SCIENCE, PROFIT AND POLITICS: Scientific Whaling in the 21st Century

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Executive Summary

The role of Special Permit whaling, the killing of whales for scientific research (commonly known as "scientific whaling") in 21st Century whale management has increasingly come under scrutiny as the number of whales killed and the variety of species taken has grown. More recently, the relationship of scientific whaling to the current negotiations regarding the International Whaling Commission's Revised Management Scheme has created additional controversy.

The discussion surrounding the scientific necessity and general review of special whaling permits is at a critical juncture. Unless scientific whaling is brought under the purview of the RMS or is regulated under a parallel, binding protocol, the precautionary controls discussed as part of the RMS are meaningless. A resolution to this dilemma must be found before an effective RMS can be agreed.

This report reviews the research claims made by Contracting Governments engaged in scientific whaling, the contributions that scientific whaling makes to modern whale biology, and existing scientific alternatives to lethal research. Commercial whaling has certainly contributed to our current knowledge of whales, and there may still be some information that requires lethal sampling, such as studies of pollutants on internal organs. However, there is no doubt that the study of whales has changed significantly since 1946.

Non-lethal techniques have brought whale conservation and biology well into the 21st Century and in most cases it appears that scientific whaling has not kept pace with these new techniques. In general, non-lethal techniques provide greater sample sizes and more reliable data, and have the additional advantage of repeated sampling over many years – something which is obviously impossible when a whale is killed. In our view the current research programs must be redesigned to incorporate new techniques and the scientific necessity of the research needs taken into consideration.

Of concern to WWF is whether the proponents of scientific whaling have chosen to ignore modern, scientifically proven methods due to conflicts related to economic profit and politics. We are particularly concerned about the claim that whales are somehow responsible for the depleted status of global fish stocks

WWF believes the Contracting Governments of the IWC are obligated to consider how best to align IWC-related research with the most modern accepted scientific techniques to maintain the IWC's credibility on this issue, and to further the current discussions on the RMS and its relationship to scientific whaling.

Science, Whale Conservation, and Scientific Whaling

The role of Special Permit whaling (commonly known as "scientific whaling") in 21st Century whale management has increasingly come under scrutiny as the number of whales killed and the variety of species taken has grown. More recently, the relationship of scientific whaling to the current negotiations regarding the International Whaling Commission's Revised Management Scheme (RMS)[1] has created additional controversy. Many IWC Contracting Governments demand that scientific whaling should be subject to RMS controls, while other governments insist that it should continue to operate without international oversight.

With the possible exception of inspection procedures and market controls, no other single issue has greater potential to derail the IWC's already difficult negotiations on the adoption of a Revised Management Scheme. Unless scientific whaling is brought under the purview of the RMS or is regulated under a parallel, binding protocol, the precautionary controls discussed as part of the RMS are meaningless. In effect, special permit whaling would continue as a parallel form of whaling completely outside of international control.

In this document we examine the research claims made by Contracting Governments engaged in scientific whaling, the contributions that scientific whaling makes to modern whale biology, and existing scientific alternatives to lethal research. Our goal is to answer the following questions:

1. ***Does killing whales for research provide data critical to the management of whale populations?***

2. ***Can the data from scientific whaling be obtained using other (non-lethal) methods?***

3. ***Is the current requirement to fully utilize the whales killed during scientific whaling operations an incentive to abuse the research privilege?***

4. ***If scientific whaling is to continue, should it be subject to tighter IWC controls?***

[1] The Revised Management Scheme is intended to be a set of detailed rules governing various aspects of whaling, such as inspection and observation procedures. For more details, see the IWC website, www.iwcoffice.org.

The History of Special Permit Whaling in the IWC

Both Article IV and Article VIII of the International Convention for the Regulation of Whaling (ICRW) address the collection, use, and dissemination of scientific information related to whales and whale populations.

Article IV establishes the purposes and intent of whale-related research within the IWC:

> *1. The Commission may either in collaboration with or through independent agencies of the Contracting Governments or other public and private agencies, establishments, or organizations, or independently*
>
> > *(a) encourage, recommend, or if necessary, organize studies and investigations relating to whales and whaling;*
> >
> > *(b) collect and analyze statistical information concerning the current condition and trend of the whale stocks and the effects of whaling thereon;*
> >
> > *(c) study, appraise, and disseminate information concerning methods of maintaining and increasing the populations of whale stocks.*
>
> 2. *The Commission shall arrange for the publication of reports of its* activities, and it may publish independently or in collaboration with the International Bureau for Whaling Statistics at Sandefjord in Norway and other organizations and agencies such reports as it deems appropriate, as well as statistical, scientific, and other pertinent information relating to whales and whaling.[2]

Article VIII authorizes the use of special permits to kill whales for scientific purposes:

> *1. Notwithstanding anything contained in this Convention, any Contracting Government may grant to any of its nationals a special permit authorizing that national to kill, take, and treat whales for purposes of scientific research subject to such restrictions as to number and subject to such other conditions as the Contracting Government thinks fit, and the killing, taking, and treating of whales in accordance with the provisions of this Article shall be exempt from the operation of this Convention. Each Contracting Government shall report at once to the Commission all such authorizations which it has granted. Each Contracting Government may at any time revoke such special permit which it has granted.*
>
> *2. Any whales taken under these special permits shall so far as practicable be processed and the proceeds shall be dealt with in accordance with directions issued by the Government by which the permit was granted.*

[2] Article IV, International Convention for the Regulation of Whaling, Washington, 1946. The full text of the Convention can be found on the IWC website.

3. Each Contracting Government shall transmit to such body as may be designated by the Commission, insofar as practicable, and at intervals of not more than one year, scientific information available to that Government with respect to whales and whaling, including the results of research conducted pursuant to paragraph 1 of this Article and to Article IV.

4. Recognizing that continuous collection and analysis of biological data in connection with the operations of factory ships and land stations are indispensable to sound and constructive management of the whale fisheries, the Contracting Governments will take all practicable measures to obtain such data.[3]

In 1979 the Commission added the following paragraph to the Schedule[4] regarding the issuance of research permits under Article VII:

"(30) A Contracting Government shall provide the Secretariat with proposed scientific permits before they are issued and in sufficient time to allow the Scientific Committee to review and comment on them. The proposed permits should specify:

(a) objectives of the research;
(b) number, sex, size and stock of the animals to be taken
(c) opportunities for participation in the research by scientists of other nations; and
(d) possible effects on conservation of the stock.

Proposed permits shall be reviewed and commented on by the Scientific Committee at Annual meetings when possible. When permits should be granted prior to the next Annual Meeting, the Secretary shall send the proposed permits to members of the Scientific Committee by mail for their comment and review. Preliminary results of any research resulting from the permits should be made available at the next Annual Meeting of the Scientific Committee."[5]

Clearly this last paragraph intended the IWC's Scientific Committee to provide advice to governments issuing Special Permits. Unfortunately, the IWC does not require the issuing government to heed the Scientific Committee's advice by amending their permit accordingly.

In 1982 the IWC voted to establish a moratorium on commercial whaling, to become effective with the 1986 coastal and 1985/86 pelagic whaling seasons. Prior to 1982, more than 100 scientific whaling permits had been issued by a number of governments, including Canada, the U.S.A., U.S.S.R., South Africa and Japan. However, the extent of the permits and the number of whales taken began to rise following the moratorium's effective date as whaling nations began using the special permit option as a way to circumvent the moratorium. South Korea and Iceland first exercised the special permit option in the 1986/87 whaling season, while Japan, the Soviet Union, and Norway continued whaling under objection to the moratorium. South Korea stopped whaling after just one year, while Iceland continued through the 1989/90 season.

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[3] Article VIII, International Convention for the Regulation of Whaling, Washington, 1946.

[4] The IWC Schedule is a set of adopted rules and definitions related to actions under the ICRW. Any change requires a ¾ majority of the IWC Members. For a full text of the Schedule, see the IWC website.

[5] Paragraph 30, Schedule to the International Convention for the Regulation of Whaling, amended at London, 1979.

In 1988 Japan dropped its objection to the moratorium, but continued to whale using the special permit option. At the same time, Norway temporarily switched from whaling under objection to special permit whaling, and continued special permit whaling until 1992, when they again went back to whaling under an objection to the moratorium. Japan has continued to grant itself special scientific permits through to the present day, killing the majority of these whales in the IWC Southern Ocean Sanctuary.[6]

Between 1987 and 2003, the latest date for which official catch data is available, Japan alone has taken approximately 6,700 minke whales of two species (common and Antarctic), 144 Bryde's whales, 40 sei whales and 18 sperm whales in its scientific whaling programmes. Quotas for the 2003-2004 season and the 2004-2005 season added approximately 1,400 additional whales to this figure. By contrast, only 840 whales were killed worldwide by Japan for scientific research between 1954 and the onset of the moratorium. The *annual* catches proposed in Japan's new scientific whaling program in the Antarctic (JARPA II, see below) will alone represent more than half of the total worldwide takes for scientific research by all other nations in the past half century.

