HOW ENVIRONMENTALLY-FRIENDLY IS WHALING?
An Ecological Perspective

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Much of international debate about management objectives and appropriate utilization of both whale and elephant populations centres on whether it is appropriate to regard these stocks as being essentially the same or fundamentally different from other biotic or mammalian resource stocks. Increasingly it appears that sectors of western society imbue both whales and elephants (and certain other selected species, e.g. see Kellert 1986) with a special status that requires that they be treated fundamentally differently from other species for management and conservation purposes.

The special status accorded whales and elephants comes in part from their biological characteristics, though very often these may be imputed or imagined biological characteristics rather than scientifically established ones. For example, the question of "intelligence", or communication abilities, or behavioral or social characteristics of these particular animals are areas where sentimentality, imagination, extreme anthropomorphization, or mere wishful thinking frequently overtakes the available scientific evidence. Unfortunately it is not only non-scientists who suffer lapses of critical thinking in regard to these matters (though often these scientists are non-specialists in the areas of science they uncritically embrace).

It is easy to be misled in these matters, as government officials, public figures, the media and various national and international organizations promote the impression that whales and elephants are highly intelligent, seriously endangered and subject to needless and irresponsible slaughter and consequently in urgent need of total protection.

Many scientists associate themselves with these "environmental" campaigns. Championing a popular "green" cause certainly can provide a welcome change from labouring in relative obscurity, as public advocacy may result in invitations to speak and be consulted, the promise of travel, and, perhaps, enhanced access to research funds.

Biological Attributes and Special Status

Earlier I referred to the special status of whales and elephants as derived in part from their biological characteristics. For purpose of discussion here I only refer to one particular biological characteristic, namely large body size, which has several significant implications for the discussion about appropriate management.

Large-sized species are generally associated with slower growth, slowed attainment of sexual maturity, and smaller litter size (frequently a single offspring only at the end of each reproductive cycle). A biological consequence of slower growth is greater longevity. Elders in human societies are due respect and solicitude, and are associated with wisdom. An inglorious end to an old person, and by extension by those who wish to make the connection, to an old animal one feels empathy toward, is often equated with a real sense of tragedy and loss. It might be noted for example, that in social groupings of elephants, writers (e.g. Payne 1989) frequently use the terms matriarch or patriarch when referring to the aged members of the herd.

As mentioned above, large bodied slow maturing mammals generally have a single offspring. It is easy to believe that such species are especially vulnerable to over-exploitation, and most laypersons would draw that conclusion. But in the natural world a given female only has to produce between two and three surviving offspring in a lifetime to perpetuate the population, and given the longevity of whales there is a good chance any given female has already accomplished this feat (perhaps several times over) before dying by whatever means.

Whale populations have demonstrated their ability to continue growing in the face of continued harvesting, as with the North Atlantic pilot whales, the antarctic minke whales, the Alaskan bowhead whales, and the Pacific gray whales for example. They do this despite have only a single offspring every two or three years and having a sizeable number of animals removed for human food needs each year.

Brain Size and Quality

Larger-sized animals require a larger brain than smaller-sized animals. Another way of saying this is that small-sized animals necessarily cannot accommodate large brains in their small bodies. Some appear to believe that large brain size correlates with more intelligence (a discredited notion, but still finding support in certain quarters, e.g. Maddox 1992). If large heads and brains are significant in the search for intelligence, then elephants and whales are certainly prime candidates for the highly-intelligent label.

It is often stated, for example, that the sperm whale has the largest brain of any animal, including man. Thus at 7.8 kg the sperm whale brain is far larger than that of a human (ca. 1.5 kg) and a little larger than that of an African elephant (7.5 kg). But a sperm whale with a 7.8 kg brain is 500 times as heavy as a human and more than seven times heavier than an African elephant, so having a larger brain than a human is entirely predictable, and having a larger brain than an elephant is not unexpected.

What may be less expected, if brain size is looked at in relation to body size, is that the sperm whale has only one-quarter as much brain to control it's bodily and mental functions as does a cow, which as far as the literature is concerned does not appear to be exceptionally brainy, but is, in fact characteristically bovine (Figure 1).

	Brain Weight (kg)	Body Weight (kg)	Brain wt. as % of body wt
Sperm whale (male)	7820	37000	0.02
African elephant	7500	5000	0.15
Human	1500	70	2.10
Cow	500	600	0.08

Table 1. Approximate brain and body weight of some animals (After Klinowska 1992).

