FAROE ISLANDS
PROGRESS REPORT ON MARINE MAMMALS 2017

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I. INTRODUCTION

This report summarises research on cetaceans and pinnipeds conducted in the Faroe Islands in 2017, by the Museum of Natural History and the Environment Agency.

II. RESEARCH BY SPECIES 2017

II.a Species/Stocks studied

- Grey seal (*Halichoerus grypus*) – hunting statistics
- Pilot whale (*Globicephala melas*) – landed animals, abundance
- Northern bottlenose whale (*Hyperoodon ampullatus*) – abundance

II.b Field work

In 2017, biological samples, for age, reproduction and diet, were collected from a total of 559 **pilot whales** by the Natural History Museum – Bø on 21 May (82 samples), Tórshavn on 16 June (131), Hvalvík on 26 June (114), Tjørnuvík on 29 June (43), Hvannasund on 5 July (68), Hvannasund on 17 July (18), Tórshavn on 18 August (61) and Hvannasund on 29 August (42). This is a continuation of a small-scale sampling programme, with the plan to complement with a more comprehensive monitoring programme.

In 2017, the Environment Agency took samples of **pilot whales** in connection with grinds in Tórshavn 16 June, in Hvalvík 26 June, in Tjørnuvík 29 June and in Tórshavn 18 August. In all, 93 individual samples of muscle and blubber, and liver and kidney tissue samples were taken.

II.c Laboratory work

The biological material collected from **pilot whales** in 2017 has been prepared ready for finalizing the analysis of age, diet and reproduction.

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 are undertaken. In 2017, samples of pilot whales were included in a Nordic Council of Ministers supported study of new per- and polyfluorinated alkyl substances, as arranged and coordinated by the Nordic Screening group, see also www.nordicscreening.org. The results will

be reported in 2018. Another ongoing study focuses on mRNA in liver tissues in pilot whales, where the objective in terms of pollutants is to be able to assess the relationship between mRNA and selected pollutants. The study, which is done as a visiting student work (Univ. Bremerhaven) in cooperation with the University of the Faroe Islands- is meant to outline a more direct approach to assess toxic stress responses like enzyme induction. In 2017, one of the authors defended a PhD degree in biology on effects of pollutants on pilot whale; see below in the section Research results.

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

*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, **grey seals** may be culled at salmon sea farms, as a protective act, when interacting with the installations. In 2010, a logbook system of seal culls was introduced, and fish farmers were motivated to deliver statistics on an annual basis. The reporting system need to be validated, in order to provide a more accurate number of grey seal removals.

II.e Research results

The sightings data from the Faroese component of the Trans North Atlantic Sightings Surveys (TNASS) in 2007 were integrated in a study on the distribution, abundance and habitat use of deep diving cetaceans; together with data from the SCANS-II (2005) and CODA (2007) surveys in EU waters (Rogan et al., 2017). For the **pilot whale**, the design-based estimate of total abundance was 172 195 (CV = 0.35) individuals. Depth, distance to the 2000 m depth contour and latitude were found to be important in predicting pilot whale abundance of groups while depth and contour index were retained in the best model for group size. Abundance of groups was predicted to be highest in water depths > 1000 m, was strongly associated with the 2000 m depth contour and showed geographic variation with latitude, with a peak at 55 °W. Group size was predicted to be smaller in deeper waters, and higher at contour index values of 30–50, indicating that they occur in waters over moderately steep slopes. The model-based estimate of pilot whale abundance was 152 071 (CV = 0.32) whales. Results suggest that the steep slopes on both sides of the Rockall Trough are important areas for pilot whales in the North-East Atlantic, along with an area further west on the Rockall Plateau. In addition, this publication provide a design-based abundance estimate for **Northern bottlenose whale** of 19,539 (95% C.I. 9,921-38,482) for the entire area.

Sightings of Northern bottlenose whale were almost exclusively from the Faroese survey area.

Temporal trend in 15 PFASs measured in muscle from juvenile male **pilot whales** harvested on the Faroe Islands between 1986 and 2013 were analysed (Dassuncao et al., 2017). Perfluorooctane sulfonamide (FOSA) accounted for a peak of 84% of the 15 PFASs around 2000 but declined to 34% in recent years. Perfluorooctanesulfonat (PFOS) and long-chained PFCAs (C9−C13) increased significantly over the whole period (2.8% yr−1 to 8.3% yr−1), but FOSA declined by 13% yr−1 after 2006. Rapid changes in atmospheric FOSA in polar and subpolar regions around 2000 helps to explain large declines in PFOS exposure for species that metabolize FOSA, including seafood consuming human populations.

Katrin Hoydal defended her PhD thesis: "Levels and endocrine disruptive effects of legacy POPs and their metabolites in long-finned **pilot whales** of the Faroe Islands" at the Norwegian University of Science and Technology (NTNU) (Hoydal, 2017). The study analysed the relationship between persistent organic pollutants (POPs) and several biomarkers for effects of POPs; Thyroid and steroid hormones, vitamin A, E and D and CYP enzyme induction. Some correlations (mostly positive) were found between POPs and hormones (thyroid and steroid hormones) and vitamins (A and E). It was however concluded that although the pilot whales were exposed to relatively high concentrations of POPs, and the concentrations exceeded some of the toxic reference levels suggested for effects on marine mammals, the POPs did not seem to have clear overall negative effects on the analysed biomarkers. Along with the effect analyses, knowledge was gained about concentrations and relative distribution of POPs in different sex and age groups, biotransformation of POPs and levels of hormones and vitamins in pilot whales.

