GREENPEACE

Whales in Competition with Commercial Fisheries:

A Modern Myth Based on Pseudo-Science

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Contents

Introduction

Recently, the Japanese Institute of Cetacean Research (ICR) published a paper which estimated the total food consumption of cetaceans worldwide as between 2.8 and 5.0 hundred million tons some 3 to 6 times the amount taken in marine capture fisheries. Subsequently, the upper figure has been used in undated pamphlets and press releases to promote the view that "Clearly, whales are competing with humans for limited fisheries resources".

In fact, the truth of this assertion is far from clear. In addition to concerns about the accuracy of the estimate itself, the development of the argument by the ICR to suggest that whales should be managed (e.g. culled) to reduce this competition is based upon a series of misconceptions and misrepresentations]. In short the ICR premise is one underpinned at best by a naive understanding of ecosystem interactions and at worst by pseudo-science. It is focussed, it would seem, more upon justifying the resumption of commercial whaling rather than upon an honest attempt at characterising an ecological situation in an objective manner.

Given the known Japanese expertise in the field of fisheries science, it is somewhat surprising that the ICR Report is characterised by a general, wide ranging, lack of scientific rigour. The thesis that fisheries are in competition with whales is demonstrably flawed. Multiple flaws range from the somewhat disingenuous assumption that all fish consumed by whales are targeted by fisheries, to serious doubts about the basis on which the consumption figures have been estimated in terms of whale metabolism and feeding habits. Added to these methodological flaws are numerous flawed assumptions concerning ecosystem dynamics. In particular, the implicit assumption that removal of whales from ecosystems will simply increase fish yields is astonishingly naïve since it fails to take into account the poor understanding of whale trophodynamics and the wholly unpredictable responses of the ecosystems concerned.

Accordingly this brief document details some of the major concerns attached to the ICR paper and the associated pamphlets and also outlines some of the flaws in the "scientific" rationale behind these proposals. A simple analysis suggests that the evidence for competition between fisheries and whales is best regarded as virtually non-existent. In short the ICR paper is a highly simplistic and evidentially flimsy document

The underlying scientific basis of the Japanese claims has already been challenged in a paper prepared for Environment Australia by CSIRO Marine Research. The conclusion reached in this paper is worth reproducing:

"Before industrialised fishing began, the marine environment, with all its components, would have been in some sort of steady state (fluctuating environmental factors permitting). Therefore, in the past, when whale populations were far larger, there was obviously enough fish and plankton to sustain them, and enough left over to support the huge global fish stocks that have been exploited by modern day fisheries. The partial recovery of some whale populations over the past 30 years cannot nearly explain the decline in fisheries worldwide."

The State of Global Fisheries

By framing the debate in terms of the above conclusion as a point of reference it becomes clear that the central problem is one of consistently poor regulation and management of fisheries: as marine capture fishing has been allowed to steadily grow over the last century, appropriate checks and balances have not been emplaced. Fishing fleet overcapacity resulting in high fishing effort and hence overfishing is the major contributory problem. It is estimated that as early as between 1880 and 1900 trawling efficiency of the English fleet alone was some 4-8 times multiplied simply as a result of the introduction of powered trawlers. Power and numbers of vessels continued to increase: by 1990, abundance of target species in these waters had fallen to half or less of their 1880 level on average. This situation has been broadly reflected around the majority of the world's fisheries.

As things currently stand:

- FAO figures suggest that for 200 major fish resources, 35% are overfished, 25% are being fished to their maximum potential while 40% are still in the development stage. Hence, at least 60% of world stocks require urgent and appropriate management measures. Fishing of over exploited resources continues.

- Fisheries rely on relatively few species. Of the 20,000 known species of fish around 9,000 are routinely fished, 22 species are taken in amounts of 100,000 tonnes per annum while five groups make up 50% of global fisheries.

- Fisheries discard an estimated 27 million tonnes of fish annually in addition to the landed catch.

- There have been numerous collapses of commercial stocks due to poor scientific information and/or failure to implement the advice of fisheries scientists.

- There is extremely good evidence that fisheries are now increasingly targeting smaller, lower value pelagic species which feed lower in the food chain and are subject to large fluctuations in annual productivity. This follows (and masks) the slow but steady degradation of the demersal high value resources and can be best described as fishing down food chains.

