[4], Jonas Teilmann[1] and Rune Dietz[1]

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Perfluorinated alkylated substances (PFASs) are synthetic compounds with several applications, e.g., fire-fighting foams, cleaners, lubricants and various coatings. Among the reported effects of PFASs are reproductive toxicity, neurotoxicity, hepatotoxicity, immunotoxicity and effects on the metabolism. Profiles of seven compounds of perfluoro-alkyl substances (PFASs) were compared among three species of top predators from the Danish North Sea; the white-beaked dolphin (*Lagenorhynchus albirostris*), the harbour porpoise (*Phocoena phocoena*) and the harbour seal (*Phoca vitulina*). The seals had higher total burdens (757.8 ng g-1ww) than the dolphins (439.9 ng g-1ww) and the porpoises (355.8 ng g-1ww), probably a reflection of feeding closer to the shore and thus contamination sources. The most striking difference among the species was the relative contribution of PFOSA to the profiles; the seals (0.1%) had much lower levels than porpoises (8.3%) and dolphins (26.0%). In combination with values obtained from the literature, this result indicates that Carnivora species have a much higher capacity for transformation of PFOSA to PFOS than cetacean species. Another notable difference among the species was that the two smaller species (seals and porpoises) with supposedly higher metabolic rates had lower concentrations of the perfluorinated carboxylic acids (PFCAs), which are generally more easily excreted than perfluorinated sulfonamides (PFSAs). Species-specific characteristics should be recognized when PFAS contamination in marine mammals is investigated, for example, several previous studies of PFASs in cetaceans have not quantified PFOSA.

Ultrasonic components of vessel noise: Assessment of the potential impact on harbor porpoises (*Phocoena phocoena*)

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Noise has recently been acknowledged as an important source of pollution in EU's marine strategy framework directive (MSFD descriptor 11). A main focus of the directive is low-frequency ship noise in 1/3 octave bands around 63Hz and 125Hz. However it is largely unknown if all ships radiate most of their noise in those bands, and whether marine animals are most affected at these frequencies. Species, such as the harbor porpoises, use high-frequency sounds (110-150kHz) to navigate, communicate and echolocate. To alleviate a clear lack of broadband recordings of shipping noise, we recorded noise from 20 different vessels in four marine areas in Denmark with a Reson TC4014 hydrophone at known distances. Vessel noise was quantified in 1/3 octave bands (0.025–160kHz) and back-calculated to nominal source levels (S-TOLs) using both a cylindrical and spherical spreading model. Transmission loss (TL) was also modeled with linear regression. Received 1/3 octave levels of vessel noise was compared to the hearing threshold of harbor porpoises, to estimate the masking impact by calculating the reduction in active space. We found that, vessel noise significantly increase ambient noise levels across the entire recording band, including the ultrasonic frequencies (>20kHz). In the echolocation range of porpoises, noise levels were increased considerably out to a distance of at least 360m. TL modeled as the regression coefficient confirmed the difficulties in estimating spreading loss, which is likely between spherical and cylindrical spreading for these shallow water recording areas. S-TOL calculations showed differences of 20-30dB, depending on the spreading loss model, and the recording distance (60-1200m), with S-TOLs up to 162dB re µPa at 1m in the 125 kHz TOL band. Active space reductions were based directly on received levels of vessel noise, thus TL did not have to be considered. Estimations revealed severe masking impacts (90-99%) at ranges out to 1190m for TOL bands 1kHz and 10kHz, whereas vessel noise in the 125 kHz band caused almost total acoustic masking (~99%) out to distances of 360m. Vessel characteristics, such as size, type and speed, are likely all affecting masking impact to some degree. We conclude that the two low-frequency bands designated by the MSFD, as indicators of shipping noise, are poor proxies for noise impacts of the vessels investigated here, at least for evaluating shipping effects on marine mammals with good ultrasonic hearing. In consequence, the higher frequencies should be included in assessment of the environmental status of marine habitats.