In 2002, Iceland rejoined the IWC with a controversial objection to the commercial whaling moratorium, stating it would not exercise whaling under that objection until 2006 unless the IWC adopted an RMS during the intervening period. However, in the following whaling season Iceland began a scientific whaling program.

Since the whaling moratorium came into effect, more than 24,000 whales have been killed[7] in known whaling operations, and more than 7,000 of those have been killed in the name of science (See Table 1).

[6] Source: IWC website.

[7] This figure does not include whales killed for aboriginal subsistence, or "small" cetaceans (pilot whales, striped and Commerson's dolphins, etc.), the hunts for which are not managed or monitored by the IWC or other international fora.

The Controversy Over Scientific Whaling

At the time Article VIII was written, the study of whales was still in its infancy in spite of centuries of intensive global whaling. Most of what was known about the various species had indeed come from whaling data, including information on pregnancy rates, age at attainment of sexual maturity, age distribution, sex ratio and other basic biological parameters. In an effort to expand upon that knowledge, between 1932 and 1984 more than 33,000 numbered stainless steel cylinders, known as "Discovery tags," were fired from shotguns into the bodies of living whales in the hope that some of these cylinders would be recovered when the whales were killed and butchered. This program allowed scientists to collect additional information on migratory routes and other related data, but still relied upon killing whales to obtain the information.

In the early 1970s, however, whale biology was revolutionized with the discovery that individuals of many species could be identified and tracked based upon variations in natural markings (Hammond *et al.* 1991). This technique allowed scientists to follow living whales in long-term studies across both breeding and feeding grounds, and to determine, in a non-invasive manner, information of importance to management and conservation. This included abundance, population structure, reproductive rates, age at sexual maturity, habitat use and migratory movements, as well as detailed investigations of behavior, ecology and social structure. In recent years, these non-lethal individual identification techniques have been complemented by the development of sophisticated methods such as satellite tagging and genetic analysis.

The application of genetics to the study of whales has been a particularly important development. This technique is now used to understand population structure in a wide variety of taxa. Genetic analyses allow the examination of whales in different geographic areas, assisting in determination of stock boundaries. This is a critical question in quota management, since in the past whaling nations frequently set high quotas for large areas based upon the mistaken belief that all of the whales in the area were part of the same population.

Genetic samples are now routinely taken from a living whale using a biopsy dart, and do not require killing or injuring the animal. Biopsy darting is also far more efficient, allowing scientists to rapidly acquire large amounts of data from a broader section of the whale population (Palsbøll *et al.* 1997). Further details of such methods are summarized below.

In recent years more questions have arisen regarding the ethics of scientific whaling, as the programs have grown both in the number of whales killed and the species taken. In 2003, two members of the IWC Scientific Committee published a paper entitled "The Ethics of Scientific Whaling" (Appendix 1) in which they summarized recent criticism of current scientific whaling programs. In addition to questioning the overall quality of research in these programs, as reflected in the low number of resulting scientific publications in international peer-reviewed journals, they raised the following concerns:

- The commercial sale of products from scientific whaling creates a conflict of interest potentially biasing management advice provided by the member nation and its contracted scientific institute.

- Continued commercial sale of products from the Japanese program acts as a cover for illegal or unregulated exploitation of other species.

- The primary scientific objectives of the programs are not required for the effective management of whales under the goals of the International Convention for the Regulation of Whaling.

Other concerns have been raised regarding the effect of the scientific whaling proposals on the work of the IWC Scientific Committee. In a paper entitled "Concerns Regarding Scientific Permits" (Appendix 2) submitted to the Scientific Committee in 2003, 40 scientists questioned the "increasingly frequent abuse of Article VIII of the International Convention for the Regulation of Whaling by some member nations." One important factor noted by the group was –

> *"Member governments that promote poorly conceived research whaling programmes place their scientists in the untenable position of having to defend these proposals in order to support the agendas of their governments. In turn, this causes unnecessary conflict between SC members (as has occurred at the last several SC meetings), damages the credibility of the SC as a whole, and undermines the agreed basis by which the IWC manages stocks of whales."*

Finally, catches under Article VIII require no approval by the IWC and have no restrictions on number of whales killed, effectively allowing a country to conduct commercial-scale operations without the safeguards imposed by the IWC Revised Management Procedure (RMP) [8].

This WWF discussion document does not attempt to address many of the detailed critiques of the overall scientific quality and design of the scientific whaling proposals; for that, readers should refer to the discussion of specific proposals in recent IWC Scientific Committee reports (IWC 2002, 2003, 2004), as well as to a general critique by Clapham *et al.* (2003). Instead, we discuss the specific question of whether it is necessary to kill whales to answer the questions posed by Japanese and Icelandic scientists, and whether non-lethal alternatives provide a better option.

[8] The Revised Management Procedure incorporates a complex formula for calculating catch limits that takes into account the IWC's approved recovery goals, and variables such as sex composition and other factors of the species being taken.

Scientific Whaling: Current Programs and Non-lethal Alternatives

Current scientific whaling operations: Japan

Japan currently operates two scientific whaling programs, one in the Antarctic, known as JARPA/JARPA II, and the other in the North Pacific, known as JARPN II.

The Antarctic program (JARPA) recently ended after 18 years of lethal sampling, with the focus exclusively on Antarctic minke whales *(Balaenoptera bonaerensis)*. In its first year of operation (the 1987/88 pelagic whaling season) 273 minke whales were killed. Since that time the numbers have steadily increased to the current quota of 440. The program's stated goals were (1) to estimate biological parameters (especially the natural mortality rate) to improve management; (2) to elucidate stock structure to improve management; (3) to examine the role of whales in the Antarctic ecosystem; and (4) to examine the effect of environmental change on cetaceans.[9] By the conclusion of the 2004/05 season, a total of 6800 minke whales had been killed in this program, with the meat all brought into the Japanese market.

In a 1997 review of the Antarctic program and its results (IWC 1998), the Scientific Committee noted that the results of the program were "not required for management under the RMP". However, the Committee acknowledged that the program had contributed data that were potentially useful to an improved understanding of stock structure, feeding ecology and biological parameters. The review did not address the fact that much of the information could be better obtained by non-lethal techniques (some of which have been further developed since the review). In subsequent years there has been considerable criticism by IWC scientists of the publication record of the JARPA programme; this is extremely poor with remarkably few papers published in international peer-reviewed journals (Clapham *et al.* 2003).

Prior to the 2005 Annual Meeting of the IWC, the Government of Japan proposed a new 18-year program representing a second phase of Antarctic special permit catches, or JARPA II. The proposal (Government of Japan 2005) calls for more than doubling the previous JARPA catches of minke whales to a total of up to 935 a year, as well as adding ten fin whales *(Balaenoptera physalus)* per annum for the first two years, and 50 fin whales and 50 humpback whales (*Megaptera novaeangliae)* per year thereafter. The proposal also represents a fundamental switch in management strategies, and essentially calls for replacement of the IWC's accepted RMP with a vaguely defined "ecosystem-based management" approach and a contention that some species should be selectively culled to stimulate the recovery of depleted and more commercially valuable populations, such as those of fin and blue whales *(Balaenoptera musculus)*.

In the North Pacific, scientific whaling by Japan has been carried out in two phases: a "feasibility study" named JARPN and a full-scale program called JARPN II. The program initially targeted minke whales *(Balaenoptera acutorostrata)* in the western North Pacific, killing 100 per year from 1994 to 1999. The

[9] Ref: IWC website.

primary aims were to clarify questions of stock identity to improve the design of RMP Implementation Simulation Trials[10] for the North Pacific, and to act as a feasibility study for the development of a program on feeding ecology.[11] Beginning in 2000, the program was expanded to take 100 minke whales, 50 Bryde's whales (*Balaenoptera edeni, B. brydeii* and possibly *B. omurai*) and 10 sperm whales (*Physeter macrocephalus*) each year, and later expanded again to 220 minke whales, 50 Bryde's whales, 100 sei whales (*Balaenoptera borealis*) and 10 sperm whales.

The stated goal of the expanded North Pacific program is to obtain information "to contribute to the conservation and sustainable use of marine living resources" in the western North Pacific. Its primary aim is research into feeding ecology (including prey consumption and preferences of cetaceans and ecosystem modeling) with secondary goals regarding determination of stock structure and environmental effects on cetaceans and the marine ecosystem.[12]

When the JARPN II program expansion was reviewed by the Scientific Committee in 2002, there was considerable disagreement within the Committee over most aspects of the research, including objectives, methodology, likelihood of success and effect on stocks. [13]

The following analysis examines the stated goals in light of currently accepted scientific methods to determine whether the goals of the program could be adequately reached via non-lethal means.