- Restoration of fisheries and their subsequent management will require substantial reduction of the fishing effort applied in existing fisheries. Overall, management paradigms will also require to change in order that

management of fisheries is actually effective. Effective management is regarded widely as the key rather the attempts at ecosystem manipulation.

These facts are not in dispute: generally it is acknowledged that global fisheries are in a critical state. It is also fairly obvious that this situation has developed as a result of human activities and that the driving force behind the current problems reported in global fisheries is overexploitation rather than overpredation upon stocks.

Condition of Global Whale Populations

It is difficult to visualise how whales could currently be in competition with humans for fishery resources given the history of whaling activities and its results. The above trends in fisheries closely mirror the historical exploitation of whale populations. For much the same reasons, whaling led to decimation of many whale stocks with progressive targeting of smaller species as the larger exploited species were pushed to the brink of extinction. Once again, the wide scale industrialisation of this fleet and the move towards factory ships after 1926, as opposed to land stations, significantly increased killing and processing efficiency.

Currently it is accepted that:

- Many whale populations were reduced to less than 10% of their original size. This pushed some species close to extinction and others to population levels that could threaten their recovery. The Atlantic grey whale was extirpated and blue, fin and humpback whales reduced very markedly in numbers.

- Whale populations are at a fraction of their pre-exploitation population level. At least 1.5 million were killed in the fifty years following 1925 after industrialisation of the fleet. Precise figures are not known but some whaling nations significantly under-reported their true catch.

- While it is believed that some whale populations are recovering, many stocks are not being monitored adequately, and so knowledge of population sizes is subject to some considerable uncertainty. Recovery, where it has been monitored, appears to be relatively slow.

These facts, which are not in dispute, need also to be considered in the context of whole ecosystems. The ICR document appears to consider ecosystems only in a highly simplistic “black box” manner: i.e. that less whales will simply equate to more fish to be caught by humans. In fact ecosystem relationships are considerably more complex and ecosystem dynamics are governed not only by interrelationships between species but also by variable environmental factors.

The Ecological Context

To a very great extent, the target fish of commercial fisheries do not coincide with those taken by whales. Baleen whales which migrate to the southern ocean in the austral summer depend, for example, largely upon krill for food for a significant part of the year, although some fish are also taken. Over the rest of the year, feeding is greatly reduced in many species. Hence the ICR estimate of Krill consumption by the great whales in the Antarctic, moreover, has been estimated at the much lower figure of between 34 and 43 million tonnes per annum and is only a small proportion of the krill consumed by all marine predators considered together. The ICR report does not make a distinction, and considers krill consumption as competitive with commercial fisheries. This is a clear misrepresentation of the known facts since there is no overlap between whale diet and commercial fisheries in this case.
The toothed whales prey upon cephalopods to a large extent, and in the case of many whales, such as sperm whales, the major prey groups are considerably spatially separated from targets of commercial fisheries. There is, therefore, one very clear anomaly in the data presented by the ICR. This relates to estimated food consumption of the sperm whales. In the ICR report, the total food consumed by sperm whales alone is given as some 254 million tonnes (upper limit). Sperm whales feed largely upon cephalopods. In fact their distribution may be limited by the availability of cephalopod prey]. The larger the whale, the deeper the water in which they feed and the larger the cephalopod prey taken. The deep-sea squid are currently not commercially exploited and so there is no overlap between sperm whale diet and commercial fisheries. To suggest, therefore, that sperm whales are competing with fisheries in this way is entirely erroneous and misleading.

There are some fish stocks exploited by fisheries which are also important prey for cetaceans and it is known that cetacean diets can show wide variability. Nonetheless, the greatest predators on fish populations in the majority of ecosystem examples studied, by an order of magnitude, are other predatory fish. It has been stated that a qualitative overlap in dietary items between the large baleen whales in the Southern Pacific is not supported by any evidence. Accordingly, even if the 500 million tonne figure is regarded as robust the total consumption of sperm whales should be removed from this total, together with the total for baleen whales in the Southern Hemisphere. If this is done, then the 500 million tonne figure must be revised downward by some 360 million tonnes. Hence, a new upper bound limit for fish consumption by whales can be set at 140 million tonnes where there is a potential for dietary overlap. Undoubtedly, this figure would fall even further if similar considerations were made for the other whales and dietary overlap with fisheries could be defined for them. Baleen whales feeding in Northern Hemisphere waters also consume substantial quantities of planktonic prey, not just fish species, for example. If the lower bound figure of 2.8 hundred million tonnes is treated similarly then the adjusted figure becomes 1.2 hundred million tonnes of food consumed by whales annually.

