CULTURE IN MARINE MAMMALS

ABSTRACTS

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WORKSHOP SCHEDULE

8:00-8:30 - Registration

8:35 - W.C. McGrew - Culture on land and at sea: Lessons from cultural primatology

9:20 - Richard Connor - Individual foraging specializations in marine mammals: Culture and ecology

9:40 - M.T. Tinker, J.A. Estes, and M. Mangel - Individual variation in diet and feeding behavior of sea otters: cultural transmission of foraging skills contributes to the persistence of alternative foraging specializations.

10:00 - Coffee break & poster viewing

10:20 - Phillip J. Clapham - Are humpback whales creatures of culture?

10:40 - Mike Noad - Cultural displacement and replacement in the songs of Australian humpback whales

11:00 - Luke Rendell - Candidate cultural behaviour in sperm whales: Beyond the curious coda conundrum

11:20 - Patrick Abgrall and Jack Terhune - The importance of culture in vocal communication of polar phocids

11:40 - Poster talks – Brief (2 minute) description of each poster by presenter

12:10 - Lunch (provided) and poster viewing

2:00 - Denise Herzing - Transmission mechanisms of social learning: Underwater observations of free-ranging dolphins in the Bahamas.

2:20 - Stan Kuczaj - What studies of captive animals can and cannot tell us about marine mammal culture

2:40 - Peter Corkeron and Louise Chilvers - Junk food culture: Dolphins, trawlers and the choices we all make.

3:00 - Coffee break and poster viewing

3:20 - Harald Yurk - Vocal cultures in killer whales

3:40 - Lance Barrett-Lennard - A propensity for isolationism: Culture and population segregation in killer whales

4:00 - Hal Whitehead - Cetacean culture: Evolution and co-evolution

4:20 - Panel discussion
ACKNOWLEDGEMENTS

We are exceedingly grateful to the Canadian Whale Institute for financial assistance in organizing this workshop.
CULTURE ON LAND AND AT SEA: LESSONS LEARNED FROM CULTURAL PRIMATOLOGY.

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Cultural primatology is a new field, but it has already learned lessons, sometimes the hard way (McGrew, 1998). Cultural cetology is emerging (Rendell & Whitehead, 2001) and may benefit from knowledge gained from primates, both human and nonhuman. I offer these for starters:

Labels are less important than substance.  
Define it as you wish, just make it operational.  
Beware of anecdotes, but don’t ignore them.  
Don’t wait to know how before you ask why.  
Social learning is the starting point, not the end.  
The Culture Club should be exclusive.  
Ethnography has never been experimental.  
Language may be a red herring.  
Anthropology does not own the culture concept.  
The process is more important than the setting.  
Culture need not have ecological validity.  
Tradition is neither a necessary nor sufficient condition.  
It all comes down to inference.  
Enculturation versus occulturation - who cares?  
Who needs technology?  
Culture is a curse as well as a blessing.  
Human culture is unique, but so is .  
Not everybody water skis, but we all drink Coke.  
Culture as checklist - a recipe for disappointment.  
Don’t quest for a Rubicon.  
Like everything else evolutionary, culture is bushy.  
Cultural survival applies to marine mammals, too.

INIDIVIDUAL FORAGING SPECIALIZATIONS IN MARINE MAMMALS: CULTURE AND ECOLOGY.

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Rendell and Whitehead (2001) argue persuasively that individual foraging specialisations, if socially learned, are examples of cetacean culture. However, they discount ecological variation experienced by individuals within a population as a factor in such behavior. I suggest that ecological variation may play an important role in individual foraging specializations and describe several ecological parameters that may help us understand the high frequency of this interesting behavior in the marine habitat.

INDIVIDUAL VARIATION IN DIET AND FEEDING BEHAVIOR OF SEA OTTERS: CULTURAL TRANSMISSION OF FORAGING SKILLS CONTRIBUTES TO THE PERSISTENCE OF ALTERNATIVE FORAGING SPECIALIZATIONS.