1. Stock structure and abundance estimation

Both the Antarctic and North Pacific Japanese scientific whaling programs state that better insights into stock structure are major goals of the research. In a 2000 review of the Antarctic (JARPA) program, the IWC Scientific Committee agreed that some of the information obtained was useful for management as it had been and will continue to be used in the refinement of Implementation Simulation Trials for minke whales. No consensus view was reached on whether the results could have been obtained using non-lethal research techniques in a suitable timeframe. There was considerable disagreement within the Committee over most aspects of the North Pacific research program, including objectives, methodology, likelihood of success and effect on stocks.[14]

In considering non-lethal options for this research, the most reliable data on population structure is obtained from genetic analysis, which can be conducted on skin tissue derived from biopsy samples without lethal sampling. In reality, a biopsy sampling program is able to generate a much larger sample size which increases the power and reliability of the analysis being conducted.

[10] The complex set of computer runs designed to test the variability and performance of the RMP's method for calculating catch limits.

[11] Ref: IWC website.

[12] Ref: IWC website.

[13] Source: IWC website.

[14] Ref: IWC website.

Even though the quantity of material taken is small, biopsy sampling is extremely efficient in terms of tissue use. The average biopsy yields somewhat less than 1 gram of tissue (skin and blubber); consequently, most samples can be used for multiple purposes. For example, a sample can be split longitudinally into thirds: one third is used for genetic analysis, a second third is used for toxicology, and the final third can be utilized for stable isotope studies or some other purpose. In addition, because genetic analysis requires very small quantities of tissue for DNA extraction, a portion of the sample can be archived for security and for future use by other researchers in a different field.

Biopsy-based genetic studies are particularly valuable for establishing the identity and structure of populations through mitochondrial and nuclear DNA, and have been used to assess the long-range movements of individually identified whales and even to estimate abundance (e.g. Baker *et al.* 1990, 1993; Clapham *et al*. 1995; Palsbøll *et al.* 1995, 1997; Bérubé *et al.* 1998; Malik *et al.*2000). Abundance estimates, conducted by identifying individual whales using genetic nuclear markers, have the additional advantage that they can be calculated for males and females separately by combining the individual identification with molecular sex determination (Palsbøll *et al.* 1997).

Biopsies are also useful in studies other than those of population structure. They have been used for examination of contaminant burdens (e.g. Weisbrod *et al.* 2000, and see review in O'Shea and Brownell 1994), for stress analysis (Southern 2001), and for investigations of diet using stable isotopes (Todd *et al.* 1997, Hooker *et al.* 2001, Wetmore 2001).

Biopsy has been extensively used in studies of large whales, including some of the smallest and most endangered populations. Examples of the latter include bowhead whales (*Balaena mysticetus*) in the Okhotsk Sea, North Atlantic right whales, eastern North Pacific right whales (*Eubalaena japonica*, and western gray whales (*Eschrichtius robustus*.) In addition, biopsy-based studies have provided considerable information on more abundant species, such as fin whales (*Balaenoptera physalus*) and eastern gray whales.

One of the most prominent examples of the importance of biopsy sampling to the study of cetaceans is a seven-nation ocean-basin-wide collaborative study called Years of the North Atlantic Humpback (YONAH). Over two years, the YONAH project biopsy sampled more than 2,600 humpback whales across most of their North Atlantic range, and this large-scale study has resulted in huge advances in our knowledge of many aspects of this population's biology and behavior (e.g. Palsbøll *et al.* 1997, Smith *et al.* 1999). The YONAH study was also the first example of the large-scale use of genetic tagging in any mammal (Palsbøll *et al.* 1997).

All of the studies noted above, and many others we do not cite here, have contributed information that is essential to the management of endangered (and non-endangered) populations of large whales and other cetaceans. Furthermore, because such studies are conducted on living whales, they have the additional advantage of repeated sampling (and thus tracking) over many years – something which is obviously impossible when a whale is killed. Lethal take is a one-time sampling event which precludes any long-term monitoring of the biology of individuals in a population.

2. Ecosystem studies

JARPN II repeatedly states that the four species killed in the scientific whaling program compete heavily with humans for fishery resources and it is therefore critical to develop a multi-species management approach (Government of Japan 2000). This approach is mirrored in the expansion of the Antarctic program in JARPA II. However, large bodies of data on the prey of these species already exist. For example, sei whales were added to the North Pacific program although it is commonly known that this species rarely eats fish, feeding instead largely on copepods, a tiny zooplankton. In 1977 the Japanese themselves published a paper on the stomach contents of 21,713 North Pacific sei whales from their earlier whaling catches, and reported that only 3.4% of the animals with food in their stomachs had been eating fish; more than 82% had been eating copepods (Nemoto and Kawamura 1977). The JARPN II program also includes killing ten sperm whales each year to learn what they eat, when the diet of this species is widely recognized to be deep-water squid, as determined by examination of the stomach contents of innumerable sperm whales (400,000 were killed in the southern hemisphere in the 20th century; Clapham and Baker 2002).

Nonetheless, if understanding the diet of whales is a valid scientific goal, in many cases non-lethal techniques yield more reliable results. For example, stable isotope and fatty acid analysis of biopsy tissue provides a long-term signal of diet and its variation over time. This is in sharp contrast to the stomach content analysis conducted under JARPN II, which provides nothing more than a snapshot view of recently consumed prey – a highly unreliable and potentially misleading indicator of overall diet. Whatever food is consumed has a unique isotopic "signature" reflected in the tissues of the animal consuming the food, which can be determined with a biopsy sample. This technique has been applied all over the world in studies of other whales (e.g. Hooker *et al.* 2001, Herman *et al.* 2005).

Of particular concern to WWF is the claim contained within these proposals, and that of Iceland (see below) that whales are somehow responsible for the depleted status of global fish stocks, and must therefore be culled in order to allow greater harvesting by humans. Scientists all over the world recognize that fish, not whales, are the largest predators of other fish; and that human overfishing, not whales, is largely responsible for the depletion of fish stocks in the North Pacific and elsewhere. If fewer whales meant higher fish catches, fish stocks would be far larger than they were 100 years ago. In fact, the opposite is true – almost all commercial fish stocks are much lower now than they were a century ago, with the biomass of the large predator fish down to only about 10% of pre-industrial levels (Myers and Worm 2000). At the same time, almost all cetacean populations were drastically depleted during the last century and many are still at just a fraction of their original numbers.

There is no scientific validity to the removal or suppression of populations of top predators such as cetaceans in order to increase populations of prey species. This is too simplistic an approach and a clear threat to ecosystem integrity and health. A 2002 paper published in the journal *Nature* provided useful comments by some of the world's leading recognized fisheries scientists on the arguments used to promote the culling of whales to increase fish resources:

> *"…predators operate within finely meshed food webs whose structure (which they help to maintain) tends to support the production of their prey. Hence the concept of 'beneficial predation', where a predator may have a direct negative impact on*

> *its prey, but also an indirect positive effect, by consuming other predators and competitors of the prey. Thus, removing predators does not necessarily lead to more of their prey becoming available for humans. Instead, it leads to increases or outbursts of previously suppressed species, often invertebrates, some of which may be exploited (for example, squid or jellyfish, the latter a relatively new resource, exported to East Asia), and some outright noxious."(*Pauly *et al.* 2002*)*

The Food and Agriculture Organisation of the United Nations reports that 47 to 50 percent of fish stocks are fully exploited; another 15 to 18 percent are overexploited by humans; and 9 to 10 percent of stocks have been depleted or are recovering from depletion (FAO 2000). The world's fishing fleets continue to expand in size and capacity, even as scientists' and fisheries ecologists' world-wide call for reductions. Furthermore, most ecologists would agree that removal of high-level predators such as whales is actually likely to have a *detrimental* effect on commercial fish abundance in the long term, through disturbance of the complex relationships involved in the marine food web (Yodzis 2001).

3. Age and reproductive status

Japan also claims that lethal research is needed to determine the sex and reproductive condition of whales. Indeed, even the IWC is rather out of date with regard to this aspect of non-lethal techniques. On its web site the following statement appears:

> *"Although there has been a great increase in the types of information that can be obtained from non-lethal research methods such as biopsy sampling and photo-identification, at present there are certain data that can only be obtained (at least in the short-term) using lethal methods. These include, for example, the age of an animal (obtained from earplugs) and the reproductive status and history of females (obtained from ovaries). Such information is important* inter alia *in any consideration of biological parameters (e.g. mortality and reproductive rates) and interpretation of pollutant levels. The question then becomes one of whether the answers one obtains using such data are 'essential', 'reliable enough' or 'critical'?"*[15]

The reproductive status of females can now be readily obtained from hormone analysis of skin/blubber biopsies as well as from fecal steroid sampling, and this technique has been used to detect pregnancy and sexual maturity in a variety of species including humpback and right whales (Rolland *et al.* 2003, Robbins *et al.* 2004).

