Canadian Technical Report of
Fisheries and Aquatic Sciences 2363

2001

THE CONSERVATION BASIS FOR THE REGULATION OF WHALE WATCHING IN CANADA BY THE DEPARTMENT OF FISHERIES AND OCEANS: A PRECAUTIONARY APPROACH.

by

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Submitted to the Department of Fisheries and Oceans, Ottawa
31 March 2000

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Cat. No. Fs 97-6/2363E ISSN 0706-6457

Correct Citation for this publication is:

Lien, J. 2001. The Conservation Basis for the Regulation of Whale Watching in Canada by the Department of Fisheries and Oceans: A Precautionary Approach. Can. Tech. Rep. Fish. Aquat. Sci. 2363: vi + 38 p.

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At present, available scientific literature on long-term, negative impacts of whale watching on the conservation of cetacean populations is lacking. Studies that show short-term disturbances of whales and dolphins during whale watching activities which disrupt or prevent animals completing essential life process are available in a number of species and many locations. In addition, a strong consensus of marine mammal scientists have the expert opinion that whale watching activities can disturb individuals and groups and that such disturbances, if repetitive and persistent over time, can produce harmful conservation impacts. Similarly, arguments based on knowledge of the general biology of cetaceans which make them vulnerable to human presence, and studies which show the affects of human presence on wild terrestrial mammals, provide reason for concern about the conservation impact of such disturbances on cetaceans.

The impacts of short-term disturbances may be exacerbated by the fact that some groups of whales are already endangered, threatened or vulnerable because of past exploitation or present changes in ocean conditions. Because of this vulnerability, as whale watching concentrates in areas of critical habitat required for specific activities, and because whale watching is competitive and vessel operators seek to make the experience more attractive by getting close to the animals or by pursuing them, whale watching alone, or because of cumulative effects, may entail conservation risks.

Generally what is clear at present is that when there are large numbers of vessels, when some approach too closely, move too quickly, operate too noisily, or pursue animals, performance of life-processes in wild cetaceans may be interrupted. When such activities become repetitive and persist in preventing completion of life processes they clearly become a conservation threat. Because of the growing popularity of whale watching with the Canadian public it is evident that this may be happening. It is therefore necessary to take a precautionary approach to the management of whale watching so that standards of operation do not permit activities that disturb whales and may become frequent, repetitive and persistent. A precautionary approach requires that whale watching activities do not develop faster than knowledge of their impact on the animals, and that it is done in a cautious manner which proactively avoids harm to individual animals and populations of whales and dolphins.

Key words: whale watching; precautionary management; wildlife viewing.

RÉSUMÉ

Lien, J. 2001. The Conservation Basis for the Regulation of Whale Watching in Canada by the Department of Fisheries and Oceans: A Precautionary Approach. Rapp. tech. can. sci. halieut. aquat. 2363: vi + 38 p.

À l'heure actuelle, peu d'ouvrages scientifiques traitent des incidences négatives à long terme de l'observation des baleines sur la conservation des populations de mammifères marins. Par contre, on compte un certain nombre d'études, pour de nombreuses espèces et divers endroits, sur les répercussions à court terme des activités d'observation sur les populations de baleines et de dauphins, qui révèlent que celles-ci ont comme effet de perturber les animaux ou de nuire à leurs comportements vitaux. De plus, les scientifiques qui étudient les mammifères marins s'entendent en général pour dire que les activités d'observation peuvent perturber les animaux, soit individuellement ou en groupe, et que si ces perturbations sont répétitives et soutenues, à la longue elles peuvent nuire à la conservation des espèces. Par ailleurs, selon des arguments fondés sur des connaissances générales de biologie voulant que les mammifères marins seraient vulnérables à la présence humaine et selon des études qui portent sur les effets de la présence humaine sur les animaux sauvages terrestres, il y aurait lieu de s'inquiéter des effets de telles perturbations sur la protection des mammifères marins.

L'incidence des perturbations à court terme peut être aggravée par le fait que certaines espèces de baleine sont déjà en voie de disparition, menacées ou vulnérables en raison des activités d'exploitation précédentes ou des changements actuels dans les conditions des océans. Étant donné que les baleines sont vulnérables à la présence humaine et qu'il y a une concentration d'activités d'observation dans les habitats critiques essentiels à des activités particulières, et étant donné que l'observation des baleines est une activité compétitive et que les capitaines cherchent à rendre l'expérience plus intéressante en s'approchant des animaux ou en les pourchassant, l'observation des baleines, à elle seule, ou en raison de ses effets cumulatifs, entraîne des risques de conservation.

Généralement, lorsqu'il y a un grand nombre de bateaux et lorsque ceux-ci s'approchent de trop près, se déplacent trop rapidement, font trop de bruit et pourchassent les animaux, il se peut que, chez les mammifères marins, certains comportements vitaux soient interrompus. Quand de telles activités deviennent répétitives et empêchent les mammifères d'accomplir des fonctions vitales, elles représentent véritablement une menace à la conservation, surtout que les Canadiens montrent de plus en plus d'engouement pour l'observation des baleines. Par conséquent, il s'avère nécessaire d'adopter une approche préventive à l'égard de la gestion des activités d'observation pour que les normes d'opération interdisent les activités qui dérangent les baleines et qui pourraient devenir fréquentes, répétitives et soutenues. Dans le cadre d'une telle approche, il faudrait s'assurer que l'industrie de l'observation des baleines progresse à la même vitesse que les études portant sur les effets de ces activités sur les animaux et que ces dernières soient entreprises avec précaution de manière à éviter d'importuner les baleines et les dauphins, soit individuellement ou en groupe.

