

FAROE ISLANDS PROGRESS REPORT ON MARINE MAMMALS 2021

By Bjarni Mikkelsen and Katrin Hoydal

I. INTRODUCTION

This report summarises research on cetaceans and pinnipeds conducted in the Faroe Islands in 2021, by the Faroe Marine Research Institute and the Environment Agency.

II. RESEARCH BY SPECIES 2021

II.a Species/Stocks studied

- Grey seals (*Halichoerus grypus*) – abundance surveys
- Pilot whales (*Globicephala melas*) – landed animals
- White-sided dolphins (*Lagenorhynchus acutus*) – landed animals

II.b Field work

In 2021, biological samples for age and reproduction analysis were collected from 354 and 305 **pilot whales**, respectively, by the Faroe Marine Research Institute, in 10 drives. In addition, 37 stomachs and 274 necropsies were stored for diet, genetic and contaminant studies. Also, 123 samples age and reproduction analysis were collected in one drive of **white-sided dolphins**.

In 2021, the Environment Agency took samples of **pilot whales** in connection with grinds in Hvannasund on 28 April, Leynar on 27 June, Sandavágur 7 July, Skálabotnur 10 August, Leynar 16 August and Leynar 1 September. In all, 71 individual samples of muscle and blubber, and approximately same number of liver and kidney tissue were taken. In addition samples of ear tissue (tympano-periodic complex) from 8 whales were sampled.

The Marine Research Institute has initiated a field study for estimating the abundance of **grey seals** in the Faroes. The survey is carried out from boat, surveying the coastline, with emphasis and increased effort around main haul-out sites. In 2021 all islands were visited, except the southernmost island. The plan is to complement the abundance census with tagging and camera monitoring, for applying a correction of animals outside the survey area during the counts.

II.c Laboratory work

The biological material collected from **pilot whales** in 2021, and material collected in previous years, together with samples of **white-sided dolphins**, is under processing for 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 pollution 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. The samples of pilot whale ear tissue have been sampled for analysis of mercury accumulation in sensory organs of pilot whales and mercury-selenium interaction as a co-operation between Environment Agency and a scientist from the Department of Anatomy and Cell Biology at Canadian Light Source in Saskatoon, Canada.

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, the legal practice for salmon farmers to cull **grey seals** was ceased with the implementation of law No. 65 from 14. May 2020. The Marine Research Institute has statistics of harvest numbers from all salmon farms back to 2010.

II.e Research results

In Desforges *et al.*, 2021, the distribution and speciation of mercury, as well as exposure-associated changes in neurochemistry, was characterized across multiple brain regions ($n = 10$) and marine mammal species ($n = 5$) that each occupy a trophic niche in the Arctic ecosystem. Consistent species differences in mean brain and brain region-specific concentrations of total mercury (THg) and methyl mercury (MeHg) was found, with higher concentrations in toothed whales (narwhal, pilot whales and harbour porpoise) compared to fur-bearing mammals (polar bear and ringed seal). Mean THg ($\mu\text{g/g dw}$) in decreasing rank order was: pilot whale (11.9) > narwhal (7.7) > harbour porpoise (3.6) > polar bear (0.6) > ringed seal (0.2). The higher THg concentrations in toothed whales was associated with a marked reduction in the percentage of MeHg (<40 %) compared to polar bears (>70 %) that had lower brain THg concentrations. This pattern in mercury concentration and speciation corresponded broadly to an overall higher number of mercury-associated neurochemical biomarker correlations in toothed whales. Of the 226 correlations between mercury and neurochemical biomarkers across brain regions, 60 (27 %) meaningful relationships ($r > 0.60$ or $p < 0.10$) was documented. This adds to the growing weight of evidence that wildlife accumulate mercury in

their brains and demonstrate that there is variance in accumulation across species as well as across distinct brain regions, and that some of these exposures may be associated with sub-clinical changes in neurochemistry.

Pavlov *et al.*, 2021, tested two hypothesis, that the evolution of fins as lifting structures led to a generic wing design, where the dimensionless parameters of the fin cross-sections were invariant with respect to the body length and taxonomy of small cetaceans (Hypothesis I) and that constraints on variability of a generic fin shape were associated with the primary function of the fin as a fixed or flapping hydrofoil (Hypothesis II). To verify these hypotheses, it was examined how the variation in the fin's morphological traits is linked to the primary function, species and body length. Hydrodynamic characteristics of the fin cross-sections were examined with the CFD software and compared with similar engineered airfoils. Generic wing design of both fins was found in a wing-like planform and a streamlined cross-sectional geometry optimized for lift generation. Divergence in a generic fin shape both on the planform and cross-sectional level was found to be related with the fin specialization in fixed or flapping hydrofoil function. Cross-sections of the dorsal fin were found to be optimized for the narrow range of small angles of attack. Cross-sections of tail flukes were found to be more stable for higher angles of attack and had gradual stall characteristics. The obtained results provide an insight into the divergent evolutionary pathways of a generic wing-like shape of the fins of cetaceans under specific demands of thrust production, swimming stability and turning control.

III. ONGOING (CURRENT) RESEARCH

The Faroe Marine Research Institute has since 2000 tagged 10 **pilot whale** pods, with 47 satellite transmitters deployed in total, for monitoring movements and migrations and to determine the overall distribution area of pilot whales recruiting to the Faroese harvest. The data is to be analysed, while new tagging await innovations in the field of bio-logging and the introduction of two upcoming tagging projects, MINITAG and TOPLINK, that will promote the continuation of pilot whale tagging in the Faroe Islands. The biological sampling of the drive hunt will continue.

The Faroe Marine Research Institute will continue the summer census for monitoring trend and abundance of the **grey seal** population. In 2022, the plan is to expand the study to include camera traps and satellite tracking, to study the behaviour, and to improve the accuracy of the abundance estimate.

The Environment Agency will continue to sample **pilot whales** for pollution monitoring in 2022. Co-operation with scientist at the Department of Anatomy and Cell Biology/ Canadian Light Source, Saskatoon, SK Canada, regarding the mercury/selenium in inner ear of the pilot whale, continues.

IV. ADVICE GIVEN AND MANAGEMENT MEASURES TAKEN

Law no. 65, from 14 May 2020 ban all culling of marine mammals in connection with fish farming activities. Prior to this, fish farmers were allowed to cull **grey seals** interacting with their fish farms, but with the new law enforcement, this cull has completely ceased.

The Fisheries Inspection has followed the recommendations from NAMMCO, that the 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 by-catch informations, both in the electronic and paper logbooks.

V. PUBLICATIONS AND DOCUMENTS

J.P. Desforges, B. Mikkelsen, M. Dam, F. Rigét, S. Sveegaard, C. Sonne, R. Dietz, N. Basu. Mercury and neurochemical biomarkers in multiple brain regions of five Arctic marine mammals. *NeuroToxicology*, Volume 84, 2021, Pages 136-145, ISSN 0161-813X, <https://doi.org/10.1016/j.neuro.2021.03.006>.

Mikkelsen, B., and Hoydal, K. 2021. Faroe Islands – Progress report on Marine Mammals 2020. Presented to the NAMMCO Scientific Committee, October 29 - November 1, online meeting, Faroe Islands. 6pp.

Pavlov V, Vincent C, Mikkelsen B, Lebeau J, Ridoux V, Siebert U (2021). Form, function and divergence of a generic fin shape in small cetaceans. *PLoS ONE* 16(8): e0255464. <https://doi.org/10.1371/journal.pone.0255464>