In addition, a promising new molecular technique for age determination from cetacean biopsy samples is currently under development, based upon a correlation between the age of the animal and the length of the telomere (the end of a chromosome) (Nakagawa *et al.* 2004). Several labs are currently validating this method for use with cetaceans, including humpback whales (Palsbøll, in prep.) If, as expected, this technique provides acceptably precise estimates of age in large whales, it would contribute, through non-lethal sampling, biological data that are important in management.

[15] Ref: IWC website.

The sex of whales has been routinely determined for years from genetic analysis of biopsy samples (Palsbøll *et al.* 1992), and thus does not require lethal sampling.

Current scientific whaling operations: Iceland

Shortly after rejoining the IWC in 2002, Iceland announced it would begin a scientific whaling program based upon annual catches of 100 minke, 100 fin, and 50 sei whales. They later reduced the program to target minke whales only.

The primary objectives of the research program are described as: (i) a study of the role of cetaceans in the marine ecosystem in order to improve ecosystem-based management of fisheries in Icelandic waters; (ii) a study of population dynamics and the basic biology/ecology of the three whale species being taken, including changes in biological parameters since the cessation of whaling; and "potential mortality-induced effects of pollution, diseases and parasites"; and (iii) an assessment of the applicability of non-lethal research methods to the questions being addressed (IWC 2004).

When the proposal was reviewed by the Scientific Committee in 2003 (IWC 2004), some members maintained that the proposal addressed two research areas that have been identified by the Committee. One is the need for research on fisheries-cetaceans interactions, and some members believed that in this area the research would be useful. However, in this regard the same criticisms apply as are noted in the earlier section on Japanese proposals.

In addition, the basis of this section of the Icelandic and Japanese programs runs directly counter to the goals of the IWC: implicit in the proposals is the idea that whale populations should be managed to increase yield in other fisheries. Yet this is contradictory to the principle of conservative sustainable management that is the foundation of the IWC's RMP, a set of controls which was established precisely because, in the past, the unwillingness of whaling nations to make catches under such restrictions led to the collapse of many whale populations worldwide. Attempting to manage whales to minimize their perceived impact on commercial fisheries is in effect management by culling, which - even if one ignores the great oversimplification of ecosystem dynamics implicit in this approach, as noted previously - is the opposite of what the RMP was established to achieve. Irrespective of whether IWC eventually decides to switch to a multispecies, ecosystem-based management scheme, there appears to be little scientific basis for the claim that whales are having a significant impact on fisheries (see previous section), and many IWC scientists are skeptical that the scientific approaches currently adopted under special permit whaling are anything more than a superficial and uninformative treatment of complex ecosystem issues.

The other research area identified by the Committee as receiving some potential benefit from Iceland's program is the analysis of the effects of pollution on whale populations. While many scientists believe that the objectives of pollutant research can be satisfactorily addressed with standard biopsy sampling, Iceland and other proponents of scientific whaling maintain that sampling of internal organs is necessary because the relationship between contaminant loads in skin and organs has not yet been assessed.

With respect to the high priority given in Iceland's proposal to identification of differences in fin whale diet, the same non-lethal techniques apply as noted under the previous section on Japanese scientific whaling*; i.e.* stable isotope and fatty acid analysis of biopsy tissue which provides a long-term indication of diet and its variation over time.

Iceland's scientific whaling proposal also contends that lethal research is preferable to biopsy sampling in terms of sample size (Marine Research Institute 2003) - a frankly unrealistic notion given the tens of thousands of biopsies obtained from many species of cetaceans (small and large) to date. For example, the number of biopsies obtained from North Atlantic humpback whales alone currently numbers more than 6500 (Palsbøll *et al.* 1997, Clapham, unpublished data), and a research program of similar scale is currently underway in the North Pacific.

Conclusions

In attempting to draw conclusions from an admittedly brief review of an extremely complicated issue, we return to the questions originally asked as a basis for this document:

Does killing whales for research provide data critical to the management of whale populations?

At the time Article VIII was written, the study of whales was still in its infancy in spite of centuries of intensive global whaling. Most of what was known about the various species had indeed come from whaling data, including information on pregnancy rates, age at attainment of sexual maturity, age distribution, sex ratio and other basic biological parameters. Commercial whaling has, in that respect, certainly contributed to our current knowledge of whales. There may still be some information that requires lethal sampling, notably studies of pollutants in internal organs (which may or may not be a viable issue for non-lethal research). However, whether such information is critical enough to the management of whale populations to kill animals is questionable, given other concerns noted in this report regarding conflicts of interest and lack of review. Overall, there is no doubt that the study of whales has changed significantly since 1946, and in our view the current research programs must be designed based primarily upon new techniques and research needs.

Can the data from scientific whaling be obtained using other (non-lethal) methods?

Non-lethal techniques such as, inter alia, biopsy sampling, genetic research, and hormone analysis have brought whale conservation and biology well into the 21st Century. In many cases it appears that non-lethal techniques also provide greater sample sizes and more reliable data, and have the additional advantage of repeated sampling (and thus tracking) over many years – something which is obviously impossible when a whale is killed.

Is the current requirement to fully utilize the whales killed during scientific whaling operations an incentive to abuse the research privilege?

Of concern to WWF is whether the proponents of scientific whaling have chosen to ignore modern, scientifically proven non-lethal methods due to conflicts related to profit and politics. As noted elsewhere in the report, we are particularly concerned about the claim that whales are somehow responsible for the depleted status of global fish stocks, and must therefore be culled in order to allow greater harvesting by humans when there is absolutely no objective data to support this claim. Its growing use as a basis for special permit whaling, together with the consistent criticisms relating to poor study design, raise serious questions about these proposals.

If scientific whaling is to continue, should it be subject to tighter IWC controls?

In our view, the practice of scientific whaling has not kept pace with the most recent technological advances or current conservation needs. It is clear that the practice of special permit whaling under Article VIII of the ICRW is long overdue for a general review by the Contracting Governments. The discussion surrounding the scientific necessity and general review of special whaling permits is at a critical juncture. WWF believes the Contracting Governments of the IWC are obligated to consider how best to align IWC-related research with the most modern accepted scientific techniques to maintain the IWC's credibility on this issue, and to further the current discussions on the RMS and its relationship to scientific whaling.

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Table 1

Total Whales Killed in Whaling Operations Since the IWC Whaling Moratorium Went into Effect

NP=North Pacific; SH=Southern Hemisphere; NA=North Atlantic
OBJ=objection to moratorium; SP=scientific permit

WHALING SEASON*	Country	Species	Category	NUMBER KILLED
1985/86	Japan	SH minke	OBJ	1941
	USSR	SH minke	OBJ	3028
1985/86 Total				**4969**
1986/87	Japan	NP minke	OBJ	311
	Japan	NP Brydes	OBJ	317
	Japan	NP sperm	OBJ	200
	Japan	SH minke	OBJ	1941
	Korea	NP minke	SP	69
	USSR	SH minke	OBJ	3028
	Norway	NA minke	OBJ	379
	Iceland	NA fin	SP	76
	Iceland	NA sei	SP	40
1986/87 Total				**6361**
1987/88	Japan	NP minke	OBJ	304
	Japan	NP Brydes	OBJ	317
	Japan	NP sperm	OBJ	188
	Japan	SH minke	SP	273
	Norway	NA minke	OBJ	373
	Iceland	NA fin	SP	80
	Iceland	NA sei	SP	20
1987/88 Total				**1555**
1989/90	Japan	SH minke	SP	330
	Norway	NA sei	SP	17
	Iceland	NA fin	SP	68
1989/90 Total				**415**

WHALING SEASON	Country	Species	Category	NUMBER KILLED
1990/91	Japan	SH minke	SP	327
	Norway	NA minke	SP	5
1990/91 Total				**332**
1991/92	Japan	SH minke	SP	288
	Norway	NA minke	SP	1
1991/92 Total				**289**
1992/93	Japan	SH minke	SP	330
	Norway	NA minke	SP	95
1992/93 Total				**425**
1993/94	Japan	SH minke	SP	330
	Norway	NA minke	OBJ	226
1993/94 Total				**556**
1994/95	Japan	NP minke	SP	21
	Japan	SH minke	SP	330
	Norway	NA minke	OBJ	280
1994/95 Total				**631**
1995/96	Japan	NP minke	SP	100
	Japan	SH minke	SP	440
	Norway	NA minke	OBJ	218
1995/96 Total				**758**
1996/97	Japan	NP minke	SP	77
	Japan	SH minke	SP	440
	Norway	NA minke	OBJ	388
1996/97 Total				**905**

