FAROE ISLANDS
PROGRESS REPORT ON MARINE MAMMALS 2019

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I. INTRODUCTION

This report summarises research on cetaceans and pinnipeds conducted in the Faroe Islands in 2019, by the Museum of Natural History and the Environment Agency.

II. RESEARCH BY SPECIES 2019

II.a Species/Stocks studied

- Grey seal (*Halichoerus grypus*) – abundance, hunting statistics
- Harbour seal (*Phoca vitulina*) – observation
- Pilot whale (*Globicephala melas*) – landed animals, tagged animals
- Northern bottlenose whale (*Hyperoodon ampullatus*) – stranded animals
- Fin whale (*Balaenoptera physalus*) – stranded animal

II.b Field work

In 2019, biological samples for age and reproduction were collected from a total of 154 **pilot whales**, by the Natural History Museum – from the drives in Sandavágur on 29 April (34 samples), Tórshavn on 29 May (76), Hvalvík on 2 August (23) and Vestmanna on 27 August (21). In addition, stomachs and tissues from some of the same animals were stored for diet, genetic and contaminant studies.

In 2019, the Environment Agency took samples of **pilot whales** in connection with grinds in Sandavágur on 29 April, Tórshavn on 29 May, Hvalvík on 2 August and Vestmanna on 27 August. In all, 81 individual samples of muscle and blubber, and liver and kidney tissue samples were taken. In addition, muscle, blubber, liver and kidney were taken from 6 foetuses from the grind in Sandavágur.

On July 7, the Museum tagged five **pilot whales** with satellite transmitters. A small pod counting sixteen whales was spotted in the fjord of Gøta and driven to the bay of Syðrugøta. The pod was led gently towards the shore, where most animals pertly stranded, and satellite transmitters were attached to the dorsal fin. The operation took one hour, thereafter the pod swam to the fjord again. The second day, the pod left the fjord and archipelago. This is the seventh tagging event in a dedicated tracking programme, with the objective to determine the management unit of pilot whales recruiting to the hunt in the Faroe Islands.

A research programme for estimating the abundance of **grey seals** started in 2018. During the summer of 2019, the total shoreline of the archipelago was surveyed by boat, and all seals hauled-out and in the water were counted. Each island was visited from one to three times; the only area without effort was the east side of Suðuroy. In high-density areas, footages captured from drone were used for the seal counts, which improved accuracy considerable.

By-catch of marine mammals by the Faroese fishing fleet seems not to be a regular event. The main reason for this is the exclusion of gillnet fisheries in waters shallower than 380 meters.

Gillnets are used in the fisheries for monkfish and Greenland halibut, but because of the soaking depth, by-catch is almost absent. From the logbooks, the one to five annual records of by-catches of marine mammals happen mainly in the pelagic fishery for mackerel, herring and blue whiting. The species reported have been the pilot whale and the minke whale. The Fisheries Inspection had observers on board selected pelagic vessels during operation in 2018 and 2019, where no by-catch incidences was observed.

Two **bottlenose whales** stranded and ceased in Froðba, Suðuroy, on 26 August.

Every year floating carcasses of large cetaceans are observed in Faroese waters. In most cases, the carcasses are highly decomposed, and of sperm whales. On two occasions in 2019, however, **fin whale** carcasses were observed close to the archipelago. On 22 march, a 17 meters long male fin whale stranded outside the village of Kirkjubø. The animal had been dead less than a week and was removed by the Fishery Inspection. Again, in August, a newly dead animal was observed just north of the islands.

A **harbour seal** was observed in Tórshavn for a period of a few weeks, in August. This species was extirpated from the islands around one hundred and seventeen years ago and has since been a rare visitor.

II.c Laboratory work

The biological material collected from **pilot whales** in 2019 has been prepared ready for finalizing the analysis of age, reproduction and diet.

The Environment Agency are regularly collecting **pilot whale** samples for a tissue bank, where the aim is to take samples from three schools a year, with generally 25 individuals from each. In addition to a monitoring program as outlined in Table 1, research activities are done as projects and when funding allows. Such projects could be to investigate the presence of chemicals of emerging environmental concern and elucidate potential negative impact of pollutants on pilot whales. In 2019, samples of pilot whales were included in a Nordic Council of Ministers supported study of UV-filters, as arranged and coordinated by the Nordic Screening group, see also www.nordicscreening.org.

Table 1. Pollutants in the pilot whale monitoring program of the Environment Agency.