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Longitudinal records of foraging behavior in the southern sea otter (Enhydra lutris nereis), demonstrate persistent variation in diet composition and feeding behavior among conspecifics. Individual dietary patterns are independent of age, sex, and habitat use. Pups tend to specialize on the same prey types as their mothers, both pre- and post-weaning, thus demonstrating the cultural transmission of foraging skills and specializations across generations. We developed a theoretical framework to explore how such alternative specializations might develop and persist within a population. First, we constructed a dynamic state variable model of predator foraging behavior, using body condition and prey capture/handling efficiency as state variables, and then solved for the foraging strategy that maximized individual fitness under various scenarios of prey abundance and distribution, environmental stochasticity, and “learning curve” functions for novel prey types. The optimal strategy under each set of conditions was then used to specify the behavior of individual predators in forward iterations of the model, assuming standard life history parameters and allowing mothers to transfer acquired foraging skills to offspring. Results of this simulation model indicate that alternative prey specializations tend to develop and persist within a population given three basic conditions: spatial/temporal variation in prey abundance; a “learning inertia” resulting from the performance penalty associated with acquiring new prey search images or handling skills; and matrilineal transmission of prey specializations. We highlight the importance of cultural transmission of foraging skills in this system, given that individual variation in prey specialization may moderate the population-level impact of sea otter predation on invertebrate prey species.
ARE HUMPBACK WHALES CREATURES OF CULTURE?

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Assessments of whether humpback whales (*Megaptera novaeangliae*) - or any other species - possess “culture” are largely contingent upon one’s definition of the term. Definitions range from liberal (e.g. information transferred through any form of social learning) to conservative (e.g. information transfer is multi-generational, involves teaching, and results in accumulated gains over time). Furthermore, discussions of culture (including that in humans) frequently confuse underlying evolutionary mechanisms and end up inadvertently espousing what amounts to a group selectionist argument. Here, I make the basic presumption that culture (however defined) is an adaptive mechanism, and that conformity to, or departure from, a population’s cultural norms will potentially affect individual reproductive success (RS).

Humpback whales do not possess the stable group structure characteristic of some odontocetes. Long-term social bonds are rare or absent, and kinship does not appear to play a significant role in social organization. However, possible examples of cultural transmission or differentiation include song, as well as feeding techniques and other behaviors that vary by population. Inter-oceanic differences in bubble-feeding techniques would represent cultural differences under only the most liberal definition of the term. The well-documented acquisition and rapid spread of lobtail feeding by humpback whales in the Gulf of Maine provides stronger evidence for cultural transmission through imitative learning. There is little support for the idea that foraging and other behaviors are transmitted vertically by teaching.

Humpback song appears to offer the best evidence for some sort of culture in this species. Songs change progressively over time, and are radically different among discrete populations. All members of a given population sing essentially the same song, and there is some evidence to suggest that song retention by individuals is accomplished with the aid of rhymes. Both the conformity of males to the current version, as well as the occasional introduction of novel elements and their subsequent adoption by a population, can be seen as phenomena with profound impact on the RS of individual whales. If one believes that society-wide change affecting the RS of individuals represents change on a cultural level, it is hard to argue that the remarkable switch in eastern Australian humpback songs recently documented by Noad *et al.* (2000) was not an example of this phenomenon. Overall, given the contextual similarity of song to the role of communication in human mating systems and sexual selection, it is difficult to see how humpback whale song would not represent culture under any but the most draconian of definitions.
CULTURAL DISPLACEMENT AND REPLACEMENT IN THE SONGS OF AUSTRALIAN HUMPBACK WHALES.

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Song was recorded from Australian east coast humpback whales, Megaptera novaeangliae, during migration in 1995 – 1998. Over 1000 hours of song were used to determine the song pattern in 252 song sessions. While the pattern of the song was initially highly stereotyped, in 1996 two singers were recorded with a completely different song type. During the 1997 migrations the use of this ‘new’ song type increased dramatically and completely replaced the ‘old’ song by 1998. The ‘new’ song type was identical to song from Australian west coast humpback whales recorded in 1996 but different to that from 1995 or 1997. These results demonstrate that the introduction of west coast song at a very low initial prevalence was able to completely displace the vocal cultural tradition of the east coast population. The process of change in humpback whale song and bird song has been described as ‘cultural evolution’ whereby changes in songs are passed among individuals by learning and accumulate over time. The song changes described here were cultural, but were revolutionary rather than evolutionary, the cultural vocal pattern of one population displacing and replacing completely that of another population.
CANDIDATE CULTURAL BEHAVIOR IN SPERM WHALES:
BEYOND THE CURIOUS CODA CONUNDRUM.