WHALING SEASON	Country	Species	Category	NUMBER KILLED
1997/98	Japan	NP minke	SP	100
	Japan	SH minke	SP	438
	Norway	NA minke	OBJ	503
1997/98 Total				**1041**
1998/99	Japan	NP minke	SP	100
	Japan	NP Brydes	SP	1
	Japan	SH minke	SP	389
	Norway	NA minke	OBJ	625
1998/99 Total				**1115**
1999/2000	Japan	NP minke	SP	100
	Japan	SH minke	SP	439
	Norway	NA minke	OBJ	591
1999/2000 Total				**1130**
2000/2001	Japan	NP minke	SP	40
	Japan	NP Brydes	SP	43
	Japan	NP sperm	SP	5
	Japan	SH minke	SP	440
	Norway	NA minke	OBJ	487
2000/2001 Total				**1015**
2001/02	Japan	NP minke	SP	100
	Japan	NP Brydes	SP	50
	Japan	NP sperm	SP	8
	Japan	NP sei	SP	1
	Japan	SH minke	SP	440
	Norway	NA minke	OBJ	552
2001/02 Total				**1151**

WHALING SEASON	Country	Species	Category	NUMBER KILLED
2002/03	Japan	NP minke	SP	150
	Japan	NP Brydes	SP	50
	Japan	NP sperm	SP	5
	Japan	NP sei	SP	39
	Japan	SH minke	SP	440
	Norway	NA minke	OBJ	634
2002/03 Total				**1318**

Total whales killed since the moratorium went into effect: 24,314

* Southern hemisphere pelagic (high seas) catches are taken in the southern hemisphere summer, and reported in the following calendar year, while coastal catches are reported in the calendar year in which they are taken. For example, 1986 catches include the southern hemisphere whaling season of 1985/86 + coastal catches during 1986.

Appendix 1

Ethics of scientific whaling: issues and alternatives

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Abstract

We summarise recent criticism of scientific whaling programmes, which are currently operated by the governments of Japan and Iceland. First, the commercial sale of products from scientific whaling creates a conflict of interest potentially biasing management advice provided by the member nation and its contracted scientific institute. Second, continued commercial sale of products from this programme acts as a cover for illegal or unregulated exploitation of other species, at least in Japan. Third, the primary scientific objectives of the programme are not required for the effective management of whaling under the International Whaling Commission's (IWC) Revised Management Procedure (RMP). Fourth, the overall quality of research in these programmes is poor, and this is reflected in the low number of resulting scientific publications in international peer-reviewed journals. We assess the scientific justification for the lethal research, as reviewed by the Scientific Committee of the IWC, and describe how the stated objectives of the programmes would be more efficiently accomplished through use of well-established non-lethal methods. Finally, none of the scientific whaling programmes have ever been subject to review for ethical animal experimentation protocols.

Introduction

In belated recognition of the global over-exploitation of whale populations, the International Whaling Commission (IWC) voted in 1982 to impose an indefinite moratorium on commercial hunting. Although the Moratorium has been in effect since 1986, whaling never ended. Some member nations continue to hunt whales for aboriginal and subsistence use, or for the ostensible purpose of scientific research under Article VIII of the International Convention for the Regulation of Whaling (ICRW or the Convention), the treaty that established the IWC. Article VIII is the provision governing the issuance of special permits and its intent is summarised in Paragraph 1:

> "Notwithstanding anything contained in this Convention any Contracting Government may grant to any of its nationals a special permit authorizing that national to kill, take and treat whales for

purposes of scientific research subject to such restrictions as to number and subject to such other conditions as the Contracting Government thinks fit, and the killing, taking, and treating of whales in accordance with the provisions of this Article shall be exempt from the operation of this Convention."

The extent of scientific hunting is not trivial. At the time of the Moratorium, three nations issued special permits for scientific catches: Iceland, Norway and Japan (Table 1). Following considerable international pressure, Iceland abandoned its programme in 1989 and subsequently withdrew from the IWC. Norway continued its scientific programme until 1994 after which it implemented a commercial hunt under its original objection to the Moratorium[16]. Japan has been most persistent and expansive in its issuance of special permits for scientific whaling. As of the 55th meeting of the IWC (2003) the Japanese programme in the Antarctic (JARPA) had been ongoing for 16 years and had killed over 5,900 Antarctic minke whales (*Balaenoptera bonaerensis*). The Japanese programme in the North Pacific (JARPN) has been ongoing since 1994 and, as of the 55th meeting, had killed over 1,000 North Pacific minke whales (*Balaenoptera acutorstrata davidsoni*). In 2001, the North Pacific programme, under the new acronym JARPNII, was expanded to include Bryde's (*Balaenoptera edeni/brydei*), sei (*Balaenoptera borealis*), sperm whales (*Physeter macrocephalus*) and an increased number of minke whales. In 2002, Iceland rejoined the IWC and, in a controversial decision, was allowed to lodge an objection to the Moratorium. As with Norway, the registration of this objection would allow Iceland to resume a commercial hunt without violating the Convention. At the 55th meeting, however, Iceland presented a proposal for a renewed scientific hunt and, despite considerable opposition within the Scientific Committee, initiated this hunt in the northern summer of 2003. The original proposal called for catches of 100 common minke, 100 fin and 50 sei whales, although Iceland limited the 2003 take to 36 minke whales.

The growing size of the Japanese scientific hunt and the renewal of the Icelandic programme has re-ignited the debate about the validity of special permits and the role of the Scientific Committee in the review of these special permits (e.g., Aron et al. 2002, Clapham et al. 2003, Holt 2003, Mott 2003, Orian et al. 2003). Article VIII of the ICRW was crafted at a time when no viable alternatives existed to lethal sampling, and catches under scientific permit were used to study limited numbers of whales to inform the management of whale stocks. Now, there is increasing concern that current scientific whaling programmes are simply vehicles for continuing catches at commercial levels under the guise of scientific research (Normile 2000). The quality of this science and its "necessity" for the management of future hunting under the Revised Management Procedure (RMP, the method accepted in principle for setting future catch limits if the Moratorium is lifted) have also been challenged (e.g., Clapham et al. 2003). While the former concern is more an issue of policy within the Commission, the latter has important implications for the credibility of the IWC's Scientific Committee.

Here we review some of the controversial aspects of recent scientific whaling programmes, with the intention of evaluating the scientific validity and ethics of these programmes. Our perspective on the validity of these programmes is that of active members of the Scientific Committee. In this capacity, we have participated in reviews of proposals for scientific whaling submitted in the last 10 years, including JARPN, JARPNII and the 2003 Icelandic proposal, as well as in discussions of the formal reviews of the

[16] Under the rules of the Convention, a nation that lodges and maintains an objection to any resolution is not bound by the resolution. Many view the absence of compulsion in agreed resolutions to be out of step with most modern international agreements and a fundamental weakness of the ICRW (Gillespie, 2000).

outcomes of the programmes, including JARPA and JARPN. In regards to the ethics of scientific whaling, our perspective is that of biologists who have operated under permits for scientific research and whose work has been subject to review by institutional animal ethics committees. We do not intend to review the larger question of the ethics of commercial (or aboriginal/subsistence) whaling or the fundamental philosophical basis of science and ethics. For these, we refer the reader to the more comprehensive review by Gillespie (2000).. We have also excluded, except where it is directly related to animal experimentation protocols, the issue of humane killing of whales. Within the IWC, this issue is outside the purview of the Scientific Committee and is considered annually by a technical committee established by the Commission (e.g., page 10, IWC, 2002).

Table 1

Scientific whaling programmes active since the International Whaling Commission's 1986 moratorium on commercial whaling.

Nations	Dates of programme	Species and numbers taken
Iceland	1986–89	Total of 362 fin and sei whales
Iceland	2003	Up to 100 minke, 100 fin and 50 sei whales/year; 36 minkes taken in 2003
Norway	1987–94 (now a commercial hunt)	Approximately 400 North Atlantic minke whales/year
JARPA	1988–present	Approximately 400–500 Antarctic minke whales/year
JARPN	1994–99	Approximately 100 North Pacific minke whales/year
JARPNII	2000–present	Up to 150 minke, 50 Bryde's, 50 sei and 10 sperm whales

Scientific whaling, commercial trade and conflict of interest

There is controversy, but no ambiguity, regarding the commercial sale of products from scientific whaling. The directive for disposition of products is specified in Paragraph 2 of Article VIII of the ICRW:

> *"Any whales taken under these special permits shall so far as practicable be processed and the proceeds shall be dealt with in accordance with directions issued by the Government by which the permit was granted".*

As with Paragraph 1, this directive allows considerable latitude for interpretation by the issuing Government. Japan, Norway and Iceland consider Paragraph 2 to be a mandate for commercial sale of products from scientific whaling. Japan uses the considerable profits from their hunt to support a non-governmental research institute. The Institute for Cetacean Research (ICR), with 35 scientists and support staff, has an operating budget of US$73 million (approximately NZ$126 million). It recoups about US$38 million from selling products from the whales killed in the JARPA and JARPNII programmes. The

government provides the balance of funding (Normile 2000). The ICR maintains close ties to industry; indeed, its research vessels and crews were all previously engaged in commercial whaling. Although technically a non-governmental institution, the ICR maintains close ties with the Ministry of Fisheries; furthermore, the Institute's staff scientists, including its director Dr. Seiji Ohsumi, act as delegates for the Government of Japan on the IWC Scientific Committee.