However it appear to be understood by specialists that brain/body size comparisons mean very little in relation to assessing animal intelligence. For example, brain and body weights within a given species can vary quite considerably between individuals, and furthermore in some whale species body weight can vary by about 40% between seasons within a single individual (Klinowska 1992).

Accordingly, attention has more recently focused upon brain structure rather than mere size in trying to gauge where whales rank among other animals. For example, the neocortex (that part of the brain believed to be associated with "higher" mental functions and thought to be most highly developed in primates and humans) is quite extensive in the cetacean brain. Nevertheless, despite its area it is only thinly developed and furthermore is anatomically exhibits a quite primitive structure (Klinowska 1989).

What is even worse for establishing that line of enquiry, is that the animal having the relatively largest extent of neocortical development is not a cetacean, elephant or primate species, but a primitive egg-laying mammal (the spiny anteater). It is anomalies such as this that make the search for "intelligence" within some aspect of brain size or structure a less than rewarding exercise.

Trans-science and the Superwhale Phenomenon

Similar anomalies exist in regard to behavioral characteristics

of cetaceans. The trainability of some dolphins and indeed the affinity they may exhibit toward humans is not shared by all species of dolphin, nor indeed by all individual animals within a particular species (e.g. Defran and Pryor 1980; Prescott 1981; Pryor 1981). Thus generalizing becomes difficult and in the absence of "hard" or unequivocal scientific evidence it becomes easier for both scientists and non-scientists to advance as science what is no more than pure conjecture.

This indulgence in what has been termed "trans-science" (Weinberg 1976) is by no means uncommon when scientists assume an advocacy stance on a popular issue. Unfortunately it may take little more than a citation to another's book for a writer to have an opinion uncritically accepted by many others as an established, or scientific, fact.

When it comes to the conventional wisdom about "whales" there is certainly no shortage of seeming "authorities" (i.e. book writers) to cite in support of fanciful, yet fashionable, notions. Such ideas have been responsible for creation of the "superwhale" by certain whale enthusiasts. The superwhale is a composite, mythical, creature that combines various real and imagined characteristics of different cetaceans, to constitute a creation that does not exist but serves as proxy for all whales (Kalland 1991; see also Gaskin 1982:115-6).

In this conception the (super)whale is endangered (like the blue whale), largest-brained of all animals (sperm whale), playful and accepting human contact (gray whale), lives in extended family groups (killer whale), has complex communication (humpback) and is highly intelligent (dolphin). Of course, such creative exercises, even if only intended to be metaphorical, are seen as harmless enough and may even do some good if generally supportive of conservation and environmental causes.

Impression Management and Harm/Benefit to Whom?

This last statement, about questionable statements of fact being "harmless enough" was deliberately introduced to allow challenge of that particular viewpoint. Some false and misleading statements about environmental issues have in fact been extremely damaging to some just as these same messages have brought benefit to others who profit by engaging in campaigns in support of popular (yet erroneous) beliefs.

The best documented cases perhaps relate to the economic destruction and consequent family and community dislocations in various aboriginal (e.g. Wenzel 1991) and non-aboriginal (e.g. Henke 1985) societies in North America and Greenland caused by anti-sealing campaigns of the 1970's and 1980's. These damaging campaigns were based upon the twin falsehoods that the target species was endangered and that the method of killing was cruel

and inhumane.

As the economic destruction to small sealing societies in the north was set into motion, a number of animal welfare and animal rights' organizations profited handsomely and, in the recent U.K. General Election, one of the principal organizations opposing the killing of seals contributed fifty million pounds (ca. $100 million) to the major political parties (Goodman 1992)

The Justification for Opposing Commercial Whale Fisheries

However, in this paper I do not wish to look at the specifics of damage to particular societies caused by such environmental and animal welfare campaigns, as other papers in this conference session will address these issues. Rather, I wish to address a principle that is officially invoked by a number of governments in support of policies that proscribe consumptive use of particular resource stocks.

In the example being considered in this paper, the resource stocks are whales, the vehicle for opposing their consumptive use is a moratorium imposed on commercial harvest of whales a decade ago by the International Whaling Commission (IWC). The IWC consists of about thirty-six constituent governments, of which a majority continue supporting the imposition of the whaling moratorium. This majority includes the United States as well as, among others, Australia, Finland, France, Germany, India, Ireland, Mexico, the Netherlands, New Zealand, Sweden, Switzerland, and the United Kingdom.

The justification advanced in recent years by these particular countries to continue opposing the harvesting of whales by certain other countries is referred to as the Precautionary Principle. This principle, proscribing the killing of whales, is invoked in this case because of the levels of depletion of some whale stocks caused by excessive harvesting in the past, and the consequent need to exercise great care so that recovery of these stocks occurs, preferably to pre-exploitation levels of abundance.

