

Project information

Project title

1.1 Arctic Cetaceans and Ocean Noise (ACON)

Year

2015

Project leader

Kit M. Kovacs

Participants

Kit M. Kovacs (Project Leader, NPI). National partners: Drs Christian Lydersen (NPI), Laura de Steur (NPI), Rolf Ims (UiT), Jørgen Berge (UNIS) and Øystein Wiig (UiO). International partners: Drs Kate Stafford (University of Washington), Peter Tyak (SMRU, Univ. of St Andrews) and Finlo Cottier (SAMS, Scotland): [www.npolar.no](http://www.npolar.no) , [www.uit.no](http://www.uit.no), [www.nina.no](http://www.nina.no) , [www.unis.no](http://www.unis.no), [www.uio.no](http://www.uio.no) , [www.uwashington.edu](http://www.uwashington.edu) , [www.smru.st-andrews.ac.uk](http://www.smru.st-andrews.ac.uk) , [www.sams.ac.uk](http://www.sams.ac.uk)

Flagship

MIKON

Funding Source

The FRAM Centre program MIKON provided a budget of 1 M nok in 2015 to the ACON project. We will repeat our request for this sum for year 2 of this three year program (2015-2017) in our grant submission this year - in order to continue to staff this research effort. Most of the budget pays salary and overheads, with the remainder allowing the PDF to travel to project meetings and conferences, and providing for basic costs of keeping the AURAL network functioning (all deployment and recovery costs for ship time etc. are covered by NPI and project partners).

Please note that ACON is part of a larger NRC funded program entitled ICE whales, which has a total budget of 25, 244 M nok, 11,044 M nok of which comes from NRC (2015-2019). WWF and the Norwegian Foreign Affairs Departments are also sponsors that contribute to the total project budget estimated above.

Summary of Results

During the first year of this 3-year research program (2015-2017), considerable effort has been expended in PDF training, both in terms of Arctic cetacean ecology

and practical training in the specific and rather demanding field of Passive Acoustic Monitoring (PAM). This latter expertise has not been available in Norway in the past, so this program in MIKON is actually building national capacity in this field of research. The educational experience of ACON staff in 2015 included 1) a local FRAM Centre workshop in which all of the cetacean species occupying Svalbard waters were introduced, both in terms of identification of species in the field and general ecology 2) an intensive course offered by PAMTech ([www.pamtech.eu](http://www.pamtech.eu)) entitled "PAM – A Practical Introduction, the learning outcomes of which were - a general introduction to PAM as a research tool – capabilities and limitations; applications of PAM and use of different type of acoustic recorders; understanding how sound travels underwater, how to measure and understand the intensity of sound underwater; comprehensive knowledge of how to use PAMGuard (a standard soft-ware tool for PAM studies); an overview of how to use PAMGuard in real time for mitigation, detection, classification and localisations of marine mammals and an overview of how to use PAMGuard as a post-processing tool to navigate large datasets, use automatic detectors and species classification; ability to run and configure Click and Whistle & Moan detectors for different cetacean species. This workshop also facilitated our team linking-up with acousticians who form the core group for PAM research in Europe i.e. important professional networking and 3) intensive analytical training during a research visit with an ACON partner (Dr Kate Stafford, U of Washington, Seattle) during which Dr Ahonen learned how to : 1) program AURALs and troubleshoot for problems with the network's instruments 2) rearrange and rename raw data (WAV. sound files) recovered from the AURALs, including instructions in how to use InfoWAV and MatLab, specifically for acoustics studies 3) use Ishmael – bioacoustics analysis software, which allows for viewing of a sound by displaying it in a spectrogram and time series and 4) use program AMBSTAT for ambient noise level analysis and 5) familiarization with underwater noise source signatures as well as those of target arctic cetacean species.

Concrete progress with the scientific outcomes of the program achieved in 2015 include: 1) creation of automated detectors for both blue and fin whales and for seismic airguns in order to make analyses time effective 2) continued data processing (of newly achieved data records from 2013-2014 – the 2014-2015 data series have just been brought to Tromsø in the past weeks) in terms of both anthropogenic noise (an example of which can be seen in Fig. 1) and whale sounds ; 3) collection of environmental data (sea ice cover, water temperature etc.) which are essential to perform the complete package of analyses of impacts of ocean noise on cetacean behaviour; 4) visual analyses of all narwhal signals from Fram data sets (2010-11, 2012-13 and 2013-14) – the odontocete echolocation signals are analysed manually because of their unique spectral qualities.