The financial incentives of scientific whaling and the participation of staff scientists from the funded institute in the scientific advice given for management within the IWC SC creates the potential for considerable conflict of interest. This can undermine the credibility of advocates of the scientific whaling programme. The potential for such a conflict of interest is recognised in comparable international oceanic convention such as the Convention on Fishing and Conservation of Living Resources in the Baltic Sea and the Belts and the North Atlantic Fisheries Organisation (Gillespie, 2000). Although both have exceptions allowing takes for scientific research, the sale of products derived from such catches is prohibited.

Scientific whaling as a cover for illegal or unregulated takes

In addition to the direct conflict of interest created by the commercial sale of scientific whaling products, there are important indirect consequences of this activity, at least for the Japanese markets. In particular, the sale of products from this programme acts as a de facto cover for undocumented or illegal products from protected whales (Baker & Palumbi 1994). Surveys of Japanese markets using molecular genetic methods have identified eight species of baleen whales, as well as sperm whales, beaked whales, killer whales (*Orcinus orca*), dolphins, porpoises, domestic sheep, and horses, among nearly 700 "whale" products purchased from 1993 to 1999 (Baker et al. 1996, Baker et al. 2000b, Baker et al. 2002). The diversity of baleen whale species found in available market products directly contradicts the expectation that scientific hunting of Antarctic and common minke whales represents the only source of such products since the 1986 global whaling moratorium (products from the scientific hunting of Bryde's, sei and sperm whales were released to the market subsequently). While many of these products originate from whales incidentally entrapped in fishing gear (i.e., bycatch), there is mounting evidence that much of this "entanglement" is directed.

Six of the baleen whale species found in Japanese markets (the fin, sei, Bryde's, blue/fin hybrid, gray, and humpback) and the sperm whale are protected by various international agreements dating from 1935 to 1989. These include fin whale (*B. physalus*), sei whale, gray whale (*Eschrichtius robustus*) and humpback whale (*Megaptera novaeangliae*), as well as a hybrid between a fin and blue whale (*B. musculus*). Overall, these protected species accounted for about 10% of whale products from the Japanese markets (excluding products from small cetaceans). The documented sale of products from gray and humpback whales, protected since 1937 and 1966, respectively, is particularly disturbing. The Asian gray whale (also known as the western gray whale) stock is considered one of the most critically endangered populations of whales in the world today, with perhaps 100 individuals remaining extant. Despite this, western gray whale meat is being sold under cover of products from scientific whaling. Similarly, the Asian population of the humpback whale lags well behind other populations in its recovery from past whaling, perhaps partly as a consequence of this hidden exploitation.

Scientific hunting of an abundant population can also act as a cover for the continued exploitation of a protected or endangered population of the same species. Using population-level molecular markers, we estimate that up to 43% of market products from North Pacific minke whales do not originate from the

reported scientific hunt in pelagic waters but rather from the illegal and unregulated exploitation of a protected population in the Sea of Japan (the "J" stock, Baker et al. 2000a; Dalebout et al. 2002). At the observed rate of exploitation, the genetically distinct Sea of Japan population is predicted to decline towards extinction over the next few decades (Baker et al. 2000a).

Basis for scientific whaling programmes, and relevance to management

As Article VIII clearly states, an IWC member country can issue a special permit to itself or its operators as it thinks fit. Proposed permits must be submitted for review by the Scientific Committee following Guidelines issued by the Commission. However, delegates of the whaling nations concerned fully participate in these reviews (and in the compilation of the resulting reports), and governments are ultimately not bound by any recommendations arising from this procedure. Furthermore, the Scientific Committee attempts to operate by consensus. Given that membership can exceed 150 delegates, of whom nearly 30 represent the Government of Japan or the Institute of Cetacean Research (the beneficiary of sales from scientific whaling), these reviews have never achieved consensus. The resulting ambiguity in the published reports of the Scientific Committee is frequently exploited, often out of context, by those seeking to support or defend scientific whaling programs (e.g., Aron et al. 2003).

The Scientific Committee's review concentrates on the following criteria:

1) *whether the permit adequately specifies its aims, methodology and the samples to be taken;*
2) *whether the research is essential for rational management, the work of the Scientific Committee or other critically important research needs;*
3) *whether the methodology and sample size are likely to provide reliable answers to the questions being asked;*
4) *whether the questions can be answered using non-lethal research methods;*
5) *whether the catches will have an adverse effect on the stock;*
6) *whether there is the potential for scientists from other nations to join the research programme.*
(see http://www.iwcoffice.org/sciperms.htm#Guidelines)

Of these, recent debate about proposals and reviews of scientific whaling has centered on Questions 2 and 4: is the research essential for the purposes of the agreed RMP; and could comparable, or superior, information be collected by non-lethal methods? From our own experience and recent comments in publication (Clapham et al. 2003), the majority of the members of the Convention believe that scientific whaling is not essential for the purposes of management under the RMP. As it stands, at best, the conclusion for scientific whaling is that it may produce *"useful"* results with limited application to management (Gillespie, 2000). We discuss these two issues in more detail below.

The scientific whaling programmes of both Japan (JARPNII) and Iceland are described as attempts to better understand the ecosystem role played by large whales in order to further multi-species management in the regions concerned. Implicit in this contention is the principle that whales must be managed because of their potential impact on commercial fisheries. The proposals for these respective programmes also contend that they provide information essential to the management of whales by the IWC.
However, a key point is that management of whales by the IWC is not conducted on an ecosystem basis, but rather according to a system (the RMP), which calculates catch limits in a conservative manner relative to population levels. The RMP does not take into account the role of whales in the ecosystem, nor

was it developed to manage other (non-whale) species. Information required by the RMP is limited to whale abundance estimates over time, information on past (and/or present) catches, and supporting data on other aspects of the population (in particular its genetic structure and migratory boundaries). Accordingly, any other information is not relevant to the way in which IWC manages whale populations. Furthermore, killing whales to minimise their impact on commercial fisheries is, in effect, management by culling. This is the opposite of the conservative philosophy of sustainability embodied in the design of the RMP. Such an approach also reflects an oversimplified view of ecosystem dynamics and ignores the inability of current ecosystem models to serve as reliable predictors in a management context. Finally, it misdirects attention (intentionally, many believe) from over-fishing as the primary cause of declining fish stocks worldwide.

If scientific whaling is not necessary for the RMP, does it at least provide high-quality science *useful* for other purposes? This does not seem to be the case. The publication record of the Japanese scientific whaling programme is remarkably poor considering the 16-year effort and the killing of over 5,900 whales. Although JARPA claims, in a list posted on the ICR website, to have generated more than 150 "publications", the list includes only a single paper (Kishino et al. 1991) that concerns IWC assessment needs and that is published in an international peer-reviewed journal; 19 similar Japanese papers were published by IWC. The remaining 137 "publications" consist of: cruise or progress reports (7), unpublished IWC papers (58), Scientific Committee meeting reports (14), Japanese theses (6), conference presentations (40, many of which repeat the same un-refereed and irrelevant results in multiple forums), and peer-reviewed articles (12) on topics of no value to management. Although Iceland has only recently resumed scientific catches and thus has had insufficient time to publish results from this work, major results from previous scientific and commercial takes (including data on 1609 fin and 247 sei whales) remain unpublished 14 years later.

Non-lethal alternatives to scientific whaling

With no significant exceptions, information required for management of whales by IWC can be achieved far more efficiently and cheaply—and at no cost to the whale—through established non-lethal methods. We briefly review some of these methods below. The most important non-lethal techniques currently in use are photo-identification and genetics. Photo-identification relied on the photographic documentation of natural markings, usually along the dorsal fin or flukes of a whale or dolphin. This method has been widely applied to numerous species over the last three decades and has provided accurate estimates of many life history parameters (e.g., Hammond et al. 1990). Some of these could never be measured by lethal methods (e.g., calf mortality, Gabriele et al. 2001).

