changes in numbers of sea lions were indeed related to the frequency of trawling (number of hauls) or amounts of Atka mackerel caught within 10, 20 or 40 nautical miles of sea lion rookeries and haulouts in Fishery Management Areas 541, 542 and 543 from 2000-2009. We considered the total amounts of fish removed within each zone as measures of possible depletion of sea lion prey, and used the average catches per haul within each zone as localized relative measures of stock size of Atka mackerel available to sea lions. None of our models found a relationship between measures of Atka mackerel biomass and numbers of sea lions at rookeries and haulouts. Nor did our models detect a negative relationship between fishing effort (number of hauls and total catch) and sea lion numbers or population trends. However, three models found small positive associations between fishing and sea lion numbers. Our findings are not consistent with the *a priori* expectation that lower sea lion numbers were associated with greater fishing effort. The data from the Atka mackerel fishery do not support the contention that sea lion trends were negatively associated with groundfish fisheries in the central and western Aleutian Islands.

A case-study of Baltic ringed seal (*Pusa hispida bothnica*) adaptation in the wild after a long-term rehabilitation and use of satellite tagging method for confirmation of its success.

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Baltic ringed seal *(Pusa hispida botnica)* at the age of 2,5years and with 54kg weight was released to the Gulf of Finland (Baltic sea) on the 16th of September 2009. The animal was rescued in April 2007 from the Gulf of Finland shore. It was a lone 1,5 weeks old white coated pup with a weight of 10kg. During *almost 2,5 years* the seal has been kept in captivity in different facilities including private apartment. Long rehabilitation period was related to complicated bureaucratic procedure of the releasing and necessity of proper animal preparation (due to health problems). The seal was released in the area of Kurgal'skiy reef where the relaxation haul-out sites of Baltic ringed seal are located in this period of the year. The released animal was equipped by Argos satellite tag in order to control if its adaptation in the wild was successful or not. During 4 month we've been registering ringed seal movements and analyzing its locations in relation to ringed seal traditional seasonal concentration places in the Gulf of Finland, fish stocks migrations and distribution of ice fields. Movement pattern, an average distance covered per day (16km), speed, max covered distance (104km) were estimated. Only 0-3 location classes were used in order to reduce error level. We stopped receiving data from the satellite on January 13, 2010 that possibly happened due to temperature decreasing up to -20C and subsequent battery breakdown or tag tearing off because of its physical contact with ice. We've confirmed the fact of successful adaptation of the animal for life in the wild and foraging on live fish. Moreover we've revealed the similarity of its behavioral patterns with wild animals of the same subspecies (similar seasonal movements). Indirectly we've confirmed the adequacy of our rehabilitation method and preparation of seal for releasing.

Anthropogenic and Physiological Data Reconstructed from Whale Earwax Plugs

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We have determined that whale earwax plugs represent a potential high-resolution short-term marine matrix capable of recording and archiving anthropogenic and physiological data. Like all mammals, whales excrete wax into their ear canals, where it accumulates over their entire life forming an earwax plug. This accumulation is thought to occur in response to diet or migration and has been used to estimate the age of mysticetes. Recently, our labs have been successful in extracting historic-use contaminants profiles (i.e. pesticides) and hormones (cortisol) from a grey whale earwax plug, suggesting lipophilic compounds accumulate in this waxy ester and lipids rich matrix. The proposed method for detecting and quantifying chlorinated pesticides, brominated flame-retardants and polychlorinated biphenyls in whale earwax consists of homogenizing earwax, spiking with isotopically labeled surrogates prior to extraction with an Accelerated Solvent Extractor (ASE 350). The ASE extract is concentrated and large-molecules weight interferences, such as waxes, are chromatographically separated from target analytes using Gel Permeation Chromatography. Extracts are spiked with the internal standard, 13C12-PCB 138. Target analytes are analyzed GC/MS ECNI mode with selective ion monitoring. Specifically, we quantified PCB's, trans-choradane and trans-nonachlor as a function of time as well as corresponding cortisol levels. In essence, our novel technique was used to reconstruct physiological and anthropogenic profiles though time. We believe this demonstrates that long-lived whales are active marine monitoring systems with the ability record and archive data via earwax. The ecosystems these whales inhabit span the Arctic Ocean to the Southern Ocean and the development of earwax plugs as a new analytical tool for historical trend reconstruction could potentially improve our understanding of the fate and transport of contaminants on global scale as well as provide chronological profile on the health and/or stress of the whale.

The effects of mechanical property manipulation on minke whale hearing sensitivity

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There is little knowledge about the biomechanics of hearing in mysticetes. Biophysical models of the middle ear can predict audiograms in part via the middle-ear transfer function. Previous work predicted that the frequency range of best sensitivity for the minke whale (*Balaenoptera acutorostrata*) is near the range of vocalizations for that species. A revised middle ear finite element model incorporates middle ear soft tissues as geometry, including the glove finger, the ear drum homologue familiar from terrestrial mammalian species. Since the mechanical properties of cetacean tissue have not been measured extensively, mechanical properties of human tissue were used in the model. In this study, we measure the sensitivity of the minke middle ear model to changes in those mechanical properties. Results show that increasing the Young's modulus of the annular ligament causes the transfer function to decrease in the middle and lower frequencies. Increasing any other parameter by up to two orders of magnitude changed the transfer function by less than 10%. Since input of sound to the middle ear is

not well understood, the location of the incident pressure was also moved to determine the effect on the transfer function. The two areas tested were the tip of the glove finger and the area of attachment of the fat pad to the tympanic bone. Pressure at the tympanic plate resulted in the transfer function magnitude being one order of magnitude greater than pressure applied to the glove finger. The tympanic plate input also resulted in a remarkably higher bandwidth for the best sensitivity region of the transfer function; the high-frequency cutoff moved from 2 kHz to 60 kHz. The low-frequency cutoff remained the same. Assuming minimal impedance mismatch, the model shows it is possible that the fats could play a role in sound transmission. Supported by OPNAV Environmental Division

Do androids dream of eclectic seals?' - testing for pinniped personalities in wild populations.