Matrix (tissue)	blubber & muscle	kidney	liver	blubber / liver*,**	blubber*
Frequency of sampling	yearly, pref. from 3 schools, focus incr. on juv. males for timetrend				
number of samples analysed per year	25	15	15	5	5
Tissue analysed for:	Blubber:Legacy persistent organic pollutants$ Muscle:metals£	Cadmium, dry mass	Mercury, selenium, cadmium, dry mass	Perfluoroalkyl substances, polybrominated diethyl ethers	hexabromo cyclo-dodecane, Dechlorane plus

*Time trends

** PFAS is analysed in liver

$ PCB, HCH, HCB, DDT, DDE, and from ca. ½ of the samples even o,p-isomer DDT and metabolites, CHL, Mirex, Toxaphene.

£ Mercury, selenium, dry mass and stable N and C isotopes

II.d Other studies

In the Faroe Islands, it is legal for salmon farmers to cull **grey seals** interacting with installations, as a protective act. Since 2018, salmon farmers have been legislated to deliver monthly removal numbers to the authorities. However, the Museum of Natural History have since 2014 had access to these harvest numbers from salmon farmers.

II.e Research results

The **pilot whale** pod tagged with satellite transmitters on July 7 left the islands in a northward direction. After reaching the slope of the Plateau, the group took a westward direction, towards Iceland. During the next month, the group moved on the Ridge, towards the Iceland Shelf and east to the Faroe-Shetland Channel. South in the Channel, one tagged animal retained and left the group, while the other animals moved southward, following the UK Shelf slope. The group finally turned south at $51^0$4'N, and thereafter moved on the same path north again. Since, the group has moved north and south between 52^0N and 60^0N, tightly connected to the Shelf break. One tag still transmitted at the end of the year, 178 days after tagging.

The results from the contaminants analyses of **pilot whales** were reported by the Environment Agency in the report Andreasen et al., 2019 "AMAP Faroe Islands 2013-2016: Heavy Metals and POPs Core programme", Environment Agency, pp.103. Along with the data for heavy metals and legacy POPs, the report includes data from time trend analyses of PBDEs and PFAS in pilot whale. The monitoring of pollutants in pilot whales are focused on juvenile males, so as to minimize variability that stems from sex/age related biological processes. The monitoring results indicate a steadily decreasing concentration of POPs in general (ie PCB and legacy pesticides) including the brominated flame retardants PBDE. For perfluorinated alkyl substances, like PFOS, however, there are no clearly discernible trend, other than that the concentrations appear to have levelled out, or still be on a weekly increasing curve.

Trends in the abundance of long-finned **pilot whale** was investigated by Pike *et al*., 2019, based on the North Atlantic Sightings Surveys (NASS) conducted in 1987, 1989, 1995, 2001, 2007 and 2015. Conventional distance sampling was used to develop indices of relative abundance to determine if pilot whale abundance has changed over the 28-year period from 1987 to 2015. Varying spatial coverage of the surveys was accommodated by delineating common regions that were covered by all 6 surveys, and the 3 largest surveys (1989, 1995 and 2007), respectively. These "Index Regions" were divided into East and West sub-regions, and post-stratification was used to obtain abundance estimates for these index areas only. Total abundance in the Index Regions, uncorrected for perception or availability biases, ranged from 54,264 (CV=0.48) in 2001 to 253,109 (CV=0.43) in 2015. There was no significant trend in the numbers of individuals or groups in either the 6 or 3 Survey Index Regions, and no consistent trend over the period. Power analyses indicate that negative annual growth rates of -3% to -5% would have been detectible over the entire period. The Index Regions comprise only a portion of the summer range of the species and changes in annual distribution clearly affect the results.

Pike *et al*., 2019, estimated the abundance of cetaceans in the central North Atlantic from the North Atlantic Sightings Survey (NASS). The sixth in a series of surveys, done between 1987 and 2015, was conducted in June/July 2015 and covered a large area of the northern North

