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Marine Mammals in the Arctic – Monitoring Human Impact

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Background

Over the past decades, air temperatures over much of the Arctic have been rising, causing a substantial decrease of the geographical extent of sea ice. This will cause a considerable change of the arctic ecosystem, as well as lead to longer open water seasons, which will give way to increases in human activity (e.g., oil and gas exploitation, mining, marine transport, commercial fishing and tourism). Marine mammals can be regarded as sentinel species for the state of the ecosystem they live in and can contribute to the assessment of the responses of the system to a topical issue such as climate change. Here, we have chosen some exemplary case studies to show the wide range of observed and potential impacts, as well as the methods available to monitor changes in animals' performance as a consequence of sea ice reduction and the expected inherently increased human activity.

Impacts

REDUCTION IN SEA ICE

POLAR BEARS
- habitat loss due to reduction in sea ice
- reduced prey availability
- increase in contaminants

WALRUSES
- changing from sea-ice to land haul out sites
- reduced access to benthic feeding habitat
- potential prey shift to seals

PAGOPHILIC SEALS
- haul out site loss
- breeding site loss
- effects of contaminants on health
- changes of prey availability

BOWHEAD WHALES
- impact of increasing acoustic noise
- change of migration routes due to sea ice change
- changes in prey distribution and availability

Responses

- reduced reproductive success
- changed distribution patterns
- changes in stock size
- changes of position in food web
- changed nutritional and health status and contaminant level
- hearing impairment, behavioural reactions

Monitoring Methods

VISUAL AND ACOUSTIC SURVEYS
- design based surveys
- pup and lair counts, seal counts on ice
- modelling of survey data

REMOTE SENSING
- investigating migration routes and changes thereof
- collection of environmental data via telemetry
- recording sound

PHOTO-IDENTIFICATION
- mark recapture studies for abundance estimates
- individual identification and studies for the determination of population parameters (recruitment, mortality)

TOXICOLOGY / PATHOLOGY
- health assessment
- analysing relationship between contaminants and health
- pathology of marine mammals
- investigating hearing damage
- quantifying reproductive success

PREY
- fatty acid analysis
- stable isotope analysis
- stomach content analysis
- scat sample

BEHAVIOUR
- direct observations of behaviour
- acoustic monitoring of behaviour
- individual identification

Conclusion

The marine mammals that will be most affected by climate change in the Arctic are those that live in close association with the sea ice such as the polar bear, ringed seal, harp seal, bearded seal, hooded seal, narwhal, beluga whale, bowhead whale, gray whale and walrus. The increase of temperature will lead to overall changes in the arctic ecosystem.Changes in the extent and concentration of sea ice may alter the seasonal distributions, geographic ranges, patterns of migration, nutritional status, reproductive success, and ultimately the abundance and stock structure of numerous species. In addition, increasing human activities causing disturbance in the broad sense, as well as increasing the risk of pollution, could further worsen the situation for these animals. One special problem are activities causing intensive noise, e.g. icebreakers and seismic surveys. The acoustic sense is especially vital to cetaceans, and a permanent or temporal impact on their hearing capabilities will endanger the survival of individuals and potentially of populations that are already at risk because of the major changes occurring in their habitat.

It is obvious that monitoring the response of marine mammals to ecosystem changes as well as to specific human activities is complex. Since the observed changes in sea ice extent in the Arctic are non-uniform, the direct and indirect effects on marine mammals can be expected to vary geographically as well as on a species level. For some species a change in the ecosystem could even be beneficial. The potential and observed negative impacts can range from small scale short term changes, e.g. behavioural reactions to a boat, to the complete loss of a vital habitat. Apart from investigating direct impacts on a small scale, studies that cover large geographical scales and include as much baseline data as possible are needed to understand effects on marine mammals and ultimately on the whole arctic system. Collection of such reference data needs to be done now- before human activities are increasing further in the Arctic sea.

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scheidat 01-2007

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