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Recent research demonstrates consistent individual variation in behavior patterns ('behavioral types' or 'personalities') in taxa ranging from molluscs to mammals. However, marine mammals are poorly represented in this literature. Here, we present evidence of 'personalities' in post-partum female gray seals (*Halichoerus grypus*) at the North Rona colony (Scotland), using behavioral observations and a novel, standardized in-field experimental test. Activity budget analyses revealed highly repeatable individual patterns of alertness across three successive breeding seasons (2008-2009: ICC2=0.57, $F_{9,9}$=5.0, p=0.013, 2009-2010: ICC2=0.78, $F_{7,7}$=7.6, p=0.008, all 3 years: ICC2=0.45, $F_{5,10}$=4.0, p=0.03) unrelated to local environmental or social context. Experiments in 2009 and 2010 employed a remotely-controlled vehicle (RCV) to deliver a mildly alarming but novel auditory stimulus (a 'wolf' call) to females. The RCV was driven to within 2m of the target seal. After 5 minutes of acclimation the stimulus was played 3 times, each separated by 2 minutes. Over these 6 minutes we recorded the number of pup-checks made by the target mother as a metric of maternal attentiveness. Mothers were tested once early and once late in lactation. These tests revealed highly repeatable individual responses within seasons (2009: ICC2=0.80, $F_{19,19}$=8.6, p<0.001, 2010: ICC2=0.64, $F_{18,18}$=4.4, p=0.001) and across seasons (early lactation: ICC2=0.75, $F_{7,7}$=6.6, p= 0.012, late lactation: ICC2=0.73, $F_{7,7}$=5.8, p =0.017). These results imply distinct mothering styles: socially 'attentive' vs. 'inattentive'. Relationships between individuals' pup-checking tendencies and fitness proxies indicate that mothering style might impact upon pup survival; pups of more attentive mothers had higher daily growth rates, even controlling for maternal post-partum mass (Adj. R^2 = 0.31, $F_{2,15}$ = 4.7, p = 0.02). These results demonstrate highly repeatable individual behavioral patterns in wild pinnipeds across seasons and under differing environmental conditions. Whether or not these constitute 'personalities', it does seem that there are fitness consequences of these differing behavioral types.

Response of Dtagged Cuvier's beaked whale, *Ziphius cavirostris*, to controlled exposure of sonar sound

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A Cuvier's beaked whale (*Ziphius cavirostris*) was tagged with an acoustic recording tag (WHOI DTag) on 29 Sept 2010 on a naval underwater range off southern California (SOCAL10 study). The tag recorded animal movement data for 18.3 hours and acoustic data for 14.3 hours. Playback of simulated mid-frequency sonar pings commenced during the second deep foraging dive after tagging. The source level started at 160dB re 1µPa@1m, and increased by 3dB per ping up to 209dB. Received levels (RLs) recorded on the whale ranged from 84-138dB re 1 µPa rms. When the RL reached ~100dB, the whale stopped echolocating and made a rapid (up to 6.5m/s) descent from 1060m to 1160m. The whale then made a long slow ascent for 65 min, moving about 8 km away from the sound source before surfacing. During this interval, the whale fluked strongly and continuously, sustaining swimming speeds over 4m/s for 10 min, the highest observed among 13 *Ziphius* Dtagged to date in different locations. The interval until the next deep foraging dive was 6.6 hours, the longest observed for any Dtagged *Ziphius*. The intense fluking and high speed swimming observed here differ from responses observed in Blainville's beaked whales, *Mesoplodon densirostris*, but the reactions of both species include early cessation of clicking and a prolonged ascent. This high speed response could be a risk factor for stranding when exposure is more prolonged, intense or complex due to reverberant conditions or the presence of multiple or fast moving sources of sound.

Behavioral lateralization in the Florida manatee (*Trichechus manatus latirostris*)

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Many species of animals ranging from fishes to primates show population-level and individual-level behavioral lateralization. Although evidence of behavioral lateralization has been found in dolphins and whales, this is the first study to examine the phenomenon in manatees. We examined behavioral lateralization in the Florida manatee using observations of limb use (right and left flipper) in 123 wild and 16 captive individuals. In addition, we obtained data from the U.S. Geological Survey Sirenia Project describing over 1900 boat strike scars and used the presence of body scarring as an index of lateralized evasive behavior in wild manatees. The most common behaviors observed in both populations were swimming and substrate walking. Overall wild and captive manatees displayed a population-level left limb preference. However, manatees displayed different limb preferences for different tasks. For example, more manatees preferred the left flipper for the most common behavior, swimming, but preferred the right for substrate walking. Significantly more manatees had scars on the left side of their bodies