Atlantic. The Icelandic and Faroese ship survey component covered the area between the Faroe Islands and East Greenland from latitude 52° to 72° N. The survey used 3 vessels and an independent double-platform configuration with each platform staffed by a minimum of 2 observers. Both uncorrected abundance estimates derived using Multiple Covariates Distance Sampling, and corrected abundance estimates derived using Mark-Recapture Distance Sampling, were providedfor the following species (corrected estimates given): fin (*Balaenoptera physalus*; 36,773, CV=0.17, 95% CI 25,811–52,392), common minke (*B. acutorstrata*; 42,515, CV=0.31, 95% CI 22,896–78,942), humpback (*Megaptera novaeangliae*; 9,867, 95% CI 4,854–20,058), blue (*B. musculus*; 3,000, CV=0.40, 95% CI 1,377–6,534), sei (*B. borealis*; 3,767, CV=0.54, 95% CI 1,156–12,270), sperm (*Physeter microcephalus*; 23,166, CV 0.59, 95% CI 7,699–69,709), long-finned pilot (*Globicephala melas*; 344,148, CV=0.35, 95% CI 162,795–727,527) and northern bottlenose (*Hyperoodon ampullatus*; 19,975, CV=0.06, 95% CI 5,562–71,737) whales as well as white-beaked (*Lagenorhynchus albirostris*; 159,000, CV=0.63, 95% CI 49,957–506,054) and white-sided (*L. acutus*; 131,022, CV=0.73, 95% CI 35,251–486,981) dolphins.

In Dassuncao *et al*., 2019, the role of phospholipids for PFAS accumulation was investigated by analyzing associations among concurrent measurements of phospholipid, total protein, total lipid, and 24 PFASs in the heart, muscle, brain, kidney, liver, blubber, placenta, and spleen of North Atlantic **pilot whales** (*Globicephala melas*). The sum of 24 PFASs (∑24 PFAS) was highest in the liver [median of 260 ng g−1; interquartile range (IQR) of 216−295 ng g−1] and brain (86.0 ng g−1; IQR of 54.5−91.3 ng g−1), while phospholipid levels were highest in the brain. The relative abundance of PFASs in the brain greatly increases with carbon-chain lengths of ≥10, suggesting shorter-chain compounds may cross the blood−brain barrier less efficiently. Phospholipids were significant predictors of the tissue distribution of the longest-chain PFASs: perfluorodecanesulfonate (PFDS), perfluorododecanoate (PFDoA), perfluorotridecanoate (PFTrA), and perfluorotetradecanoate (PFTA) (rs = 0.5−0.6). In all tissues except the brain, each 1 mg g−1 increase in phospholipids led to a 12−25% increase in the concentration of each PFAS. The conclusion was that partitioning to phospholipids is an important mechanism of bioaccumulation for long-chain PFASs in marine mammals.

In Li *et al*., 2020, Hg stable isotopes, total Hg, MeHg and selenium (Se) concentrations measured in multiple tissues of North Atlantic **pilot whales** (*Globicephala melas*) was used to investigate processes affecting the distribution and accumulation of Hg^{II} and MeHg. It was found that simple mixing of two distinct isotopic end-members: MeHg (1.4‰) and Hg^{II} (−1.6‰) can explain the observed variability of $\delta^{202}Hg$ in brain tissue. A similar isotopic composition for the MeHg end-member in the brain, muscle, heart, and kidney suggests efficient exchange of MeHg in blood throughout the body. By contrast, the Hg isotopic composition of the liver of adult whales was different from younger whales and other tissues that follow the two-end member mixing model. Measured Se:Hg ratios were lowest in adult whales with the highest levels of MeHg exposure. In these individuals, Se availability was likely reduced by complexation with demethylated Hg^{II}. It was speculated that this could results in a higher fraction of labile Hg^{II} eliminated from the liver of adult whales compared to young whales and subsequent redistribution to other tissues, potentially affecting toxicity.

III. ONGOING (CURRENT) RESEARCH

The Museum of Natural History will continue to track **pilot whales** by satellite telemetry, in order to monitor migration and determine the distribution area of pilot whales recruiting to the Faroese harvest. In addition, collection of samples from the drive hunt will continue.

The Museum of Natural History will continue the summer census for estimating the abundance of the **grey seal** population. In 2020, the plan is to expand the study to include camera traps and satellite tracking, in order to improve the accuracy of the estimate.

The Environment Agency will continue to sample **pilot whales** for pollution monitoring in 2020.

IV. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

In a new amendment, from 2018, to the legislation regulating fish farming activities in the islands, farmers are demanded to deliver statistics to the authorities, once a year, on monthly removals of grey seals, for each farming locality separately. This is based in a recommendation from NAMMCO, to collect statistics of the removals of grey seals around fish farms.

The Fisheries Inspection has followed the recommendations from NAMMCO, that Faroes should collect data on bycatch of marine mammals in the pelagic fisheries targeting mackerel, herring and blue whiting, and has performed opportunistic inspections of the fleet. For all fisheries, fishermen are mandated to deliver this information, both in the electronic and paper logbooks.

