

Project information

Keywords

Ocean noise, marine mammals

Project title

Arctic Cetaceans and Ocean Noise (ACON)

Year

2017 (2015-2017)

Project leader

Kit M. Kovacs

Geographical localization of the research project in decimal degrees (max 5 per project, ex. 70,662°N and 23,707°E)

79 N 5 W; 81 N 31 E; 78 N, 12 E; 89 N 22 E; 78 N 13E

Participants

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, University of St Andrews) and Finlo Cottier (SAMS, Scotland).

Flagship

MIKON

Funding Source

MIKON plus some additional support from NPI and NRC (via the ICE-whales research project, Økosystem Programme)

Summary of Results

Three primary study elements have dominated our work in ACON to date.

1) The ACON project has documented the complete annual soundscape for a principle breeding area of the Critically Endangered Spitsbergen bowhead whale population. The soundscape was quasi-pristine much of the year, with low numbers of ships traversing the area. However, during summer/autumn signals from airgun surveys were detected more than 12 hrs per day. Mean received peak-to-peak SPLs for loud airgun pulses reached 160.46 +/- 0.48 DB (1 uPa) when seismic-survey ships were close (at 57 km). Bowhead whales were present almost daily October-April in all years studied to date, with singing occurring in almost every hour of the day from November - March. Currently, loud anthropogenic sound sources do not temporally overlap with the peak period of bowhead singing; this is vital to ensure that sound masking does not take place, which could negatively impact bowhead breeding behaviour. This study (Ahonen et al. 2017) provides important baseline data for future monitoring.

2) The extreme singing documented above has been explored structurally. Members of the Spitsbergen bowhead whale population produced 184 unique song types over a 3-year period at a site in Fram Strait. Individual songs occurred over short periods, lasting at most some months. One hypothesis that might explain this extreme song diversity is that bowhead whales in this area could be a mix of animals from multiple populations - but this in itself does not explain the annual shifting of song types that is taking place. Another hypothesis that seems more likely is that the extreme historical exploitation experienced by this population drove selection pressure for extraordinary levels of novelty in males' songs (Stafford et al. submitted to PLOS one - in review).

3) Pulsed and tonal signals, as well as echolocation clicks from narwhals have been studied in Northwestern Fram Strait. Remarkably, this species, similar to bowhead whales, is found in this area throughout much of the year. Peak numbers of detections were recorded from August through until October. Fewest detections were consistently recorded in April. In addition to this strong seasonal patterns, a diel pattern in signalling was also found, with more signalling taking place during daylight and early twilight than at night. Narwhals are considered to be the Arctic cetacean species that is most vulnerable to climate change, in part due to the reduction in seasonal sea ice, as well as increased anthropogenic activity and noise accompanying sea ice reductions. Knowledge of distribution and seasonal occurrence are vital to inform management and conservation of this endemic Arctic species. These results were presented at the Society for Marine Mammalogy meeting in Halifax in October 2017 and will soon be submitted for publication.

Additionally, arrival and departure times of seasonally resident whales are currently under analyses.

Master and PhD-students involved in the project

For the Management

ACON is producing vital knowledge relevant to management and conservation of Arctic endemic cetaceans. This includes distributional information as well as current sound exposure levels.

Published Results/Planned Publications

- 1) Ahonen, H., Stafford, K.M., de Steur L., Lydersen, C., Wiig Ø. and Kovacs, K.M. 2017. The underwater soundscape in western Fram Strait breeding round of Spitsbergen's endangered bowhead whales. *Marine Pollution Bulletin* 123: 97-112.
- 2) Stafford, K.M., Lydersen, C. Wiig, Ø. and Kovacs, K.M. 201x. The Arctic's Pavarotti: extreme complexity in the songs of Spitsbergen's bowhead whales. Submitted to *Biology Letters*.
- 3) Ahonen, H., Stafford, K.M. de Steur, L., Lydersen, C. and Kovacs, K.M. Northeast Atlantic narwhal (*Monodon monoceros*) - a multi-year study of occurrence detected with a passive acoustic recorder. MS - soon to be submitted.
- 4) Phenology of arrivals and departures of fin and blue whales in the Northeast Atlantic Arctic - signals of climate change. MS - under analyses - to be completed by the end of the project period.

Communicated Results

Ahonen, H., Kovacs, K.M. and Lydersen, C. 2017. The soundscape where Spitsbergen's critically endangered bowhead whales breed. *Research Notes - Fram Forum* 2017: 72-75.

Ahonen, H., Stafford, K.; Lydersen, C., de Steur, L., Kovacs, K.M. 2017. Northeast Atlantic narwhal (*Monodon monoceros*) - a multi-year study of occurrence detected with a passive acoustic recorder. 22nd Biennial Conference - Biology of Marine Mammals, Society for Marine Mammalogy, Halifax, Nova Scotia, Canada 22-27 October 2017.

Interdisciplinary Cooperation

Marine mammalogy, sound physics and oceanography come together in ACON to produce exciting interdisciplinary results.

Budget in accordance to results

Four primary publications, as well as some outreach results will be published/submitted within the three year project period (3 M budget). This is somewhat lower production than initially envisaged - but autodectors that we had hoped would function did not - so data extraction has been much more laborious than initially thought.

Could results from the project be subject for any commercial utilization

Yes

If Yes

Yes - commercial operators should actively use data such as that from ACON to plan seismic surveys or other potentially disruptive human activities to minimise their negative consequences for animal populations in the High Arctic.

Conclusions

ACON is an exciting and productive programme that has provided a solid start on analysing extensive PAM data from Svalbard and surrounding waters (extending west to Fram Strait) collected by an AURAL acoustic array. It clearly demonstrates the promise of this technology to provide valuable, management-oriented data streams that are essential to mitigate human impacts on sensitive Arctic animal

populations. Our Norwegian data should be linked up to circumpolar arrays to provide broad, comparative circumpolar coverage of soundscapes across the Arctic. CAFF and other agencies are actively seeking such data.