There is, therefore, some considerable uncertainty about the ICR figure of 5.0 hundred million tonnes of fish taken by whales each year in competition with fisheries e.g. fish of commercially important species and indeed the validity of the upper and lower estimates overall. This is due to a general lack of a demonstrated overlap between whale prey species and those targeted by commercial fishing operations. In any case, it must be appreciated that the figure of 5.0 hundred million tonnes is likely to represent an extreme upper bound. This is because its calculation depends upon an assumed intake of food amounting to 3.5% of body weight per day. In fact, it is likely that the true figure as an annual average lies between 1.2%-1.6% taking into account differences in summer and winter consumption in many species. Given the lack of overlap with commercial fish species it is probable then that even the lower bound of 2.8 hundred million tonnes quoted by the ICR is an extreme overestimate in terms of the impact upon commercial fisheries. An initial correction needs to be made that reduces the estimated figures to between 60 and 70% of the ICR upper and lower values. Further reductions would undoubtedly result from the application of more realistic consumption figures.

The precise trophic interrelationships and ecological roles of whales are regarded as very poorly understood and indeed this constitutes a broad problem in fisheries research with respect to completeness of data. There has been no systematic attempt to identify and describe the role of cetaceans in marine ecosystems in the post-industrial whaling era. There was certainly no concerted effort to characterise whales in their ecological niches prior to whaling operations of all kinds commencing. What is certain, however, is that the relative importance of whales as apex predators has been considerably diminished as a result of whaling activities. The impacts of this change on the ecosystems as a whole remains highly uncertain and has not been extensively evaluated.

Without a more holistic understanding of these ecosystem interactions, there is no reason to believe that removal of whales from marine ecosystems will cause these systems to respond in a predictable manner. Even in the few areas where relatively robust attempts have been made to evaluate cetacean diet and quantitative consumption, the figures necessarily have to be regarded as “unlikely to be better than an approximation”. This paper also notes in relation to the uncertainties attached to the ecosystem studied that “Unravelling all of the interconnecting linkages and fully understanding these sorts of effects will require a great deal of research effort.” This is likely to be true of other marine systems. Furthermore, the characteristics of ecosystems are such that resolution and analysis of all interconnections may never be achievable, simply because of their diversity and complexity and their indeterminable sensitivity to the manipulations involved in scientific study.

In short, those limited studies which have been carried out have been performed on populations of whales which have been severely depleted and which are interacting with fish populations which themselves have been overexploited and mismanaged. Indeed the potential complexity of marine ecosystem interactions which need to be taken into account in establishing the ecological role of cetaceans in quantitative terms is immense.

Accordingly, it is very unlikely (and therefore completely pointless to attempt it in experimental terms) that removal of whales from an ecosystem will produce detectable changes in fish yields while fishing pressure remains a primary driving force of ecosystem dynamics. If the ICR view is correct the huge reduction in the numbers of whales as a result of commercial whaling should have resulted in marked increases in the quantities of fish available to marine capture fisheries. In fact, the gradual increases in landings have resulted from a combination of increasingly ruthless exploitation of existing resources and the targeting of new resources of generally lower commercial value. No impact of removal of whales on fish populations has been demonstrated as unequivocally resultant from the *circa* 1.5 million taken in this century. Any "benefit" to fisheries of removing whales from ecosystems on this huge, uncontrolled, basis has either been non-existent or impossible to detect against the influence of the confounding variables.

It will not be possible to test the ICR hypothesis rigorously since it will not be possible to satisfactorily resolve the other variable factors operating in the ecosystem. The only way of achieving such a controlled experiment would be to remove all whales from the system under study. Partial removal of the whales is unlikely to produce ecosystem responses or changes in fishery yields which can be resolved and could, moreover, prejudice whale population recovery. As such, therefore, culling cannot be justified on any scientific basis whatsoever nor upon any commercial basis except those relating to the short-term expedient economics of whaling and the sale of whale products.