V. PUBLICATIONS AND DOCUMENTS

Andreasen, B., Hoydal, K., Mortensen, R., Erenbjerg S.V., and Dam, M. 2019. AMAP Faroe Islands 2013 – 2016: Heavy Metals and POPs Core Programme, Umhvørvisstovan, Argir, Faroe Islands, x + 103 pp

Dassuncao, C., Pickard, H., Pfohl, M., Tokranov, A. K., Li, M., Mikkelsen, B., Slitt, A. and Sunderland, E. M. 2019. Phospholipid Levels Predict the Tissue Distribution of Poly- and Perfluoroalkyl Substances in a Marine Mammal. *Environ. Sci. Technol. Lett.* 2019, *6*, 119-125. DOI: 10.1021/acs.estlett.9b00031

Dietz, R., Letcher, R.J., Desforges, J.-P., Eulaers, I., Sonne, C., Wilson, S., Andersen-Ranberg, E., Basu, N., Barst, B.D., Bustnes, J.O., Bytingsvik, J., Ciesielski, T.M., Drevnick, P.E., Gabrielsen, G.W., Haarr, A., Hylland, K., Jenssen, B.M., Levin, M., McKinney, M.A., Nørregaard, R.D., Pedersen, K.E., Provencher, J., Styrishave, B., Tartu, S., Aars, J., Ackerman, J.T., Rosing-Asvid, A., Barrett, R., Bignert, A., Born, E.W., Branigan, M., Braune, B., Bryan, C.E., Dam, M., Eagles-Smith, C.A., Evans, M., Evans, T.J., Fisk, A.T., Gamberg, M., Gustavson, K., Hartman, C.A., Helander, B., Herzog, M.P., Hoekstra, P.F., Houde, M., Hoydal, K., Jackson, A.K., Kucklick, J., Lie, E., Loseto, L., Mallory, M.L., Miljeteig, C., Mosbech, A., Muir, D.C.G., Nielsen, S.T., Peacock, E., Pedro, S., Peterson, S.H., Polder, A., Rigét, F.F., Roach, P., Saunes, H., Sinding, M.-H.S., Skaare, J.U., Søndergaard, J., Stenson, G., Stern, G., Treu, G., Schuur, S.S., Víkingsson, G., 2019. Current state of knowledge on biological effects from contaminants on arctic wildlife and fish. *Science of the Total Environment*, 696, 133792. https://doi.org/10.1016/j.scitotenv.2019.133792

Kärrman, A., Wang, T., Kallenborn, R., 2019. PFASs in the Nordic Environment. TemaNord 2019:515. Nordic Council of Ministers, Copenhagen, Denmark.

M. Li, C.A. Juang, J.D. Ewald, R. Yin, B. Mikkelsen, D.P. Krabbenhoft, P.H. Balcom, C. Dassuncao, E.M. Sunderland. Selenium and stable mercury isotopes provide new insights into mercury toxicokinetics in pilot whales. *Science of the Total Environment* 710 (2020). https://doi.org/10.1016/j.scitotenv.2019.136325

Mikkelsen, B., Dam, M. and Hoydal, K. 2019. Faroe Islands – Progress report on Marine Mammals 2018. Paper presented to the NAMMCO Scientific Committee, October 29 - November 1, Tórshavn, Faroe Islands. 4pp.

Pike, D. G., Gunnlaugsson, T., Mikkelsen, B., Halldórsson, S. D., & Víkingsson, G. (2019). Estimates of the abundance of cetaceans in the central North Atlantic based on the NASS Icelandic and Faroese shipboard surveys conducted in 2015. *NAMMCO Scientific Publications*, *11*. https://doi.org/10.7557/3.4941

Pike, D.G., Gunnlaugsson, T., Desportes, G., Mikkelsen, B., Víkingsson. G.A. & Bloch, D. (2019). Estimates of the relative abundance of long-finned pilot whales (*Globicephala melas*) in the Northeast Atlantic from 1987 to 2015 indicate no long-term trends. *NAMMCO Scientific Publications, 11*. https://doi.org/10.7557/3.4643

Rigét, F., Bignert, A., Braune, B., Dam, M., Dietz, R., Evans, M., Green, N., Gunnlaugsdóttir, H., Hoydal, K.S., Kucklick, J., Letcher, R., Muir, D., Schuur, S., Sonne, C., Stern, G., Tomy, G., Vorkamp, K., Wilson, S., 2019. Temporal trends of persistent organic pollutants in Arctic marine and freshwater biota. Sci. Total Environ. 649, 99–110. https://doi.org/10.1016/j.scitotenv.2018.08.268