Inuit Qaujimajatuqangit of the Narwhal; Traditional Knowledge Integrated with Tusk Scientific Research.

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Narwhal Tusk Research, $P_{C,C} > L^{C} > L^{C} - L^{C}$ $D_{C,C} = D_{C,C} + D_{C}$ $D_{C,C} = D_{C} + D_{C}$ $D_{C,C} = D_{C} + D_{C}$ $D_{C,C} = D_{C} + D_{C}$ $D_{C} = D_{C} + D_{C} + D_{C} + D_{C}$ $D_{C} = D_{C} + D$

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Scanning electron microscopy, of two freshly harvested narwhal tusks, at the Paffenbarger Research Center under the direction of Dr. Frederick Eichmiller and Anthony Giuseppetti revealed open tubules at the surface. When extrapolated over a length of nine feet, there are approximately 10 million of these connections that run through the entire thickness of the dentin. These micro anatomical findings suggest sensory function from the outer external arctic water and air environments to the inner nerve of this tooth.



Visual Map





Dr. Naomi Eidelman Principal Investigator FTIR analysis FTIR, Fournier transform infrared fluorescence microspectroscopy



FTIR analysis completed by Dr. Naomi Eidelman revealed a reverse architecture of normal mammalian teeth. The narwhal tusk is softer on the outside with a higher concentration of collagen and is most dense, with a high mineral content, at its inner core surrounding the nerve.





























Inuit elders and hunters from six communities in northeastern Baffin Island and northwestern Greenland were interviewed about their knowledge and experience about the narwhal. Recordings were completed using a three CCD digital video recording and digital wave files, both of archival quality. The integration of *Inuit Qaujimajatuqangit* with scientific study has directed, influenced and contradicted scientific results and ultimately has assisted in the greater understanding of this unique arctic species.

SAMPLE QUESTIONS FROM THE INTERVIEWS:

How often do you notice or hear about a double tusked narwhal? Can they occur in males and/or females? いしんしょうしょうしょうしょう。 しいしいしょうしょう。 Qanuq akulikitsigisumik marlunnik tuugaalimmik tusagaqartarpit? Maarlunnik tuugaallit angutiviaasarpat arnavissalluunniit?

Do male and female narwhals swim differently? ۲۰۵۰ ۵۰۵۰ ۵۰۵۰ ۵۰۵۰ ۵۰۵۰ ۵۰۲۰۲۰ Qilalukkat tuugaallit arnavissallu naloriaasiat assigiinngissuseqarpat?

How often have you seen or heard about a male without a tusk? రెడ్రి సిన్ రెడ్రా ఎన్ రెడ్రి సిన్ రెడ్రా స్రామిగ్ రెడ్రి సిన్ రెడ్రి సిన్ రెడ్రి సిన్ రెడ్రి సిన్ రెడ్రి సిన్ Qanuq akulikitsigisumik angutivissamik tuugaaqanngitsumik takusarpit imaluunnit tusartarpit?

An 11-page questionnaire with 91 questions of narwhal anatomy, migration, population, and behavior was prepared and translated into two dialects of Inuktitut and two dialects of Western Greenland. Formulation of questions was reached over a two-year period and based on scientific inquiry, and suggestions and comments from those Inuit interviewed.

NAMING THE WHALE

Monodon *monoceros*, Linneus, 1758 "One tooth, one horn"

Narwhal, from the Old Norse, Naar meaning cadaver or corpse, thus the translation to corpse-like whale. If the meat was ingested, Danish lore told of a corpse-like state the body would develop.

Qilalugaq Qirniqtaq, Inuit name translates to mean, the one that is good at curving itself to the sky.

Perhaps one of the best examples of differing insights about the narwhal is in the naming of the whale. Western and scientific names, still most commonly used, have shortcomings. Narwhal have arguably four teeth and no horns and their skin patterns and color have a higher contrast and are more interesting than the skin of a drowned Scandinavian sailor. The Inuit name, however, is both descriptive and accurate.



DESCRIBING ANATOMICAL VARIATION

The Encyclopedia of Marine Mammals (Academic Press, 2002) describes the adult narwhal as "completely mottled on the dorsum but with increasing white fields on the ventral side. Old adult males only maintain a narrow darkspotted pattern on the top of the back, whereas the rest of the body is white."