Negative long term effects on harbour porpoises from a large scale offshore wind farm in the Baltic - evidence of slow recovery

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Offshore wind farms constitute a new and fast growing industry all over the world. This study investigates the long term impact on harbour porpoises, *Phocoena phocoena*, for more than 10 years (2001-2012) from the first large scale offshore wind farm in the world, Nysted Offshore Wind Farm, in the Danish western Baltic Sea (72x2.3 MW turbines). The wind farm was brought into full operation in December 2003. At six stations, acoustic porpoise detectors (T-PODs) were placed inside the wind farm area and at a reference area 10 km to the east, to monitor porpoise echolocation activity as a proxy of porpoise presence. A modified BACI design was applied to detect changes in porpoise presence before, during and after construction of the wind farm. The results show that the echolocation activity has significantly declined inside Nysted Offshore Wind Farm since the baseline in 2001-2002 and has not fully recovered yet. The echolocation activity inside the wind farm is gradually increasing (from 11% to 29% of the baseline level) since the construction of the wind farm, possibly due to habituation of the porpoises to the wind farm or enrichment of the environment due to less fishing and artificial reef effects.

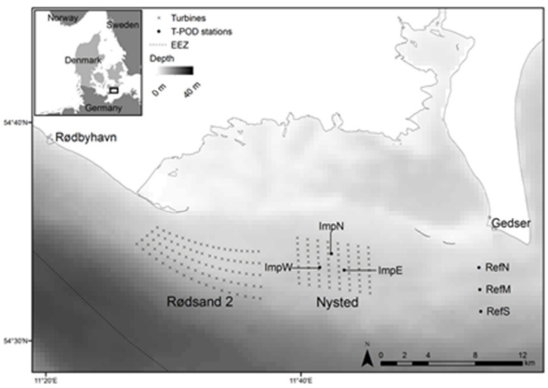
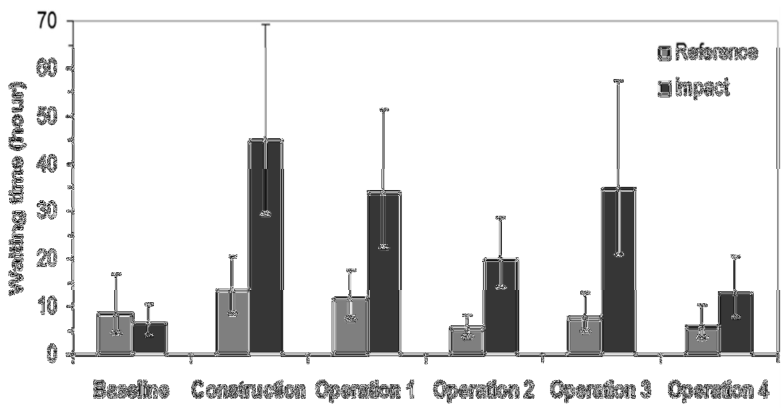


Figure 1 (left). Study area with Nysted and Rødsand 2 offshore wind farms. Wind turbines are shown with an "X" and monitoring stations with solid circles; three inside the wind farm and three reference stations.

Figure 2 (below). Mean values for waiting time between encounters for the two areas and six periods (2001-2012). Error bars indicate 95% confidence limits for the mean values.



ASCOBANS Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat – presentation and discussion

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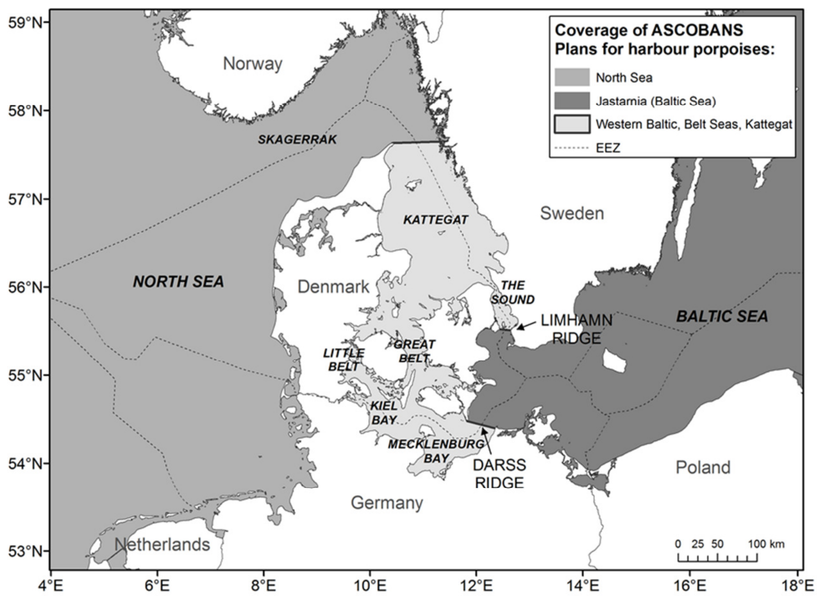
In November 2012, the 7th Meeting of the Parties in ASCOBANS (Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas) adopted the "Draft Conservation Plan for the Harbour Porpoise Population in the Western Baltic, the Belt Sea and the Kattegat (WBBK)". The Plan is designed to fill a gap in conservation efforts between two other ASCOBANS conservation plans namely in the North Sea and the Baltic and was written mainly by the Jastarnia group. The so called "Gap area" covered by the Plan is inhabited by a genetically distinct harbour porpoise population and is therefore of particular interest with regard to conservation issues and potential new gene flow into the endangered Baltic Sea Harbour porpoise. Here, we present the current knowledge of the WBBK population as well as the major threats and recommendations as outlined in the Plan: Furthermore, the problems of creating and implementing such a Plan will be discussed.