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Group level variation in the ‘coda’ vocalisations of sperm whales has been put forward as an example of cetacean culture, based on observational and genetic data. Objections to this suggestion include a lack of data on the relationship between group and individual coda repertoires and a question mark over how labile day-to-day groupings can support stable cultural variation. The first question, that of group versus individual repertoire, can potentially be addressed using the inter-pulse interval (IPI) of sperm whale clicks – these clicks have a multi-pulsed structure and it has been shown that the IPI is closely related to the size of the vocalising animal. I tested this method on recordings of a group of nine sperm whales made off the Galápagos Islands in 1999. 94 of 880 codas had highly consistent IPI measurements (inter-quartile range <0.02ms). Median within-coda values ranged from 3.6 to 4.2ms, the range expected for female/immature sperm whales, and the spread of values was inconsistent with the idea of a single animal dominating the group’s vocal output. Examining the relationship between IPI and coda structure revealed that very similar codas sometimes had very different IPIs; that is, different animals made them. Thus single hydrophone recordings of sperm whale groups do give us true ‘group’ repertoires, and coda types are shared between individuals within a group – sperm whales do have genuine group repertoires of codas. This coda sharing can be contrasted with the low level of relatedness between five of the nine animals in the group from which skin samples were collected, making it likely that the sharing is based on learning rather than common genetic descent. While vocal culture in sperm whales could be supported at the level of the stable social ‘units’ that come together to form day-to-day groupings, there is evidence from analyses of unit repertoires for a higher level of social structure, the community or clan. I suggest that this is the primary level at which sperm whale vocal culture is supported. While vocalisations are an easily recorded and measured aspect of sperm whale behavior, foraging behavior and movement strategies are other areas where cultural transmission could significantly improve fitness and there is some limited evidence for group variation in both. Sperm whales are not candidates for captive study, so going to sea remains our only option for studying these behaviours in greater depth.
THE IMPORTANCE OF CULTURE IN VOCAL COMMUNICATION OF POLAR PHOCIDS.

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Weddell seals (Leptonychotes weddellii) and harp seals (Phagophilus groenlandicus) are two of the most vocal phocid species. Both species possess a large underwater vocal repertoire used for social interactions. This discussion will highlight the main differences in both these vocal repertoires while attempting to shed light on the role of learning in their establishment and maintenance.

Harp seals gather in large herds of tens of thousands on the pack ice. They are promiscuous breeders and the pack ice makes it impossible for males to defend large territories. The background noise is predominately from short duration conspecific calls. Their vocal repertoire has changed little over the past 30 years. The call types are very stereotyped.

Weddell seals breed in small groups of up to a few dozen individuals on stable land-fast ice. They are a polygynous species with males defending underwater territories at haul-out holes. The main source of background noise is primarily abiotic and they use more long duration calls than harp seals. While no information is available on long-term repertoire variation in Weddell seals, their call types show greater variations in pitch and duration than those of harp seals.

In the cases of both species, the vocal repertoires exhibit geographical variation. These can be observed through the presence/absence of unique call types, differences in proportional call usage and differences in call features (pitch/duration variations within call types). These differences in vocal repertoires might be due to erroneous learning on the part of the pups and serve as an indicator of cultural existence. There is also evidence that seals use temporal and pitch separation to avoid masking and are not actively trying to block calls of other seals. This anti-masking strategy could partly be responsible for the large number of calls used by these seals and again result from cultural learning.
TRANSMISSION MECHANISMS OF SOCIAL LEARNING:
UNDERWATER OBSERVATIONS OF FREE-RANGING DOLPHINS
IN THE BAHAMAS.

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For most cetaceans the potential existence of culture is deduced from temporal or spatial
patterns in the wild. Transmission mechanisms of information between conspecifics are
usually observable only in close-proximity situations in captivity. In the clear waters of
the Bahamas long-term underwater observations of two species, the Atlantic spotted
dolphin (*Stenella frontalis*) and bottlenose dolphin (*Tursiops truncatus*), provide a unique
opportunity to observe transmission mechanisms of social learning/exposure within and
between these societies. Since 1985, 220 spotted and 200 bottlenose dolphins have been
individually identified and regularly observed for five months every summer.
Underwater video with hydrophone input was used to document individuals, sounds, and
associated behavior. Many spotted dolphins are of known gender, relationships
(mother/calf, siblings), and association patterns. 15% of all spotted dolphin observations
include the presence of, and active participation with, bottlenose dolphins.

Spotted dolphin society has qualities conducive to socially oriented transmission
mechanisms including 1) mixed age-class groups, 2) multi-generation family groups, and
3) long-lives and extended maturation periods. This suggests that there may be a variety
of social mechanisms available for the transmission of information between dolphins.
How might dolphins in the wild transmit such information? Are dolphins likely to share
information between mother/offspring or other individuals? Are we likely to recognize
in dolphins, with anatomically different abilities, analogous social learning mechanisms
described for primates? Are mechanisms of transmission mutually exclusive or bound
together to form bundles of potential information at the same time?