More recently, genetic analysis of small skin samples has been widely used to understand population structure in many mammals, including whales (Baker & Palumbi 1995). These analyses include examining the genetic differences between whales in different areas (to assess where the boundaries of populations might be) as well as identifying individual whales and tracking their movements from place to place. The population structure issue is essential to management; it is vital when attempting to manage populations that the IWC knows how many populations there are in the area(s) concerned, and whether those populations mix or are separate. Failure to understand this can result in major management mistakes. For example, in the past whaling frequently set high catch quotas for large areas on the assumption that all of the whales in one area were part of the same population when in fact they were often divided into two

or more smaller groups. As a result, some populations were wiped out and the areas have still not been repopulated over periods ranging from years to centuries (Clapham & Hatch in review).

Samples for genetic analyses (and some other non-lethal methods) are routinely acquired from skin biopsies. Because modern techniques such as the Polymerase Chain Reaction (PCR) make unlimited copies of DNA sequences, these very small samples typically provide enough DNA for thousands of experiments. It is a very efficient technique, and one that has been used by scientists all over the world to obtain samples from tens of thousands of whales, dolphins and other animals. Since biopsies can be taken quickly and easily, scientists can gather hundreds or thousands of samples from a population of whales with no harm to the animals. Such large samples sizes provide considerable confidence in estimation of population structure and other parameters. Killing whales for this work is not only unnecessary, it is far less efficient as lethal sampling cannot acquire this many samples without depleting the populations under study. Thus, analyses based upon lethal sampling are inevitably compromised by a lack of statistical power.

One example of the value of the biopsy-based genetic technique and photo-identification comes from the North Atlantic, where an international collaboration (which included Iceland) obtained more than 3,000 biopsy samples and photographs from humpback whales over this entire ocean basin (sampling from the Caribbean to the Arctic in 1992 and 1993; Palsbøll et al. 1997, Smith et al. 1999). That project (known as Years of the North Atlantic Humpback, YONAH) provided a wealth of information on this species; it essentially resolved most of the long-standing questions about population structure in North Atlantic humpback whales, and was in fact the basis for a recent IWC assessment of that population. YONAH demonstrated the central role played by genetics and non-lethal sampling in reliably addressing exactly the kinds of management questions posed by IWC about whale populations.

As with photo-identification, it is now routine to identify individual whales by genotyping. Thus, if a whale is biopsied in more than one location, it can be tracked over considerable distances. In the YONAH project mentioned above, hundreds of whales were sampled twice or more, and some of these were tracked over thousand of miles. By tracking the movements and migrations of whales in this manner, additional information can be obtained about the structure and boundaries of the populations to be managed. Individual identification by genetics can also be used to estimate abundance, and this technique has been used for North Atlantic humpback whales and some other species (Palsbøll et al. 1997).

By definition, lethal sampling cannot be repeated on the same individual, so tracking of movements or estimating abundance in the manner of photo-identification and genotyping is impossible. A whale is "sampled" (killed) once only, whereas with biopsy sampling an animal can be genetically "captured" many times over many years, giving new information every time. Genetics can also provide detailed information on other scientific issues, including kinship and parentage in the population (e.g., maternity and paternity analyses), how much genetic variation exists, and the sex of each sampled individual.

Other non-lethal methods

Iceland and Japan both claim that they require lethal sampling to determine whale diet by examining stomach contents. An alternative, and potentially more accurate view of individual prey consumption is available through DNA-based analysis of faeces collected in the wake of feeding whales (Jarman et al.

2002). The combined use of photo-identification and DNA-based faeces analysis could provide information on changes in the diet of an individual across a feeding season and even across years of observation. By comparison, the stomach content of a carcass provides only a snapshot of recently consumed prey and is often a misleading indicator of the whale's overall diet. This is particularly true in species such as the minke whale, which have a large variation in prey species in both space and time.

A long-term signal of diet and its variation in time is also possible by stable isotope analysis of tissue from skin biopsies or other tissues. Furthermore, because the isotopic signatures of prey often differ from area to area, the technique can sometimes be used to track the migratory movements of animals (e.g., bowhead whales, *Balaena mysticetus*, Schell et al. 1989). A similar technique to stable isotopes involves analysis of fatty acids in biopsied tissue; this also provides valuable information about the diet of individual whales.

Iceland and Japan assert that the only way to obtain information on the sex and reproductive condition of whales is to kill them and examine them internally, yet this is not the case. The sex of a whale is now easily and routinely determined from genetic analysis of a biopsy sample. Also, techniques have recently been developed to detect pregnancy in female whales using the small quantity of tissue obtained in a biopsy sample. This technique has recently been successfully employed on the humpback whale population off the eastern coast of the U.S. (J. Robbins, unpubl. data), and it will likely be in wide use in a few years.

A final non-lethal method with demonstrated potential to provide information on the movements of animals is radio tracking. Satellite tags have been attached to many large whales and have allowed scientists to monitor remotely the daily movements of individuals as their positions are "reported" by the tags to a satellite. With several species (including humpback, blue, fin and right whales) tagged whales have been tracked on migration over thousands of miles (e.g., Mate et al. 1997). Again, this has obvious value to assessments of the structure and boundaries of populations, and is something that can never be obtained from lethally sampled whales.

Ethical science alternatives

At the 1997 meeting of the IWC, then-Commissioner for New Zealand, the Honourable Jim McLay, raised the ethical quandary of scientific whaling and questioned the adequacy of the Scientific Committee to address this quandary:

> *Science is the province of the Scientific Committee, but there are occasions when it is proper for this body [the Commission] to give guidance on the Committee's scope. That is particularly true where a scientific research programme raises moral and ethical issues. And ethical issues are inevitably raised when a research programme results in nearly 3,000 animals being killed over eight years, with the prospect of another eight years to come... We need more than just a scientific direction here... we also need a moral compass.*[17]

[17] Intervention by the IWC Commissioner For New Zealand, the Honourable Jim McLay on the Japanese Programme of Scientific Research Whaling. 1997. Monaco (Gillespie, 2000). See also McLay, J. (1998). 'Whale Research Needs Moral Compass.' New Zealand Herald. March 23.

The programme referred to here by McLay was JARPA, following a review of the programme's first 8 years. Another 8 years have transpired and nearly 3,000 more whales have been killed without the ethical guidance called for by Commissioner McLay. While acknowledging the need for guidance from the Commission, we disagree that the Scientific Committee cannot help navigate a direction on ethical issues. Scientists in modern society do not act in an ethical vacuum. As the presentations of this ANZCCART 2003 conference demonstrate, scientists routinely face ethical questions about animal experimentation and must justify the harm of such experiments with the benefits of the result.

Scientists such as ourselves look to two sources for guidance in the ethics of animal experimentation: domestic animal experimentation legislation and scientific peer review. Most developed countries, including Japan, have domestic legislation prescribing treatment and conditions of animal experimental. Japanese legislation includes principles for both general and experimental animal welfare.[18]

> ***Law Concerning the Protection and Control of Animals***
> *(Law No. 105, October 1, 1973)*
> Article 1. *The purpose of this Law is to prescribe matters relating to the prevention of cruelty to animals, the appropriate treatment of animals and other matters relating to the protection of animals, and to engender a feeling of love for animals among the people, thereby contributing to the development of respect for life and sentiments of amity and peace;*
>
> ***Standards relating to the care and management etc. of experimental animals***
> *(Notification No.6, March 27,1980 of the Prime Minister's Office)*
> ***I. General Principles***
> Persons in charge, etc. should understand the physiology, ecology and habits etc of experimental animals and should care for them with affection, and ensure that they be used for scientific purposes;
> ***II. Definitions***
> *In these standards, the meanings of the terms listed below shall conform to the following definitions:*
> *(1) "Experimental animal" means a mammal or bird reared or kept at a facility (including an animal being transported to a facility) for use in experiments, etc.*
> *(2) "Experiment, etc." means use of an animal for educational purpose, experimental research or manufacture of biotics or other scientific applications*

As with some other animal experimentation legislation, however, the definition of *"Experimental Animals"* or *"Experimental Manipulation"* is ambiguous in regards to scientific whaling or hunting. The ANZCCART *Code of Practice for the Use of Veterinary and Human Medicines in Research, Testing and Teaching Organisations*, for example, specifically exempts the following from its definition of "manipulation":

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Section 4 Definitions (Manipulation)

The term defined by subsection (1) does not include-

(c) The killing of an animal in order to undertake research, testing, or teaching on the dead animal or on prenatal or developmental tissue of the animal if the animal is killed in such a manner that the animal does not suffer unreasonable or unnecessary pain or distress; or

(d) The hunting or killing of any animal in a wild state by a method that is not an experimental method.

(see http://www.rsnz.govt.nz/advisory/anzccart/code.php)

Thus, scientific whaling or hunting could fall through a rather large gap in experimental animal legislation or guidelines. In our view, however, the key term in these acts is "experimental". Scientific whaling is undertaken with an "experimental design", although arguably a poor one, while other forms of hunting and fishing are not. By claiming a scientific or experimental design (and exemption), scientific whaling programmes should become subject to the same judgement used for other animal experimentation.