Marine Mammals and the Principles of Zoological Nomenclature

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All animal species formally only do exist upon their scientific description and after they have been described and “baptized” with a binary Latin or Latinized name introduced by Carl von Linné in his 10th edition of SYSTEMA NATURAE of 1758. There is an international code of zoological nomenclature published and revised by The International Commission of Zoological Nomenclature. The main objectives are to provide uniformity and stability, and most importantly be in accordance with phylogeny. The Linnean system may be considered a set of Chinese boxes - developed in pre-Darwinian time and therefore not always fit to reflect the dynamics of evolution. The earliest species descriptions were short and ambiguous and lead to the designation of a holotype for subsequent descriptions of additional species. Phylogenetic classification should be based on shared derived characters (synapomorphies) and not over-all similarity. DNA-based research has provided a wealth of new information sometimes challenging morphologically derived findings. Nomenclatorial problems and pitfalls of marine mammalogy causing taxonomical turmoil will be presented.

Dealing with marine mammal species

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The complexity and plasticity of nature complicates the task of sorting living beings into man-made categories. Charles Darwin wrote in “The origin of Species”: “... I was much struck how entirely vague and arbitrary is the distinction between species and varieties”. The theme of this year’s symposium is “Marine Mammals – from species to management units” reflects this ever-returning problem of grouping and categorising life into meaningful units for us to discuss. This was already a vexing problem for the ancient Greeks, and most likely way before.

Systematically categorising organisms into units based on similar morphology using binominal nomenclature started with Linneus in the 18th century. The science has advanced considerably since then and is a continuous work of defining what we call a species. But what is a species exactly?

According to the biological species concept, a species is defined as a group of organisms that are reproductively distinct, that is, they are able to interbreed and to produce fertile offspring. This is actually a wonderfully exact and simple definition. In practise, this is quite difficult to use, because it can be impossible to test. Extinct species are a good example of this problem.

The fact that most species are also morphologically distinct makes the morphological description a good way of identifying species. And it is continuously the best and most practical way of identifying species.

A key component of the morphological description of a species is the identification of a type-specimen. One specimen selected to be the representative of a species. The reference point when discussing species should therefore always be that single individual.

New methods of studying marine mammals, as well as other organisms, continuously aid and improve the understanding of how to interpret morphological variation. This is important, since a good and solid taxonomic understanding of the groups we work on is the fundamental frame upon which much scientific work is build.

Using genetic data to identify populations and management units – concepts, cases and consequences with focus on Danish marine mammals

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Identification of populations and management units is an essential step in the study of natural systems. Still, there is limited consensus regarding the most appropriate path for such inference. This presentation discusses the use of genetic methods for identification of marine mammal populations and management units. It starts with a brief background on the history of genetic methods and markers for marine mammals. It then provide examples of using modern and historic DNA, next-generation sequencing and integration of demographic and ecological data in the management and conservation of harbour seals, grey seals and harbour porpoises in Denmark. The talk concludes with a discussion of the benefits and potential pitfalls associated with the use of genetic methods and provide some perspectives for future uses in the management and conservation of marine mammals.