Inuit descriptions of narwhal include:

Adult narwhal	Tiggaq	∩ ^ւ Լ
Female with tusk	Arningali	ᢀ᠋ᢅᡃᠳᡐ᠋᠘᠋᠆
Female and male without tusk	Tuugaittuq	ϽႱϪϲϽͼϷ
Male with white color	Qakuyuktuq	᠈᠈᠘ᢋᢣ᠘ᡆ
Male with black color	Qinnijuktuq	᠄᠙ᠳ᠊ᢣᡃᡃᠫ᠋᠄ᡃᡉ
Male with long tusk and black	Tuujrinnirsait	᠋ᢃᡰ᠋ᡅᡨᠳ᠋ᠮ᠋ᠴ᠘
Male with shorter and wider tusk	Tuugaitun	⊃i∆⊃°

Inuit descriptions of anatomic variation are more highly developed than scientific published results. In addition to classification schemes of narwhal body and skin morphology, there are observations of tusk morphologic variations that are descriptive by phenotype and variations within each sex that are not in scientific published accounts.

COMPARING CANADIAN AND GREENLANDIC NARWHAL

- Morphology, Greenlandic narwhal have a broader and wider body form than Canadian.
- Behavior, Canadian narwhal are less timid and easier to hunt than Greenlandic.



Differences in body morphology are also evident among different populations of narwhal as described by many Inuit.

Climate Change and Narwhal Migration

Narwhal are migrating further into inlets to new communities in northern Baffin Island. In northwestern Greenland summer migration was delayed approximately two weeks from the previous year. Both observations were made during the summer months of 2006. With climate change and new ice conditions in the arctic, narwhal behavior, migration and population dynamics have changed. By listening to these Inuit voices, we have gained further insight into the unique relationship of this whale with its arctic ice environment and more fully understand the dynamic inter-play and changes affected by changing weather and ice conditions.



Besides many of the unique and known tusk variations and morphologic variations, *Inuit Qaujimajatuqangit* reveals other noteworthy patterns. For example, within male narwhal, there are three characteristic phenotypes. The first is the bull narwhal, usually darker in color and larger, and with no tusk. The second is the bull narwhal that is usually all or mostly black with a wider and shorter tusk. The third is the more common adult male with a characteristic skin pattern and having black only on its dorsal surface with a wider area around its head and becoming narrower toward the flukes. Tusk morphology for this type is the usual form documented in the literature.

FINDING THE CAUSE OF BROKEN TUSKS

Inuit observation describes narwhal that are scared from killer whales and hunters dive in shallow waters hitting the bottom and breaking their tusks against the ocean floor..





Estimates of broken tusks in the scientific literature range from 30% (Silverman and Dunbar, 1980) to 66% (Gerson and Hickie, 1985). Aggressive use of the male tusk between males or in defense against predators (Buckland, 1882; Gray, 1889; Freuchen, 1935; Breummer, 1966; Ford, 1986) is the most common cited cause.

Inuit observations are often insightful and may clarify recorded scientific field results. The cause of broken tusks is one such example, where studies being conducted result from museum samples that are skewed toward broken samples that were more easily acquired. Inuit report narwhal behavior in reaction to hunting

from Orca and human hunters to be the primary cause of broken tusks and not intra-narwhal behavior from tusking.



Scientific fieldwork is often assisted by hunters familiar with narwhal anatomy. In 2003, cryogenic work was assisted by hunters who were skilled in retrieving tissue from specific anatomic landmarks.

Who Leads The Herd?

Many elders commented that male narwhal with the largest tusk often leads the group. Others stated that in some cases a female can lead smaller groups or act as scouts to check if an area is safe.

Studies centered on the purpose and function of the tusk are dependent on narwhal behavioral observations. Traditional knowledge that describes males commonly leading larger migrating groups during spring movement into the inlets, provides valuable information to this biologic puzzle.



Besides its dietary importance and use as a food source, the narwhal has significant social and cultural importance. The legend of the narwhal describes a story of a mother who is not kind in the raising of her blind son. Her punishment is seen in this graphic illustration. Attached by a rope to a beluga that is harpooned by her son, the mother is thrown in to the water with her hair twisting to form the narwhal tusk. The story is similar and known by all Inuit and its lesson is a testament to social mores that teach the Inuit to respect and value each other as equals. To cite this publication:

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