Vertical (mother/offspring), oblique (non-parental/juvenile), and horizontal (peer/peer)
are potential *directions* of transmission. Potential transmission *types* of visual/kinesthetic
behavior including 1) contagion, 2) observational learning, 3) matched dependent
learning, 4) social exposure/enhancement and 5) goal emulation will be described during
foraging, courtship, play, and aggressive activity. Examples of both *intraspecific*
(spotted/spotted, bottlenose/bottlenose) and *interspecific* (spotted/bottlenose,
spotted/human) activity will be given to explore other potentially emergent mechanisms
available to dolphins in the wild.
WHAT STUDIES OF CAPTIVE ANIMALS CAN AND CANNOT TELL US ABOUT CETACEAN CULTURE.

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Even though the captive environment is vastly different from that of wild animals, studies of captive animals can provide valuable insights into both the processes and products that characterize cetacean cultures. Well controlled experiments in captivity are likely to prove crucial to the understanding of the mechanisms that provide the basis for cetacean culture, particularly if the possibilities of false negatives and false positives are kept in mind when results are interpreted. In addition, careful observations of spontaneous behavior in captivity may increase our understanding of the factors that influence the acquisition of novel behaviors. For example, our longitudinal studies of young captive-born bottlenose dolphins have revealed that dolphin calves use their mothers as secure bases from which to explore the world, reminiscent of mother-infant interactions in both human and non-human primates. Although these dolphin calves did learn from observing their mothers, they were more likely to learn novel behaviors via observation of and interactions with other calves. Additionally, the learning curve for novel behaviors was accelerated for calves that had the opportunity to interact with other calves that were slightly older than themselves. These observations are consistent with other findings that demonstrate the capacity of dolphins to learn new behaviors, a requisite flexibility for cultural change. However, our findings highlight the role of peers in behavioral acquisition and possibly cultural change. These results will be discussed in terms of their implications for the study of cetacean culture, with particular attention being given to the roles that studies of captive animals might play in this endeavor.
JUNK FOOD CULTURE: DOLPHINS, TRAWLERS AND THE CHOICES WE ALL MAKE.

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There are two communities of bottlenose dolphins in Moreton Bay, Australia, that live in overlapping ranges. The communities are separated by their response to food patches created by trawling: members of one community feed from prawn trawlers but members of the other do not. This is a cultural development associated with anthropogenic perturbation of an ecosystem. The two communities have slightly differing habitat requirements, so this finding has implications for the management of Moreton Bay. This presents managers with an interesting set of choices, as bottom trawling has deleterious ecosystem impacts, but is needed to maintain this social structure. This finding raises a series of other questions that will improve our understanding of ecological factors influencing delphinid social behaviour. Is trawling responsible for dividing one community into two? How is this segregation maintained, and how do dolphins end up in one or the other community? Can we assess the roles of horizontal and vertical cultural transmission in this system? Is this community segregation present elsewhere among inshore dolphins where trawling occurs? Better understanding of how trawlers and dolphins interact will require choosing study sites where fisheries management regimes alter the temporal availability of trawlers to dolphins.
The existence of vocal cultures depends on, A) whether the vocalizations are learned, and B) are passed on by teaching or copying, and C) the vocal difference between groups cannot be explained better by other ecological differences that could have caused the divergence. Some evidence in support of vocal culture comes from a well-studied killer whale population in the northeastern Pacific, called residents. Residents live their entire life in stable groups, called matrilines. Members of matrilines mingle regularly with whales of other matrilines but appear to use discrete group-specific call dialects to stay in contact with their own group. Call sharing among matrilines reflects their maternal relatedness. Although no conclusive proof for call learning exists, a number of anecdotal observations support the learning notion, and inferences made from parallel maternal relatedness and vocal similarity make call learning within the matriline the best explanation for observed call sharing patterns. For example, observations of captive killer whales with different regional ancestries have shown that whales regularly imitate calls of their tank mates. Furthermore, vocal mimicry has also been observed in the wild, and horizontal or oblique transmission of structural features of calls between closely related matrilines exists. If calls are not learned, but instead are genetically inherited, it is hard to explain that all members of a matrine line use the same set of calls and that mating usually takes place between pods (Barrett-Lennard, 2000-Ph.D. Dissertation). Paternal genetic inheritance is unlikely, because it would over time produce different repertoires for individuals within the matriline, and maternal genetic inheritance of call types either through the influence of mitochondrial DNA, maternal sex chromosomes, or through genomic imprinting, is also very unlikely, because many call types are highly complex. From this body of evidence, it seems most likely that calls are learned within the matriline and that vocal clans represent true vocal traditions that can be defined as culture.
A PROPENSITY FOR ISOLATIONISM: CULTURE AND POPULATION SEGREGATION IN KILLER WHALES.