Sound production in male Pacific walruses

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During the breeding season male walruses produce the most peculiar sounds, probably different from any other sounds produced by marine mammals. Like humans most carnivores produce sound by activating the vocal folds in their larynx. This also applies to most of the walrus sound signals produced in air. Their sound signals produced under water, however, sound rather as if they emanated from an industrial plant than from an animal. For instance, their so-called ‘knocks’ sound like knocking on a door, while their so-called ‘bells’ sound like a gong or a church bell. These sounds are not accompanied by release of air bubbles in the water. Therefore, it is reasonable to hypothesize that they are produced by mechanisms different from the normal vocal mechanisms involving larynx and vocal tract. To determine how male walruses produce these sounds we conducted a series of in situ studies on two captive adult male Pacific walruses that were trained for voluntary participation in bioacoustics research. We used a combination of methods including hydrophones, endoscopes, and ultrasound imaging to confirm the probable anatomical origins of knock and bell sounds. From these recordings we gained a mechanistic understanding of how these sound signals are produced within the walrus body and transmitted to the environment. The two different mechanisms involving jaws and air sacks, respectively, are illustrated with video recordings and are considered with respect to the unique biology of this species.

Amazon River dolphin communication and echolocation: The potential consequences of shallow talk

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Toothed whales rely heavily on sound production for orientation, navigation, and foraging. To date, the majority of species studied acoustically have largely been marine, whereby sound propagation in their environment assumes free field conditions with few reflections. In contrast, little is known about species, which inhabit shallow water river systems and the corresponding sound propagation in their environment. The Amazon River, home to the Boto (*Inia geoffrensis*), provides an example of such environment, and species, we know very little about. The shallow waters and high level of vegetation found in the river greatly contrasts marine ecosystems, with different sound propagation parameters potentially leading to distinct evolutionary pressures on the Boto’s sound production.

The presentation will cover the prospects of my Masters project, which will focus on establishing sound propagation characteristics in the river and quantitatively describing boto communication. This will allow us to estimate boto’s active space and noise exposure ranges, allowing for effective conservation efforts, as well as identifying how sound propagation parameters have shaped boto sound production.

Echolocation by the harbour porpoise: Life in coastal waters

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The topic is a short review of echolocation by the harbour porpoise: life in coastal waters. The harbour porpoise is one of the smallest and most widely spread of all toothed whales. They are found abundantly in coastal waters all around the northern hemisphere. They are among the 11 species known to use high frequency sonar of relative narrow bandwidth. Their narrow biosonar beam helps isolate echoes from prey among those from unwanted items and noise. Obtaining echoes from small objects like net mesh, net floats and small prey is facilitated by the very high peak frequency around 130 kHz with a wavelength of about 12 mm. We argue that such echolocation signals and narrow band auditory filters give the harbour porpoise a selective advantage in a coastal environment. Predation by killer whales and a minimum noise region in the ocean around 130 kHz may have provided selection pressures for using this frequency band for biosonar signals.

Behavioural development of a harbour porpoise (*Phocoena phocoena*) mother-calf pair in captivity

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The behavioural development of a harbour porpoise (*Phocoena phocoena)* mother-calf pair in captivity is presented.

In this study the social and spatial interactions between mother and calf are described in harbour porpoises. The study started 2 months after the birth and presents the development of their behaviour during 10 months in a captive situation. Being this the first time a porpoise calf is documented to have been born and survived in captivity and this study being the only description of a mother-calf pair bond along time in either captivity or the wild.

Spatial relative positions between mother and calf, the apparition or extinction of behaviours, and the variation in their occurrence along time were quantified. The study was done using focal sampling and observations were always conducted by the same observer.

Avoidance and aggression from the mother towards the calf tended to increase when the calf was 8 months old, while potential fishing in the calf increased around that time. However, weaning did not occur during the first 12 months of life, and nursing was observed to be constant. The amount of time they spent in close proximity decreased around the 10th month of the calf, but the bond continues being strong. Additionally, differences in mother and calf time budgets, and durations of behaviours showed age-related differences.

This study postpones the expected weaning times for the species, and describes the behaviour of a healthy mother-calf pair.