The complexity inherent in marine ecosystem interactions tends to be obscured historically and in contemporary studies of commercial fisheries. This is because, to a very high degree, account has only been taken of demand-driven (commercial) ecosystem services which are often regulated using single species models to simulate reality. A recent descriptive analysis of the ecosystem services generated by fish populations makes it clear that they are of both a fundamental ecological nature and of a demand driven kind.

Possible Alternative Ecological Scenarios

There is also the possibility that further removal of whales from an ecosystem could actually reduce the chances of target fish species undergoing stock recovery due to regime shifts, or indeed actually be doing so. One possible, speculative, example relates to global cephalopod populations and while it perhaps has no more merit than the overly simplistic ICR speculations, nonetheless at least illustrates potential indirect pathways which may be involved and which ICR do not appear to have considered. It serves to exemplify the potential dangers of relying, like the ICR, upon a simplistically derived and ecologically naïve ecosystem characterisation.

The thesis put forward can be broadly represented as follows: Landings of cephalopods have shown consistent increase since the 1970s while groundfish landings have barely increased at all in aggregate, and have declined in relation to many other stocks. It can be plausibly postulated that increased cephalopod production has resulted both from reduced predation by toothed whales (60-70 million tonnes per year exploitation) reduced predation by tuna (20 million tonnes per) year due to intensive fisheries exploitation of these species. Reduced predation by other fish such as cod is inferred as a result of fall in absolute numbers and fall in mean age/size.

While this situation may have increased cephalopod landings, it may also be contributing to inhibiting recovery of the finfish populations. Young fish often contribute to the diet of cephalopods, and hence recruitment of some finfish stocks may be limited by high cephalopod abundance. In addition, under high fishing pressure, groundfish may be poor ecological competitors with cephalopods as a result of different life-histories. Hence, in this example, culling of whales could have an extremely negative impact upon commercially valuable finfish populations, and prevent their recovery from overfishing.

This scenario provides a clear and plausible example of how fisheries could be negatively impacted as a result of regime shifts taking place in the ecosystem. The feeding ecology of whales and interrelationships between whales and other species are for the most part very poorly understood. Hence, the assertion that culling whales will protect fish stocks can be regarded as really little more than idle speculation in the absence of anything like comprehensive information on their ecosystem interactions either pre-exploitation or subsequent to the exploitation of both. Given the potentially large number of species interactions possible in any given ecosystem, it may be that counterintuitive changes result from the removal of an apex predator. This could mean that prey species could actually fall in number rather than increase.

Conclusions

- Both fish stocks and whale populations have been reduced, in some cases to the points of collapse and/or extinction as a result of poorly regulated and intensive commercial fishing and whaling operations.

- There is currently no evidence of significant qualitative overlap or quantitative impact of baleen whales or sperm whales upon commercial fisheries. This is illustrated by the consumption of krill and of cephalopods by baleen whales and sperm whales respectively which are part of the ICR total but which are not of commercial importance and which account for a significant proportion of the 500 million tonnes cited by the ICR.

- The assertion that whales consume 500 million tonnes of commercially significant fish each year is undoubtedly an extreme overestimate since consumption and degree of overlap are likely to have been overestimated in the ICR paper.

- Even without taking into account such factors in relation to the numerous species of toothed whales, both upper and lower bound limits are subject to considerable revision: a reduction of around 60% at the lower level and of 70% at the upper bound.

- The ecological characteristics and trophodynamics of whales are poorly understood. They have not been studied extensively on either an historical or a contemporary basis.

- Since ecological interactions have been poorly characterised, there is no certainty that removal of whales from the ecosystem would increase commercial fishery yields.

- With ecosystems under continuing heavy fishing pressure, removal of whales is unlikely to have any detectable impact on commercial fishery yields.

- Further erosion of whale numbers coupled with continued fishing pressure could in fact prevent the recovery of finfish populations by conferring a competitive advantage to other ecosystem components. Although these other ecosystem components are commercially of some value, they may nonetheless, compete with higher value species by preying upon eggs and juveniles.

- The major predators upon fish in marine ecosystems are other fish, not whales.

- On the basis of the information available, the ICR proposal must be viewed as ecologically naïve, and based upon a number of fundamental misconceptions. It is highly likely that attempting to manage whales for the benefit stocks would in fact only benefit (in the short term) the commercial whalers.

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