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Coastal killer whale populations in the northeastern Pacific show a remarkable degree of sympatric and parapatric segregation. Two dietary specialist groups are well described: fish-eating residents and mammal-eating transients. These groups overlap partially with a poorly-studied third group referred to as offshores, the diet of which is unknown. The resident and transient groups both consist of at least three genetically discrete regional populations, thus a total of at least seven populations coexist within a single continuous environment. How can this situation be explained? Here, I advance the hypothesis that the extreme segregation of killer whales results from an effective inbreeding avoidance system coupled with a reliable group identification and recognition system, both of which rely on culturally-transmitted markers of group identity. According to the hypothesis, inbreeding avoidance within each population reduces the relative genetic benefits of inter-populational dispersal, and group identification and recognition foster the development of social linkages that favour long-term population membership. Two lines of evidence indicate that culturally transmitted acoustic repertoires are central to both systems. In the best-studied populations (members of the resident group), each maternal kin group or pod uses a unique call repertoire. Most matings occur between individuals from pods that (a) belong to the same population but (b) have markedly dissimilar acoustic repertoires. Since relatedness and repertoire similarity are correlated, this mating preference results in lower inbreeding levels than would be expected in a same-sized random mating population. Repertoires also allow pods to announce their identity over long distances. Pods hearing the calls of members of their own population often approach and intermingle with the callers. Mating presumably occurs during some of these temporary associations and helps to maintain social ties. In contrast, calls do not elicit approaches or social contact between members of different populations. The hypothesis implies that population maximum size is a function of the frequency with which pods associate, with fission occurring if the size and range of a population become such that some member pods fail to encounter others at a threshold rate. It also implies that killer whale populations are functional social units, vindicating Bigg’s (1982) categorization of them as “communities”

CETACEAN CULTURE: EVOLUTION AND CO-EVOLUTION.

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Studying the behaviour of cetaceans in the wild is difficult. In only a few populations of a very few species has behaviour been studied in any detail. Despite this, a remarkable number of confirmed or candidate cultural traits have emerged. There are also features of cetacean culture which have so far been found only in humans among terrestrial animals, such as the sympatric multifaceted cultures of resident killer whale pods. So I ask: 1) why has culture seemingly become an important determinant of cetacean behaviour; and 2) has it affected evolution in other areas of cetacean biology? Cetaceans certainly possess some of the characteristics which predict culture on land: cognitive and imitative abilities, complex social structures and slow life history processes including prolonged parental care. But other aspects of the animals and their environment may have boosted the evolution of cultural attributes in these species. These include substantial variation in the biotic marine environment over medium to large spatial and temporal scales, the ease of movement and general lack of territoriality in an aquatic habitat, and the importance of the vocal channel in cetacean communication. While the attributes and habitat of cetaceans likely had a role in the evolution of cetacean cultures, it is also possible that the reverse may have happened: that other aspects of their biology have co-evolved with their cultures. Suggestions include life history traits such as menopause, mass strandings, genetic diversity, speciation, wide niches, and vocal behaviour.
POSTERS

KILLER WHALES FEEDING ON BOTH MAMMALS AND FISH; A TRANSIENT, RESIDENT OR OPPORTUNISTIC TYPE?

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Killer whales off the Norwegian coast were studied with photo-ID methods during 1987-1996. The whales were encountered at the spawning grounds and wintering fjords of herring, a major prey item for killer whales in this area. A total of 605 killer whales were identified. Despite the presence of other marine mammals, there are only few documented interactions between Norwegian killer whales and potential mammalian prey. This study reports three: In July 1987, five killer whales were observed chasing harbour seals around a colony for 10 min. No kills were observed. Four of the whales were identified as KI-1, KI-3, KI-5 and KI-6. In October 1990, four killer whales were observed near a grey seal colony feeding on fresh blubber, two of them were identified as KI-1 and KI-3. Five killer whales (KI-1, KI-3, KI-4, KI-5, KI-6) were encountered in March 1991 while swimming close to land. One whale surfaced with a harbour seal in its mouth, but it is not known if the seal was eaten. The probability that any pod by chance would interact with seals on three subsequent occasions is well below a statistically significant level. However, the KI-whales were also identified twice in 1991 while feeding on herring together with other groups of killer whales. Compared to transient killer whales in the Northeast Pacific, Alaska and Antarctic, described to exclusively feed on mammals, these Norwegian killer whales might represent another behavioural tradition where transient-type killer whales also include fish in their diet.
SYNCHRONOUS MOVEMENT AS A POTENTIAL MEDIUM FOR CULTURAL TRANSMISSION.