We have commenced drafting of the first paper in the series planned for this project, entitled “Annual and inter-annual ambient noise levels in the northern Barents Sea: the overlap between airguns and whales in the northern Barents Sea”. We have also started trying to assess “ship noise”, but, this is proving very challenges because of the many frequencies of various types of engines. We will continue work with this issue over the coming year, but field tests might be necessary to sort out the problems with this issue.

Highlights of where ACON is making scientific progress include: 1) building national capacity in the field of Passive Acoustic Monitoring 2) characterizing anthropogenic noise in Norway’s High Arctic and 3) determining the overlap between seismic pulses and arctic cetacean distribution on both seasonal and inter-annual scales.

For the Management

Levels of ocean noise and their impacts on arctic fauna are essential management inputs. This project has high relevance for management in the Norwegian Arctic.

Published Results/Planned Publications

No manuscripts have been submitted in this first year of the programme – but the following publications are planned for the 3-year project period:

1. Annual and inter-annual ambient noise levels in the northern Barents Sea: the overlap between airguns and whales in the northern Barents Sea
2. Inter annual variability in the presence of balaenopterid whales in the Norwegian Arctic – the influences of environmental conditions and ocean noise
3. Bowhead songs and ocean noise levels – to scream or not to scream?
4. Multi-year study to investigate the presence of narwhal (*Monodon monoceros*) in Fram Strait
5. Seasonal variation in Bowhead whales – the impact of interannual ice conditions and other environment variables (temperature, current, salinity) on the occurrence of Spitsbergen bowheads
6. Phenological shifts in the arrival times of migratory cetaceans in the North Atlantic – determined using Passive Acoustic Monitoring
7. Density estimates of rare whales, explored via Passive Acoustic
8. Inshore and offshore environments – where do Arctic whales find quiet spaces?

#### Communicated Results

The ICE-whales programme hosted an Artist in Residence this year – who has used his experience within the programme to create "Aquamarine Études", a series of piece for the grand piano, electronics and voice --accompanied by videos from the expedition. The artist (Mr Simon Tegnander) describes this work as “a musical journey into the landscapes encountered in the world of arctic whales”. He uses both video footage and recorded sound as part of this multi-media art-work. He has composed eight piano “pieces”, telling the story of a departure into the unknown. He showed footage of animals encountered the colors of the sky, water and ice, ending with the blue and turquoise open ice scenery when the tones of the piano slowly fade. This work was performed as part of Kulturnatta Tromsø 2015. Mr Tegnander is also preparing a film based on his field experiences. This is new ground for us in terms of outreach and channels for science and nature reaching the public – but we deem this first attempt as being very successful (please see <https://vimeo.com/141787627> .

#### Interdisciplinary Cooperation

ACON does benefit from its highly inter-disciplinary nature. Biology, sound physics and geophysics are all involved in this program. It is early days with integrating the environmental (ocean temperature, ice cover etc) data with the animal signals and ocean noise, but this will come together over the next two years.

#### Budget in accordance to results

The Fram Centre budget for this project is essential in getting this scientific work done. The NRC project ICE-whales would not have been able to accommodate the PDF support needed to realize our acoustics work.

The ACON project is fundamental in building national capacity in the field of PAM, which is likely to expand dramatically in the next decade as the consequences of growing recognition of the impacts of ocean noise. Industry should be financing much more work in this field, and have studies such as ours as integrated requirements for licensing of new exploration for oil and gas. We will follow-up this line of thinking with the Ministry of the Environment as our scientific results become available.

Could results from the project be subject for any commercial utilization

No

If Yes

No: PAM should be an active monitoring tool used by the oil and gas industry. But – ACON results will not produce direct commercial products.

Conclusions

Ongoing PAM is essential given the rapid reduction of sea ice cover in the Barents Region and the equally rapid response of industry to occupy these newly exposed areas that have traditionally been naturally protected environments for arctic endemic cetaceans.

In the ACON project we are improving methods for analyses by creating specific filtering tools for acoustic records for the Northern Barents Sea ; we will continue to improve these new tools and use them to filter AURAL records over the final two years of this research programme so that future PAM endeavors in this region can be achieved in a cost-effective manner.