The study of the relationship between POPs and steroid hormones in **pilot whales** from the Faroe Islands (Hoydal et al., 2017) showed some positive correlations between a few of the more recalcitrant POPs and single steroids hormones in adult females. In males, positive correlation between 17β-estradiol and the 4-OH-CB107/4'-OH-CB108 PCB metabolite was found. Although the relationships between the POPs and the steroid hormones that were found were not evidence of cause-effect relationships, these correlations suggested that POPs might have some endocrine disrupting effects on the steroid homeostasis in pilot whales.

The biotransformation capacity in **pilot whales** was studied by analyses of induction of phase I (cytochrome P450) and II (conjugating) enzymes (Hoydal et al., 2018). The study showed that although pilot whales expressed CYP1, 2 and 3 enzymes, and the CYP1A enzyme activity, analysed by ethoxyresorufin-O-deethylase (EROD) activity, was positively correlated with POP concentrations, the enzyme activities of these enzymes and phase II enzymes were low. The low enzyme activities were in accordance with the low concentrations of OH-PCBs and OH-PBDEs found and suggested a low POP biotransformation capacity in pilot whales.

The concentrations of brominated dioxins PBDD/Fs, and chlorinated dioxins, PCDD/Fs in blubber was analysed in juvenile **pilot whales** from the Faroe Islands from 1997 – 2013 (Bjurlid et al., 2017). In addition, pilot whale samples from the period 2010 - 2013 were analysed for PBDEs and compared with data from previous studies on pilot wales to investigate temporal trends between 1986 and 2013. The study showed that among the PBDD/Fs, the furans were predominant and there was no relationship between PBDD/Fs and PCDD/Fs. PBDEs were found at noticeably higher levels than PBDD/Fs and PCDD/Fs and the results

indicated that PBDE concentrations in juvenile males have decreased from 1996 to the latest observations in 2013. No relationship between the concentration levels of PBDD/Fs and PBDEs in the sampled pilot whales could be identified, which indicated possible differences in the metabolism of, or exposure to, PBDEs and PBDD/Fs.

III. ONGOING (CURRENT) RESEARCH

The Museum of Natural History will continue to track **pilot whales** by satellite telemetry (last tagging was in 2015), in order to monitor migration patterns and distribution areas of pilot whales recruiting to the Faroese harvest.

Co-operation with scientist at the Department of Anatomy and Cell Biology/ Canadian Light Source, Saskatoon, SK Canada, regarding mercury/selenium in eyes and inner ear of **pilot whales**, continues.

IV. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

None

V. PUBLICATIONS AND DOCUMENTS

Bjurlid, F., Dam, M., Hoydal, K., Hagberg, J., 2018. Occurrence of polybrominated dibenzo-p-dioxins, dibenzofurans (PBDD/Fs) and polybrominated diphenyl ethers (PBDEs) in pilot whales (*Globicephala melas*) caught around the Faroe Islands. Chemosphere 195, 11–20. doi:10.1016/j.chemosphere.2017.12.044

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Hoydal, K.S., Styrishave, B., Ciesielski, T.M., Letcher, R.J., Dam, M., Jenssen, B.M., 2017. Steroid Hormones and Persistent Organic Pollutants in plasma from North-eastern Atlantic Pilot whales. Environmental Research 159, 613–621. doi:10.1016/j.envres.2017.09.003

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Rogan, E., Cañadas, A., Macleod, K., Santos, M. B., Mikkelsen, B., Uriarte, A., Van Canneyt, O., Vázquez, J. A. and Hammond, P. S. 2017. Distribution, abundance and habitat use of deep diving cetaceans in the North-East Atlantic. Deep-Sea Research Part II 141, 8-19. http://dx.doi.org/10.1016/j.dsr2.2017.03.015

VI. APPENDIX 1 – CATCH DATA

In the whaling legislation, it is statutory declared that all harvest activities are to be reported, by the district Sheriff, to the Ministry of Fisheries within three days after each hunt.

Drives in the Faroe Islands in 2017			
Species	Pods	Number of whales	Samples taken
Globicephala melas	19	1203	559
Lagenorhynchus acutus	8	488	na
2017	**27**	**1691**	**559**

VII. APPENDIX 2 – BY-CATCH DATA

The electronic logbook system for all fishing vessels larger than 15 GRT, with mandatory reporting of marine mammal by-catches, has been in function for four years, still for some selected fleets. The rare incidences with by-catches of large whales have traditionally been reported directly to the Museum.

By-catch of marine mammals in the Faroe Islands in 2017					
Date	Locality	Species	Gear	Number	Samples
09 May	Faroese EEZ	Whale	Trawl	1	na
14 August	Faroese EEZ	Whale	Trawl	3	na
09 October	Faroese EEZ	Whale	Trawl	4	na
2017				**8**	

VIII. APPENDIX 3 – STRANDINGS

Strandings of live and dead animals are reported directly to the Natural History Museum, usually by the municipality or the district Sheriff.

Marine mammal strandings in the Faroe Islands in 2017				
Date	Locality	Species	Number	Samples
2017	Koltur	*Tursiops truncatus*	1	na