The importance of studying the development of harbour porpoises calves during its first year has capital importance for its survival in the age class with the highest mortality in the species. Even though, the study is based in one mother-calf pair, and generalizations at species level would need the study of more individuals, it sets a basis for mother and infant interactions and calf development for comparison with further studies.

Social interactions in captive harbour porpoises (*Phocoena phocoena*)

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(3) National Environmental Research Institute, Aarhus University, Silkeborg, Denmark.

Social interactions in captive harbour porpoises (*Phocoena phocoena*) were studied to provide some basis to the almost absolute lack of information on the social structure of the species. Such knowledge is necessary for adequate conservation measures and for appropriate management of individuals kept in aquaria. And nothing is known due to the impossibility of individual identification (Photo ID) of this species in the wild.

Social interactions of two harbour porpoise groups kept in captivity in Kerteminde, Denmark (4 animals); and Harderwijk, Holland (6 animals), were studied by means of quantitative analysis of the affiliative, aggressive and sexual interactions among the individuals of each group. All observations were done by the same observer.

It was found that all males attempted to mate with no preference towards any certain female, and all males had the same mating possibilities. This provides the first empirical data supporting the promiscuous mating system assumed in this species from morphological data. The strongest aggression was seen in the non-mating season among a male and a female, and the strongest affiliation pattern was between a mother-calf pair. Affiliative interactions among males-females were seen only during the mating season, suggesting they have a sexual function; in contrast with female-female affiliations that were seen both during and outside the mating season.

Many social interactions were observed with a diversity of social displays; additionally, the magnitude of interactions and the associative patterns might have changed depending on the sex, age and season. Further studies on the species would help to confirm this hypothesis. But this results show that sociality is an important feature in their biology and should be given more attention, and take into account as a welfare need.

Seasonal movement patterns for harbor porpoises

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Between 1997 and 2012, 95 harbour porpoises *Phocoena phocoena* have been tagged with satellite transmitters in Danish waters. This telemetric data has together with acoustic and visual surveys been used to identify high density areas and designate marine protected areas for harbour porpoises. In this study, individual movement patterns for 25 of these harbour porpoises, all deployed for more than 180 days, have been assessed in detail. Of the 25 animals, six were sexually mature and 20 juvenile. All sexually mature harbour porpoises showed a northern and, or western migration pattern into the northern part of Kattegat, Skagerrak and the North Sea during winter months. Average travelling speed and distance between positions also increased during winter months and decreased again in spring.

Juveniles generally showed more diverse patterns and three animals tagged in Skagerrak travelled even north of the Shetland Islands, Great Britain. Time spent and distance travelled on migration was highly variable. Abiotic conditions at migration start was also assessed but with variable results. The driving force behind the tendency towards northern or western migration in winter months thus stands unclear. We advise that seasonal distribution changes should be taken into account when planning future surveys in the Baltic and Inner Danish Waters.

Preliminary studies of Blue whale (*Balaenoptera musculus*) movements around Iceland

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During the last five years blue whales (*Balaenoptera musculus*) have been studied more intensively than previous in Skjálfandí Bay, Iceland (65°57' N, 017°25' W). Among these studies, a larger photo-identification project was launched and today the photo-identification catalog consists of more than 105 individual blue whales visiting the Bay between 2001 and 2012. In October 2011 and 2012, blue whales were sighted and photographed in the southeast of Iceland at the northern edge of the Mid-Atlantic Ridge (63°46' N, 022°31' W). At least one of these whales was seen and photographed in Skjálfandí Bay in July of the same year. A satellite tag deployed by the Marine Research Institute on a well-known blue whale in Skjálfandí Bay, 2009, revealed that this individual whale swam northwest of Iceland during July, then south through the Denmark Strait and ended up spend some time in the same area in the southwest of the Island in September. This suggest that blue whales visiting Iceland in the summer, visit Skjálfandí Bay in the North during the early summer May-July and later comes into proximity of land again in the southwest of Iceland in September-October. This supports the idea that blue whales follow the Mid-Atlantic Ridge on their southwards migration. In addition to this, the Reykjanes Ridge is known to be productive area and may provide a good end of the season feast for the whales. Further studies are needed to tell where the whales come from and where they spend the majority of their time; however, the tagged whale and previously whaling records suggests that the Irminger Sea and the Greenland Sea are important feeding ground for these giants.