Community Paper for the 2016 Arctic Observing Summit

Theme 6: Interfacing Traditional Knowledge, Community-based Monitoring and Scientific Methods for sustained Arctic Observations

Title: **Enhancing monitoring of beluga whales (*Delphinapterus leucas*) in the western Canadian Arctic through the development of local ecological indicators**

Authors:
Sonja Ostertag* (Freshwater Institute, Fisheries and Oceans Canada)
Deva Lynn Pokiak (Tuktoyaktuk, NT)
Diane Ruben (Paulatuk, NT)
Kate Snow (Inuvik Area Office, Fisheries and Oceans Canada)
Lisa L Loseto (Freshwater Institute, Fisheries and Oceans Canada)
** Corresponding author (sonja.ostertag@dfo-mpo.gc.ca)*
Ostertag, Sonja1, Pokiak, Deva Lynn2; Ruben, Diane3; Snow, Kathleen4, Loseto, Lisa5

Introduction

The Inuvialuit of the western Canadian Arctic have harvested beluga whales (*Delphinapterus leucas*) for centuries; today, the harvest continues at summer whaling camps situated along the Beaufort Sea coast (McGhee 1988; Harwood and Smith, 2002). Beginning in the 1980s, beluga harvests were monitored in the Inuvialuit Settlement Region (ISR) in Kugmallit Bay, Shallow Bay and Kendall Island and the Paulatuk area (Harwood et al., 2015). Standardized beluga monitoring documents the size, efficiency and timing of the subsistence harvest (Harwood et al., 2015); sample collection supports the analysis of indicators for beluga diet, ecotoxicological endpoints and contaminant exposure (e.g. Desforges et al., 2013; Loseto et al., 2008a, 2008b; Noel et al., 2014; Ostertag et al., 2013).

The knowledge about beluga whales held by the Inuvialuit is associated with decades of observations, and includes hunters' and Elders' knowledge of beluga whale behaviour and predation (Byers and Roberts, 1995). Although hunters and monitors have contributed to the beluga monitoring program in the ISR through sampling and data collection, the traditional and local ecological knowledge (TEK/LEK) held by the Inuvialuit have not been explicitly recorded in the monitoring process. Therefore, this study was initiated in 2013 to record local observations and identify TEK/LEK indicators of beluga whales that could support holistic monitoring of beluga whales. This project aimed to document community perspectives and observations of beluga whales that may be used as indicators of beluga health and environmental change.

Approach

This project aimed to include all interested community members from Inuvik, Paulatuk and Tuktoyaktuk, NT, to engage in the development of methods and instruments for documenting local observations about beluga whales in the ISR. The process for developing the instruments, recording observations and interpreting results involved frequent community engagement through community meetings, interviews, semi-structured questionnaires, survey forms and focus groups in the three communities. In

addition, this project aimed to provide opportunities for local employment and increased capacity for research.

Results and Discussion

This project successfully engaged community members from the predominant beluga-harvesting communities in the ISR (Table 1). Community meetings held in 2013 were well-attended and were effective for initiating the project design. In 2014, we found that the meetings were less effective for exploring findings from the data collection; therefore, we chose to use focus groups in 2015 to review the research findings and fill in knowledge gaps.

Questionnaires and surveys supported the collection of 'real-time' observations made during the harvest about beluga condition, behaviour and activity, or, opportunistic observations about migrating and feeding whales. The methods for recording shore-based observations varied between years, hence the large number of observations in 2013 and 2014 compared to 2015. Overall, community members were receptive to the use of questionnaires and surveys for documenting local observations. However, the use of questionnaires to record observations following the beluga harvest was more challenging due to the time constraints associated with butchering and food preparation.

Through interviews and focus groups, we were able to spend more time with participants, meet with more diverse knowledge-holders (e.g. women, youth, Elders, and harvesters) and reach greater depths of understanding.