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Synchronous movement is a ubiquitous characteristic of dolphins. There are two ways in which synchrony may be relevant to cultural transmission: first, by enhancing information gathering and second, through observational learning. All animals presumably learn adaptive behavior by interacting with their environment. Synchronous movement with another dolphin interacting with the environment may facilitate learning because 1) stimulus or local enhancement may be intensified, 2) several individuals moving together may act as a Sensory Integration System, or 3) one individual is able to eavesdrop on another echolocating individual, thereby sharing information. Synchrony may also facilitate observational learning. Early mother-calf synchrony may provide a foundation for later synchronous relationships. The first months of a calf’s life, a time of rapid acquisition of adaptive behaviors, are characterized by extremely high rates of behavioral synchrony as indicated by observations of six bottlenose dolphin calves. It is likely that the calf performs many behaviors for the first time while moving synchronously with its mother. This mode of learning, matching one’s movements to those of another, may then transfer to adult relationships in which behaviors that are novel to one of the individuals can be performed synchronously. The acquisition of new behaviors through synchrony provides a means for cultural transmission of information.
MtDNA ANALYSIS SUGGESTS THAT SPONGE CARRYING BY BOTTLENOSE DOLPHINS IN SHARK BAY, WESTERN AUSTRALIA IS A PATTERN OF VERTICAL MOTHER-OFFSPRING CULTURAL TRANSMISSION.

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During a long-term behavioural study on bottlenose dolphins (*Tursiops aduncus*) in Shark Bay, Western Australia, eleven individuals were observed carrying marine sponges on their rostra multiple times (regular spongers), and seven other regularly observed individuals only once (anomalous spongers). Molecular sexing revealed that ten (90.9 %) of all regular spongers, and five (71.4 %) of the anomalous spongers, were female. A total of 68 dolphins of either sex were sampled in an area of about 120 km² where sponging predominantly occurs to test if animals that engage in sponging behaviour are more likely to have the same haplotype than expected by chance. Mitochondrial DNA (mtDNA) analysis of a 351 base pair fragment of the hypervariable d-loop region showed five different haplotypes. Haplotype H was found in 16 of all 18 spongers (88.9 %) and in ten (90.9 %) of the regular spongers. However, the haplotype frequency for H among all 68 animals was only 0.132, a highly significant difference (Fisher’s exact test, p << 0.0001 for the whole data set, p < 0.001 for regular spongers) between observed and expected haplotype frequencies, suggesting a very strong association between sponging and a particular haplotype. The fact that about 90 % of all spongers have the same haplotype suggests a pattern of mother-offspring similarity in a complex form of behaviour, indicating a vertical mother-offspring cultural transmission.
CULTURE IN BOTTLENOSE DOLPHINS (TURSIOPS SP.): AN INSIGHT THROUGH SURFACE BEHAVIOURAL PATTERN.