If it were accepted that scientific whaling was necessary and that alternative non-lethal methods were not viable (neither of which has been established for recent scientific whaling programmes), the common guideline for ethical animal experimentation would be to reduce the level of harm to animals. The core of this approach, which has been commonly employed since 1959, is the "Three Rs"—*Reduce, Refine and Replace*. The "Three Rs" has been incorporated into legislation all over the world (Gillespie, 2000). Although this approach has not been mandated under international law, many international bodies have adopted these principles. To our knowledge, scientific whaling programmes have not been subject to review for ethical animal experimentation protocol, and the Three Rs have certainly never been applied during IWC Scientific Committee reviews.

It is also unlikely that Governments, having made a policy decision to issue themselves scientific permits, will undertake independent ethical reviews. However, a final source of leverage is available to individual scientists and scientific societies—peer review. A number of scientific journals have a policy requiring ethical animal experimentation protocols. In a recent survey, L. Sadler of the Royal Society for Prevention of Cruelty to Animal (RSPCA) contacted 37 scientific journals regarding this policy (L. Sadler, pers. comm.). Most journals had a policy of ethical animal experimentation but the evidence required varied considerably from journal to journal. Some required only a statement that the authors had adhered to domestic or institutional guidelines. Others had more specific requirements, such as adhering to the guidelines of professional societies (e.g., the American Physiological Society). A few journals had their own committees for ethical review.

Ethical policy alternatives

Although we view scientists as capable of participation in ethical decisions involving their disciplines, we agree that this would be aided by guidance from the Commission. Such policy, however, comes with its own baggage as noted by the International Council for Science:

> *Science for policy is a hotly debated issue. Bodies like The Intergovernmental Panel on Climate Change (IPCC), the International Whaling Commission (IWC) have the difficult task of providing scientific assessments and outlining their policy implications. Critics often question the autonomy of these bodies in regard to the political process. The typical problems related to science for policy touch upon some of the traditional ethos of science.*

Appointment to these bodies may be influenced by political expediency and visibility, to the detriment of scientific expertise….The work agenda is typically set by the political agenda and this may compromise scientific quality. Are ethical virtues sacrificed for political influence?
(see http://www.unesco.org/science/wcs/background/ethics_power.htm)

With the renewed scientific whaling by Iceland, however, the majority of members of the Commission have been unequivocal in their opposition:

Resolution on Whaling under Special Permit (2003-2)
NOW THEREFORE THE COMMISSION
EXPRESSES *deep concern that the provision permitting special permit whaling enables countries to conduct whaling for commercial purposes despite the moratorium on commercial whaling;*
STATES *that the current and proposed Special Permit whaling operations represent an act contrary to the spirit of the moratorium on commercial whaling and to the will of the Commission;*
STATES *that Article VIII of the Convention is not intended to be exploited in order to provide whale meat for commercial purposes and shall not be so used;*
REAFFIRMS *that non-lethal techniques available today will usually provide better data at less cost to both animals and budget;*
URGES *any country conducting or considering the conduct of Special Permit whaling to terminate or not commence such activities and to limit scientific research to non-lethal methods only.*
(see http://www.iwcoffice.org/sciperms.htm#Guidelines)

Conclusions

Article VIII of the ICRW, allowing whaling for scientific research, was crafted at a time when no viable alternatives existed to lethal sampling. It was assumed that catches under scientific permit would be used to study limited numbers of whales to inform the management of whale stocks. Now, with the demonstrated power of non-lethal methods for describing whale population parameters, many consider that existing scientific whaling programmes are simply vehicles for sustaining a commercial market. The recent proposal for renewed scientific hunting by Iceland and the second phase of scientific hunting in the North Pacific by Japan (JARPNII) have abandoned even the pretence of research for the purposes of whale management. Instead, these programmes are directed at establishing a spurious link between whales and declining fisheries.

The perpetuation of commercial whaling, and the more recent promotion of whale "culling", under the guise of science, has created deep divisions within the IWC. Past debate has centred primarily on the question of the necessity of scientific whaling for the purposes of the RMP. At best, it can be said that past scientific whaling programmes have produced "useful" information, although very little of these data cannot be better obtained by non-lethal methods. The ethical quandary of scientific whaling has been broached by the Commission but has not been taken up the Scientific Committee. In our own experience, the Scientific Committee has been reluctant to even consider the ethics of scientific whaling, despite clear

precedence in other international fora. The issue, however, is not intractable for scientists. Domestic legislation, international convention and the standards of peer-reviewed journals provide guidance in judging the relative benefits to science verses harm to animals. Although there may be little hope of changing the policy of nations issuing themselves permits for scientific whaling, the integrity of the IWC Scientific Committee would benefit from a more explicit debate on the ethics of animal experimentation.

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Appendix 2

Concerns Regarding Scientific Permits

A. Read, C.S. Baker, P. Berggren, F. Borsani, R. Brownell, S. Childerhouse, P. Clapham, C. Clark, C. Fortuna, M. Fossi, N. Gales, K. Groch, M. Iniguez, L. Kell, K-H. Kock, M. Krahn, G. Lauriano, R. Leaper, T. Lyrholm, S. Manzanilla, K. Martien, H. Oosthuizen, J. Palazzo, C. Parsons, W. Perrin, C. Perry, R. Pinto de Lima, P. Reijnders, S. Reilly, V. Ridoux, E. Rogan, L. Rojas, L. Sadler, D. Senn, M. Simmonds, M. Stachowitsch, B. Taylor, D. Thiele, P. Wade and B. Wilson

In its report to the Scientific Committee (SC), the IWC's Working Group on Scientific Permits (SP) noted the inadequate time allotted for discussion of scientific permit proposals. In light of this situation, we wish to register serious concerns regarding the Icelandic scientific whaling proposal, and scientific permits in general.

The Icelandic government has submitted to SC a proposal for a two-year study involving lethal takes of fin, sei and minke whales. This programme is characterized as a "feasibility study" despite the existence of substantial data from a very similar study conducted during the last period of Icelandic scientific whaling in the 1980's. By labelling the programme as a feasibility study, the proponents have effectively exempted themselves from the level of scrutiny required of a true research programme. As was the case with a similar "feasibility study" (JARPN) proposed by the Government of Japan, it is our contention that the Icelandic proposal would not meet the scientific standards required by any major international research agency.

Criticism voiced during the SC's review clearly indicate that the proposal is deficient in almost every respect. The proponents have failed to provide adequate justification for the proposed sample sizes, and have offered no performance criteria for how the work's "feasibility" will subsequently be determined. As noted in the SP report, the proponents were repeatedly asked to provide, for any aspect of the study, an example of results that would cause them to conclude that the proposed research was *not* feasible; they did not do so.

Despite the proposal's strong emphasis on multi-species management, the sampling scheme is not designed to obtain the data required for the ecosystem modeling underlying this approach. Furthermore, the recent IWC modelling workshop on cetacean-fishery interactions concluded that current ecosystem models are not sufficiently developed to provide reliable management advice in any context.

With regard to the effects of the proposed sampling on stocks of the three species, there has been no recent assessment of fin and minke whales in Icelandic waters, and no agreement by the SC on management advice. There has never been an assessment of sei whales, and considerable concern was noted during the SP review with regard to the status of this population, and the deficient manner in which the impacts of the proposed catches were assessed by the Icelandic proposal.

We reiterate that the major objectives of the Icelandic proposal are either not relevant to the management of whales under the Revised Management Procedure (RMP), or that the subset of information which *is* relevant to these management procedures can be - and routinely are - obtained with far greater efficiency by well-established non-lethal methods. Population structure (required for restricting the set of plausible hypotheses used in Implementation Simulation Trials) is now widely studied through genetic analysis of skin biopsies; thus the proposed lethal sampling is entirely unnecessary, and - unlike a large-scale biopsy program - will not yield sample sizes with the statistical power to provide a reliable picture of stock structure in the species concerned.

By linking the proposed work to "multi-species management", and through its repeated references to a need to manage cetaceans to benefit human fisheries, Iceland is in practice proposing a cull of whales, a concept that is in opposition to the conservative principle underlying the RMP. We find it particularly regrettable that the proponents chose to respond to this criticism by questioning whether the RMP is indeed "rational management". The RMP was developed by the SC, and is accepted by IWC as the basis for the management of whale stocks.

As members of the Scientific Committee, we are seriously concerned by what we see as the increasingly frequent abuse of Article VIII of the International Convention for the Regulation of Whaling by some member nations. This has important ramifications for the IWC and the work of the SC. Member governments that promote poorly conceived research whaling programmes place their scientists in the untenable position of having to defend these proposals in order to support the agendas of their governments. In turn, this causes unnecessary conflict between SC members (as has occurred at the last several SC meetings), damages the credibility of the SC as a whole, and undermines the agreed basis by which the IWC manages stocks of whales.

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