It is seen as entirely reasonable, where uncertainty in regard to whale numbers and biology are concerned, to assume the worst (i.e. that whales are at very low numbers and management uncertainty is great). In view of this uncertainty and low whale numbers a total prohibition upon whale killing is a responsible act in order to allow the populations to recover to pre-exploitation [i.e. safe] levels.

How Sound is the Precautionary Principle--In Practice?

This statement of principle has a number of problems associated with its formulation, interpretation and application. For

example, the notion that there is a pre-exploitation population level that could or should be approximated and then maintained is an ecological absurdity. Such a notion assumes an ecological stasis that no-where exists. It assumes that ocean community composition at some particular point in history was "ideal" and therefore should be reconstituted and maintained into the future.

However, this pristine ocean community remains unknown to science, and furthermore is unknowable in all its complexity and dynamism. Indeed, in place of approximating this past ecological complexity and inherent variability, the whale management authority (the IWC) attempts to set goals based upon theoretically derived models focused upon single species populations of whales alone. The imposition of this simple and misleading view of nature assumes that if human action (or the harvesting part of that action) is curtailed, then the ocean biotic community (or at least the cetacean component) will return to its pristine condition..

Despite these various failings of what might be called the historico-romantic view of whale population ecology, there is an even more serious failing associated with the uncritical application of the Precautionary Principle to the management of whales and whaling. This is the notion that by adopting what is assumed to be a no-risk option (or at worst, a very-low risk option) that damage is eliminated (or at the worst, greatly minimized).

The Precautionary Principle as it is operationalized in the context of continued opposition to whaling requires construction and belief in false opposites: that policy options involve risk vs. no-risk, or damage vs. safety. In reality however, doing nothing does not eliminate risk or damage. The replacement of one set of actions by another set of actions (or inaction as in this case) results in particular risks or damages being replaced by yet other risks or damages.

There is no indication that such an appreciation of the nature of environmental risk assessment exists in the actions or minds of those continuing to oppose the harvesting of whales.

Risk Associated with Non-Harvest

The historic excesses associated with over-exploitation of the great whales occurred when whales provided an abundance of inexpensive oil for food and for other industrial purposes. Once petroleum-based products replaced train oil (at the end of the nineteenth century) and, later, vegetable oils could be hydrogenated for use in margarine manufacture (in the 1960's), the main justification for continued large-scale hunting of whales ceased to exist for many of the former whaling nations. Thus by the 1970's and particularly the 1980's, whaling continued

principally to provide meat to those few societies where it had historically been an important part of the diet.

This use of whalemeat as food was restricted to very few countries or communities, and is in marked contrast to the situation favouring large-scale hunting of whales when a vast international market existed for whale oils for both industrial and domestic use.

It is relevant to provide this short historical background because the Precautionary Principle and a complete ban on commercial hunting of whales is more easily justified by invoking the spectre of the return of large-scale highly-capitalized and technologically-sophisticated industrial whaling fleets.

However, in reality few countries have included whalemeat in their national or local dietaries, and those that do can adequately meet the demands of their own domestic markets (e.g. Conrad and Bjorndal 1992; Ward 1992).

Recent surveys carried out in some of the present and former whaling countries indicated very low levels of demand by the general population for whalemeat as food. Thus unacceptability of whalemeat as food range from around 93% in Australia and the U.K., 88% in the U.S., and 79% in Germany. Even in those countries (e.g. Norway and Japan) where whalemeat is, for some, a dietary staple, about 40% of the population disapproved of its use as food (Freeman and Kellert 1992).

Therefore, not only is the size of the market demand for whale product quite limited, but in contradistinction to earlier periods of whale exploitation (e.g. during the so-called "whaling Olympics" in the 1950's and 1960's), these remaining markets have recently been supplied by national or even local producers. It is hard to see how, in the absence of intense international (or even national) competitors, any return to Whaling Olympic competition is possible (Kalland 1990).

Whaling and Environmental Protection

Though opposition to consumptive use of whales is to a large extent based upon a widespread belief that cruelty is involved in methods used to catch whales, some government policies against other nations' use of whale resources is likely based upon less emotionally-driven environmental concerns. Included in these are questions of harvest sustainability and species endangerment that might lessen biodiversity.

A discussion of certain ethical issues surrounding whale use will not be discussed here (however, see Freeman 1992; Lynge 1992), but rather, certain elements of environmental concern will be addressed.