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This study proposes the comparison of behavioural repertoire to assess cultural differences in bottlenose dolphins (Tursiops sp.). Culture was defined as discrepancies in repertoire, among populations, that are passed on horizontally or vertically among individuals through social learning, and are not related to genetic and environmental variations. First the presence of ten behavioural events was assessed in populations which have been studied for more than five years. Chosen behaviours were conspicuous and difficult to confuse with other events. They did not represent the complete behavioural repertoire of bottlenose dolphins. Eleven researchers (15 populations) responded to a survey posted on the MARMAM discussion list. A hierarchical cluster analysis classified populations depending on the presence/absence of these behaviours. The grouping of some populations could be explained by genetic or environmental factors; however both factors could not explain the general clustering trend. Secondly this study tried to detect the existence of social learning for the chosen behavioural events. Observations in Doubtful Sound, New Zealand, seemed to demonstrate that bottlenose dolphins socially acquire headbutting. Headbutting opponents were identified during 83 fights between January 2000 and June 2001. In 97.6% of events both opponents were males while in two fights opponents were female/calf pairs. In the first case the dyad was a mother with her 2-year old male calf and in the second case the dyad was a 3-year old male calf and a female that had regularly been his aunt. Head-butts between adult and juvenile males were also observed in seven instances.
Scientists researching cultural behavior in nonhumans generally focus on natural situations. However, much more complex cultural interactions are possible among nonhumans in captivity and their human caregivers. In particular, a co-constructed language-based culture among captive apes and their caregivers is active at the Language Research Center in Atlanta, Georgia. Within this environment, the apes were equal partners with their human caregivers, participating in decisions that alter the course of their interactions as well as making value judgements on behaviors and situations. Each ape within the environment has acquired a concept of "bad" and "good" that is not solely based on the cultural values of apes, rather, seems to have been transmitted by their human caregivers. The utterances of these apes show the use of these concepts in many different contexts that closely parallel the value judgements of their caregivers. These value judgements, however, are often not immediately comprehensible to humans who are not participants in the culture. Anecdotal evidence suggests that dolphins, too, have the ability acquire good and bad concepts. However, this evidence is not apparent within experimental trial sessions, which do not promote co-constructed culture, but during human-dolphin interactions that do not rely on the distancing structure of operant conditioning. Co-constructed cultures stimulate abilities in non-human animals, such as language, that cannot be accessed otherwise. Unfortunately, to date, marine mammal researchers have failed to create a full-blown co-constructed culture, one in which the marine mammals and human caregivers participate equally, and therefore have yet to take advantage of shared culture’s influence.
For an anthropologist to reconstruct the cultural content of a human group where the language and customs are unknown, the first step is to learn the language, only then is it possible to interview members of the group to find out how and what they think. However, in order to reconstruct cultural content in a non-human group, learning the “language” and interviewing informants is presently not possible, so other less-direct approaches need to be developed. The approach presented here is based upon the premise that a significant portion of any group’s culture will be related to the environmental history of the group, particularly in areas that are ecologically important to them. For the ethologist trying to reconstruct cultural content in a non-human group, knowing the context of important ecological events in the history of the group could provide a useful framework within which to interpret other data. To illustrate this a timeline for the Southern Resident Community of killer whales has been constructed that plots: a) sea water temperature, earthquakes, and anthropogenic influences such as salmon extirpation, hunting, vessel traffic and underwater noise over the last 200 years, and b) seasonal habitat-use of the whales over the last 20 years. Patterns of the most extreme events are identified and described as potential influences upon the cultural context of this population.
MATERNAL TEACHING OF SWIMMING AND DIVING BEHAVIOR IN WEDDELL SEALS (LEPTONYCHOTES WEDDELLII): BELOW-ICE OBSERVATIONS IN ANTARCTICA.

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This study examined initial underwater behavior of Weddell seal pups (3-4 weeks old) and that of their mothers early in the lactating period. We monitored free-ranging mother-pup pairs using underwater digital cameras and movement-data (depth, speed, acceleration and temperature) loggers that were attached to the seals. Each mother spent a total 4.5 to 7.6 hours per day submerged with her pup. Pups never entered the water alone. During the paired submersion, mother-pup pairs dived in synchrony, and some images indicated close proximity between the pair. During such synchronous diving, dives were significantly shallower and for a shorter time than when mothers dived alone. According to the acceleration data, three-week-old pups did not yet demonstrate well-coordinated strokes. However, the stroke-and-glide method was sometimes observable in four-week-old pups. The diving performance of pups, as evidenced by dive depth, increased significantly during the lactating periods. According to the working definition of “teaching” in nonhuman animals (Caro and Hauser 1992), the Weddell seal mothers might teach their pups, because of following reasons. Mothers modified their underwater behaviors only in the presence of their naive pups at some cost without obtaining an immediate benefit for themselves. Mothers’ behaviors seem to encouraged pups' swimming because pups entered the water only with mothers. The paired shallow swimming apparently provides pups with experience under the water. As a result, pups acquire a skill of swimming and diving in early life for growing up into proficient divers.
A REVIEW OF THE CETACEAN CENTRAL NERVOUS SYSTEM: OBSERVATIONS ON NEUROBIOLOGY AND COGNITIVE PROCESSES IN THE HUMPBACK WHALE, MEGAPTERA NOVAEANGLIAE.