The final stage of this work will be to identify potential indicators for beluga health and habitat use. The final decision on the best indicators and methods for monitoring local indicators will take place with the participation of northern research partners. We will use the following criteria to evaluate beluga characteristics that could serve as potential indicators:

1) An observation that can be recorded by harvesters, beluga monitors and/or community members;
2) an observation that is considered to be important by community members based on consensual informant responses;
3) an observation that supports or complements scientific studies; and,
4) observations that are quantifiable and/or comparable between years and/or communities.

Conclusions

The strong community engagement that was also diverse in its representation resulted in the successful collection of a broad range of observations and a depth of knowledge about beluga whales that will strengthen the beluga monitoring program. This work supports the inclusion of the Inuvialuit in strengthening the beluga monitoring program in the ISR through the development of novel indicators of beluga health and habitat use. Previous work has identified that the inclusion of all knowledge holders and users in developing research and management plans creates an enriched understanding of the changes occurring in arctic marine ecosystems and supports knowledge generation and sharing (Tengo et al., 2014).

Table 1. Participation in the LEK/TEK and local observations project by community members in the Inuvialuit Settlement Region. The annual number of meetings, research assistants and participant observations were pooled for Inuvik, Paulatuk and Tuktoyaktuk, NT, between 2013 and 2015.

Activity	Year		
	2013	**2014**	**2015**
Community meetings (*n*)	6 meetings >80 participants	6 meetings 51 participants	0
Focus groups (*n*)	na	na	3 meetings 28 participants
Community-based research assistants (*n*)	4	6	5
Shore-based surveys (*n*)	346	451	76
Harvester observations (*n*)	30	28	33
Interviews (*n*)	na	43	2

References

Desforges J, Ross P, Dangerfield N, Palace V, Whiticar M, Loseto L. (2013). Vitamin A and E profiles as biomarkers of PCB exposure in beluga whales (*Delphinapterus leucas*) from the western Canadian Arctic. *Aquat Toxicol.* 142-143: 317-28.

Harwood, L.A. and Smith, T.G. (2002). Whales of the Inuvialuit Settlement Region in Canada's Western Arctic: An overview and outlook. *Arctic* 55(1): 77-93.

Harwood, L.A., Kingsley, M.C.S., and Pokiak, F. (2015). Monitoring beluga harvests in the Mackenzie Delta and near Paulatuk, NT, Canada: harvest efficiency and trend, size and sex of landed whales, and reproduction, 1970-2009. *Can. Manuscr. Rep. Fish. Aquat. Sci.* 3059: vi + 32 p.

Loseto L, Stern G, Deibel D, Connelly T, Prokopowicz A, Lean D, Fortier L, Ferguson S (2008a). Linking mercury exposure to habitat and feeding behaviour in Beaufort Sea beluga whales. *J Marine Syst.* 74: 1012-1024.

Loseto L, Stern G, Ferguson S. (2008b). Size and biomagnification: How Habitat selection explains beluga mercury levels. *Environ Sci Technol.* 42: 3982-8.

McGhee, R. 1988. Beluga hunters: An archaeological reconstruction of the history and culture of the Mackenzie Delta Kittegaryumiut.

Noel M, Loseto L, Helbing C, Veldhoen N, Dangerfield N, Ross P. (2014). PCBs are associated with altered gene transcript profiles in arctic beluga whales (*Delphinapterus leucas*). *Environ Sci Technol.* 48: 2942-51.

Ostertag S, Shaw A, Basu N, Chan H. (2014). Molecular and Neurochemical Biomarkers in Arctic Beluga Whales (*Delphinapterus leucas*) were Correlated to Brain Mercury and Selenium Concentrations. *Environ Sci Technol.* 48: 11551-9.

Tengo M, Brondizio E, Elmqvist T, Malmer P, Spierenburg M. (2014). Connecting Diverse Knowledge Systems for Enhances Ecosystem Governance: The Multiple Evidence Base Approach. *AMBIO.* 43:579-591.