To consider the environmental issues it is useful to return to the precautionary principle invoked by several governments as their environmental justification for opposing a resumption of commercial whaling. As this precautionary principle appears to be understood by it's proponents during IWC debate, whaling should be suspended in order to eliminate risk of extinction of whales and thereby safeguard ecosystem integrity and sustain biodiversity.

Whales are a component of a marine ecosystem which is subject to various predatory pressures, most noticeably from food extraction (i.e. fisheries) and pollution (from land-based industrial actions, including intensive agriculture). Can whaling be sustainable, and lessen other negative impacts on the oceans and their biotic resources? If the answer is affirmative, then surely the precautionary principle, if environment-directed, should argue for a resumption of whaling.

Whaling as a Food Production Activity

There are two main areas to be considered here, both subsumed in the question: how environmentally-friendly is catching whales for human food as compared to other means of producing protein/food for human use. To answer that question both land-based agriculture and commercial fishing will be briefly considered.

In environmental terms the costs of land-based agriculture involves wildlife habitat loss (hence loss of biodiversity), soil erosion, pollution and over-use of groundwater reserves, heavy use of fossil fuels, release of greenhouse gases (especially nitrous oxides and methane), and drug/pesticide additions to the human diet. If the greatest threats to the global environment are exacerbated by poverty, as many now maintain, then it is relevant to consider the additional costs to the global environment inherent in the poverty caused in the developing world in significant degree by the trade-distorting agricultural subsidies maintained by the advanced industrial nations in support of their agricultural producers (WCED 1987).

Marine fisheries (including whaling) certainly do not contribute to loss of habitat, nor to soil erosion or groundwater contamination. No applications of fertilizers, pesticides, antibiotics or growth hormones are required to produce wild (as opposed to farmed) marine food resources, though of course those applied in agricultural practice eventually make their way to the ocean chemical sinks where they are subject to dilution before entering marine food webs.

Energy Efficiency in Food Production

In regard to energy use and greenhouse gas production, marine food production is generally more environmentally-favourable in

comparison with land-based food production. Though energy audits are not easy to make and often may not be strictly comparable from study to study, nevertheless it appears that coastal whaling generates energy savings of between 90-95% when compared to fin-fisheries (see Table 2).

Modern farm animal meat production practices are generally more energy-intensive than fisheries, a fact in part reflected in the price differential between various types of meat, fish and shellfish products. Thus compared to small-type coastal whaling in Japan where fossil energy input to protein-energy output ratios are 2:1, farm-produced chicken, pork and feedlot beef production ratios in North America are 22:1, 35:1 and 78:1 respectively (Freeman 1991).

TYPE of FISHERY	FUEL ENERGY INPUT TO FOOD ENERGY OUTPUT
Japanese coastal whaling	2.1 : 1
U.K. overall	20.0 : 1
U.S. cod & tuna	20.0 : 1
Australian shrimp	21.9 : 1
U.S. shrimp	27.0 : 1
Adriatic (small vessel)	67.7 : 1
Adriatic (large vessel)	105.6 : 1

Table 2. Fossil fuel energy demands of selected fisheries (After Pimental & Pimental 1979 & Freeman 1991)

Fishery-Caused Threats to Biodiversity

The last area to be considered relates to the issue of maintaining biodiversity. It is generally accepted that any truly endangered species or stocks of whale would be totally protected from exploitation. This has been accepted practice for some years, such that, e.g. the blue whale and the humpback whale have been under international protection against commercial hunting since the mid-1960's and right whales for an even longer period of time.

However, most whale species are not endangered and several stocks of in the North Atlantic, North Pacific and Antarctic seas are,

according to the Scientific Committee of the IWC, capable (in biological terms) of sustaining commercially-viable harvests at this time. Furthermore, the Scientific Committee of the IWC has now developed a catch algorithm that operates with all the uncertainty inherent in whale biology and management. This procedure will safeguard against the danger of stock extinction whilst allowing a depleted whale stock to recover at the same time as it allows a safe harvest to be taken (Cherfas 1992).

The question of sustainability of many non-whale commercial fisheries is more problematic however. Continued fishing of severely depleted stocks of food fish is the norm rather than the exception in most countries. For example, in the U.S. 65 food fish species of 153 assessed by the National Marine Fisheries Service are overfished, meaning that fish are being caught faster than they are replacing themselves. These endangered species include various coastal sharks, Atlantic cod, haddock, Atlantic halibut, redfish, flounder, red snapper, Atlantic swordfish, blue marlin and blue tuna as well as several popular shellfish (Specter 1992).

