



Spring and fall migration routes of the bowhead whale in the Western Arctic/Bering Sea region.

*Adapted from *The Bowhead Whale*, Special Publication Number 2, The Society for Marine Mammalogy, 1993

THE BOWHEAD WHALE (*Balaena mysticetus*) AS A POTENTIAL INDICATOR SPECIES

FOR MONITORING THE HEALTH OF THE WESTERN ARCTIC/BERING SEA ECOSYSTEM USING BLUBBER, HISTOLOGY AND CONTAMINANT INDICES



Toxicological sampling of blubber sections.

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INTRODUCTION

The bowhead whale (*Balaena mysticetus*) is an endangered mysticete and an important subsistence species to many native communities in both Alaska and Russia. The population health of the bowhead whale is intimately tied to offshore/coastal development and other human activities that influence ecosystem health. The native subsistence hunt provides a unique opportunity to examine this rare species and likewise the data to investigate the health status of Bering Sea/Western Arctic population. The research proposed in this study will provide techniques and baseline data that can be applied to other endangered marine mammal populations, such as the northern right whale.

OBJECTIVES

Determine the normal range of values for basic nutritional and health parameters in the bowhead whale

- Blubber thickness, chemical composition, and tissue structure
- Essential and non-essential elements in liver and kidney
- Tissue structure related to nutritional status in liver, pancreas, intestine, etc., and evaluation for evidence of disease
- Additional serum and tissue assays

Employ data from above to:

- Determine the role of the bowhead whale as an indicator of ecosystem health
- Develop an optimized protocol for assessing mysticete health for the Bering Sea, Western Arctic Sea and other regions

We propose to investigate and make comparisons in tissues examined for:

- Spring vs. fall harvested animals
- Size/age cohorts as determined by morphometrics, aspartic acid racemization (eye lens), and collagen/elastin/reticulin aging
- Gender/reproductive stage



A large bowhead whale has been hauled onto the ice during the spring whaling season.



Butchering begins with removal of the maktak (blubber).



A lesion on the maxilla of a bowhead whale.

Organochlorines

Analyses will be conducted on select cores (blow-hole girth) for deep, middle and outer sections, (three sections per core, nine samples per whale)

- investigate sample site/depth dependent differences in OC levels
- consider OC contaminant levels in light of overall health assessment

Histology

Establish normal histology
Establish a pathology "scoring" system and create confidence levels for pathology in tissues.

Document pathology

- epidermal lesions
- special stains
- liver (glycogen, lipid and lipofuscin stores)
- pancreas (zymogen granules)
- intestine (microvilli- document inactivity/atrophy)
- thyroid histology and hormone levels (measure serum levels of T3 and T4, relate data to OC levels)
- adrenal histology (relate data to OC levels)

Serum haptoglobins levels

We will investigate the acute phase reaction in the bowhead whale to assist in evaluating potential stressors

Metallothionein

Protein binding in relationship to heavy metal toxicity (specifically Cd) will be investigated
Histologic samples for will be stained metallothionein and it will be measured in tissues

Aging

Aspartic acid racemization (lens nucleus) techniques will be employed as a means of aging whales
We will also test the aging potential of soluble collagen cross linking quantification

Acknowledgements

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Proposed research to include:

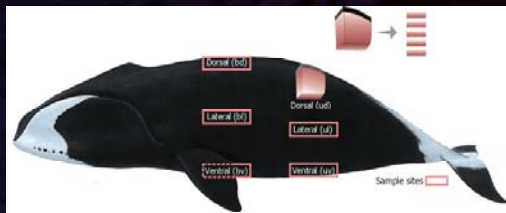
Blubber Indices

Thickness and girth (quantity) as determined by:

- blubber core/section measurement at the peduncle, anus, umbilicus, one meter caudal to the blowhole, and axilla

Sampling and depth determination along two girths at ventral and dorsal midline sites, and a lateral site

- A total of six full thickness cores will be taken and divided into five equal sections resulting in thirty samples per whale



Basic blubber indices

- % lipid, water, and protein; calories
- lipid profiles and class composition

Histology

- collagen, elastin and reticulin ratios at different depths/orientations (of cut tissue section)

Metals/Minerals

We propose to address physiological, clinical, pathological, and histopathological evaluations of whale tissue with comparisons to tissue metal/trace mineral concentrations (especially liver and kidney)

Samples from kidney and liver will be analyzed for Hg, Cd, Se, As, Cu, Zn, Mn, Mg, Pb, Mo, Co

Archived data will be available for inclusion in analysis
Special stains will be employed

Renal fibrosis has been noted in the kidneys of bowhead whales (Bratton, pers. comm.)

We will investigate the possible association between age and/or cadmium driving these fibrotic changes