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To determine whether humpback whales have the capability for sophisticated levels of communication, a review of the central nervous system and perception via important sensory modalities was undertaken in the belief that a consideration of neurobiology is fundamental to behavioural studies. Evolution of cognitive ability is adaptively specialized, rather than a series of improvements across a phylogenetic scale. Brain structure and encephalisation (the enlargement of the brain above that needed for biological function) in cetaceans is comparable to the higher primates, with a highly developed and convoluted neocortex, an association area responsible for sophisticated cognitive processes. Differential enlargement of sensory systems biases an animal to use certain biologically useful sensory modalities. In cetaceans, an excellent auditory system and complex vocalizations (which incorporate elements of novelty in the changing themes of humpback song) indicate the capacity for meaningful communication. Assuming consciousness to be an emergent property of the brain, expanded insidiously through ontogeny and as a continuum through levels of sophistication in the brains of all animals, consciousness correlates with the degree of complexity in the nervous system. Even the concept of culture can be seen from a neurobiological perspective as an increasingly intricate development of the neural network, seen in learning and memory (significant in the extraordinary cultural advances of humans). The structural complexity of the humpback brain appears capable of supporting higher mental functioning and a degree of consciousness which might facilitate meaningful communication, including that which is culturally acquired.
ONTOGENY OF INDIVIDUALLY DISTINCT VOCAL PATTERNS IN MANATEES.

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Two species of sirenians, the Amazonian manatee (Trichechus inunguis) and the Antillean manatee (T. manatus manatus) emit individually distinct isolation calls. Examples of these calls from captive animals have stimulated questions about the ontogeny of vocal patterns in both species. One calf raised with its mother, and isolated from other individuals, has a call very similar to that of its mother. Another calf, raised within a group of individuals, developed a call that is not so similar to that of its mother. Furthermore, twin siblings raised among other animals have a similar vocal pattern to each other but different from their mother. Some authors assume that among mammals vocal learning (production learning) is unique to humans. However, other investigators have demonstrated that bottlenose dolphins are capable of learning vocalization frequencies and argued that individual variation in the whistles was due to the anatomical variations in the sac system. However, a case of similarity between the whistle of an infant and its mother, isolated from other individuals most of the time, caused these investigators to consider the potential effects of the acoustic environment in which the animal was raised. My observations suggest that the acoustic environment may influence the observed vocal pattern in manatees, although there is not enough evidence to answer the question of whether individual vocal patterns are inherited or learned, or if genealogy constrains the flexibility of call ontogeny in sirenians. A case of foster parent adoption in Amazonian manatees will be described and related to these hypotheses.
HIGH RISK FORAGING BEHAVIOUR OF ORCA (ORCINUS ORCA) IN NEW ZEALAND WATERS – COULD SKILLS BE PASSED ON THROUGH A CULTURE?

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New Zealand orca forage on four main prey types (rays, sharks, fin-fish, cetaceans), of which rays and sharks are potentially lethal. In addition, as foraging for rays typically occurs in shallow water, orca may face an increased risk of stranding. Indeed, New Zealand has a high rate of orca strandings, which in turn appears to be correlated to foraging for rays. Therefore, foraging for these prey types may be a high-risk activity, requiring a correspondingly high level of skill. To acquire these skills, hunting methods may be transmitted and reinforced by members of the group through teaching, assisted foraging, and passive observations. Whilst foraging, adult male orca have been observed baby-sitting younger orca for extended periods. They have caught food and either provisioned or shared food with the youngsters. During these times the mother has not been present. On other occasions, females with young have been observed catching prey and provisioning and sharing food. At times adult orca may disorientate rays, through above-water ‘frisbee’ manoeuvres, allowing younger, inexperienced orca the chance to learn to manipulate and kill rays. Although sub-adult animals catch or ‘frisbee’ rays independently from adults, younger animals have not been observed to do so. Another foraging behaviour in New Zealand is the taking of sharks and fin-fish from longlines. Young orca do not remove prey off longlines, however, they have been observed underwater, watching adults who then provision them. As food is a strong reward, this may be the start of cultural transmission of this foraging technique.
BEFORE SEEKING THE CULTURE IN MARINE MAMMALS.

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Do whales and dolphins have the culture? Before we will discuss on the existence of any culture in marine mammals or, we have to make it clear what do we consider as the culture. We can discuss on the nature of the culture by raising various kinds of questions. For example, what is the precursor of the culture? What kinds of factors will cause the culture in animals? What are the prerequisites of the culture? What is the function of culture? What kinds of concepts do we need to talk about the culture, such as consciousness, belief, and desire? However, we may be too attracted to apply folk psychology as a major source of the discipline to examine the culture that will lead us to the empty discussion on the culture. Thus, it is very important to make the one's philosophical view clear as much as possible such as idealism vs. antirealism. Then, we need to try to define the culture and explain its function without depending on folk psychology or borrowing concepts of like voluntarism. In summary, we need to establish the definition or at least the way we talk about the culture. Then, we can step forward to examine the existence of the culture in any species.