One reason that so many species may be adversely affected is that under most commercial fishing practices, very few if any net-fisheries can be wholly selective and avoid catching non-target species. Thus, in the presence of a continued fishery, even endangered species that are not the target of the fishery may continue to be gill-netted, trawled or purse-seined into the catch targeted upon other species.

The high selectivity of a whale fishery, where the targeted whale is identified by species before being taken, and where a prohibition can be placed on, e.g. the catching of females with calves or whales of a particular size, stands in strong contrast to the far more indiscriminate fin fisheries. Part of the problem associated with fin fisheries is the large amount of by-catch, the unintended and unwanted part of the catch that is usually discarded or, at best, partly rendered into fish meal for industrial purposes rather than being used directly as human food. Again, no such waste occurs in whale fisheries, where all edible products are returned to port and directly consumed as human food (Ward 1992).

The magnitude of by-catch wastage in non-whale fisheries in sometimes very large in biomass terms and frightening in terms of implications for sustaining local or regional (if not global) biodiversity. For example, the Center for Environmental Education estimated that in 1983 nets set for halibut and shark in California killed 1000 sea lions, 100 harbour seals, 100 sea otters, 30 pilot whales, and numbers of gray, humpback and fin whales. In one study of 133 halibut nets in central California, there were more seabirds caught than halibut, with a total seabird mortality of over 25,000 reported (Specter 1992).

Similar figures come from coastal nets employed elsewhere. For example, in Australia, nets are deployed to make bathing areas safe from great white sharks. Unfortunately these nets whilst providing protection to bathers also constitute "walls of death" for more species than the great white shark. As sharks cannot swim backwards, those hitting the net are likely to be drowned. Over a sixteen-year period shark-free bathing in Queensland resulted in the death of 20,500 sharks of different species (many of which are not dangerous to humans), but also 10,889 rays and 465 dugong, 317 porpoises and 2654 sea turtles (Faimo 1990).

In reference to the issue of biodiversity, it is hard to believe that some nationally or even locally endangered, vulnerable or threatened species were not included in these inshore net fisheries. Between the years 1987 and 1992, the number of domestic endangered species increased from 451 to 617 in the United States (Mann and Plummer 1992), and in Australia about 28% of the native biota is reported to have become extinct in historic times.

Conclusions

The discussion of whaling as an economic activity is clouded by the popular conception of whales as constituting a special class of animals. This specialness derives from a widespread belief that whales are intelligent, endangered, killed by methods that are cruel, and that the products they provide are no longer needed so that their being killed is without justification.

This paper has only touched on certain of these issues; in most cases it is concluded that these ideas, in varying degrees, are not in accord with the facts. Much of the presumed "specialness" of whales derives from their presumed intelligence. However, ideas about animal intelligence are hard to test, and certainly earlier conclusions based upon whale brain size, external appearance and internal structure are no longer held by specialists to support the claim to intelligence or higher mental attributes.

This paper has not addressed issues of endangerment or the ethical concerns associated with whale hunting. However, it was noted that the IWC Scientific Committee has now identified certain whale stocks that can sustain commercial exploitation, and that it has successfully developed a catch limit algorithm that guards against stock extinction whilst at the same time allowing a safe harvest to be taken and the stock, if depleted, to recover.

The question of ethics is an important topic but one that is relevant principally if whales are accepted to be a special class of animal fundementally unlike other mammal stocks regularly killed to meet human needs. As this presumed special status

largely derives from belief in a mythical "superwhale", whose imaginary characteristics are held to be possessed by all actual whales/dolphins/porpoises, the ethical debate appears to have been uncritically exaggerated to meet the imagined specialness of whales.

In regard to questions of extreme caution in sanctioning a resumption of commercial whaling, this is understandable given the past excesses of some sectors of the whaling industry and the ineffectiveness of the then-constituted international whaling management body. However, these past circumstances and events no longer exist, and present circumstances are such that no large-scale international commodity markets exist for whale products. As whaling is carried out to supply quite limited food markets and for the most part this will occur within coastal waters, future whaling would appear to be a component of limited-access national fisheries.

The environmental justification for opposing a resumption of controlled whaling is not sustained by the evidence. Whaling is today carried out exclusively to provide a high quality human foodstuff in those societies where whalemeat has traditionally been a valued part of the local or regional food culture. The environmental costs of providing nutritionally-equivalent food is extremely high, and this is so whether land-based or marine food sources are considered as food substitutes for whalemeat.

This analysis of the whaling controversy suggests implications for the rational management of other common-pool resources which can be discussed during the Elephants and Whales sessions at the IASCP meetings in Washington.

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