Mots clés : observation de baleines; gestion préventive; observation d'animaux sauvages.

INTRODUCTION

The objective of establishing regulations for whale watching is to provide a basis for managing human activities that will, or are likely to, affect whale and dolphin populations that occur in Canada's waters. Section 7 of the Marine Mammal Regulations of the *Fisheries Act* requires that "No person shall disturb a marine mammal except when fishing for marine mammals under the authority of these regulations". One of the purposes of this regulation is to protect marine mammals to ensure their long-term conservation.

The goal of this paper is to provide information that shows that whale watching activities may disturb cetaceans in the performance of normal daily activities which are critical to their survival, and that such disturbances, if persistent and repetitive, could cause long-term conservation impacts.

CETACEAN VULNERABILITY

PREVIOUS EXPLOITATION/PRESENT STATUS

Canada has a diversity of whale species which have been the focus of interest for whale watchers, including humpbacks, fins, sperms blues, right, minke, gray, killer, long-finned pilot whales, belugas, and incidentally, several smaller species, such as white-sided dolphins, white-beaked dolphins, harbour porpoise and Dall's porpoise. Some populations of belugas and right whales are endangered due to past exploitation. Current activities or changes in the ocean habitat they require may threaten other species such as some populations of killer whales and belugas. Other populations, such as North Pacific humpbacks, fin whale and long-finned pilot whales, remain reduced in numbers although they have been protected from exploitation for years. Still other populations, such as the gray whale and the Northwest Atlantic humpback, are growing and abundant. Because of the various conditions of groups and populations there are significant differences in their vulnerability to additional human impacts such as whale watching. For some species the management objective is to minimize any possible whale watching threats to their recovery. Pending Species at Risk legislation in Canada may affect management of whale watching of some species. For others, the objective is to ensure that their populations are not harmed by the continuing development of whale watching activities.

RAPID ENVIRONMENTAL CHANGE

Cetaceans exist in an environment that is rapidly and dramatically changing (Norse 1993). Fisheries have had major impacts on biological processes, food webs and habitat in recent years. Fishing has depleted major finfish stocks such as capelin and herring and the fishing industry has devoted increasing effort down the food web (Pauley *et al.* 1998). Fisheries in Canada exploit major food sources for cetaceans. Increasing activities at sea, including offshore oil and gas, mineral extraction, transportation and recreation have expropriated or impacted major areas of productive habitat for cetaceans. There has been extensive physical alteration of large portions of Canada's coastal zone and major estuaries. Land-based and at sea introductions of a variety of chemicals and nutrients impacts many ocean species and, through primarily bioaccumulation, seriously impacts some of Canada's whale populations (Lien and Dunn 2000). More important perhaps than the extent of the changes is the very speed with which they have occurred. Canada's marine environment over the past several decades has been changed dramatically and new changes, such as the increase in human presence produced by whale watching activities, may act cumulatively with these changes.

SPECIFIC HABITAT REQUIREMENTS

A few cetacean populations, such as some killer whales and all belugas, reside more or less permanently in Canadian waters. Other species, such as gray, humpback, fin, blue and long-finned pilot whales exhibit long migrations and are present in Canadian waters only for specific portions of their life. All species found in Canada occur in concentrated areas of ocean habitat where they must complete specific activities in order to survive (Gaskin 1982). Examples of such concentrated areas are food rich locations like the head of the Laurentian Channel in Saguenay-St. Lawrence Marine Park area in Quebec (N. Menard, pers. comm.), areas of the Bay of Fundy, and the Witless Bay Ecological Reserve in Newfoundland which is less than 20 square km in area (L. Daley, pers. comm.). Specific habitat conditions which the animals require may include availability of food, lack of disturbance from predators or specific patterns of weather, currents, depth, temperature, or other factors. The animals are dependent on these areas in the performance of life processes including foraging and feeding,

resting, mating, and caring for calves or maintaining social groups.

CONCENTRATION OF WHALE WATCHING

Because whales are dependent on specific habitat areas which become well- known, whale watching activities typically become concentrated in these locations, enhancing the animals vulnerability to repeated disturbance and increasing the likely conservation consequences of any short-term disturbances. It is estimated that between 60-95% of boats engaged in commercial whale watching in Quebec use the Saguenay-St. Lawrence Marine Park area (N. Menard, pers. comm.) and well over half of all commercial whale watching in Newfoundland occurs in the Witless Bay Ecological Reserve. The present record for concentrations of whale watching activities occurred in Haro Strait when 107 commercial and recreational vessels were observed following the same small pod of southern resident killer whales (G. Ellis, pers. comm.). There are similar concentrations of whale watching effort in the Bay of Fundy. As vessel operators are often competitive, and typically attempt to increase the attractiveness of the viewing experience by getting close to the whales or pursuing them (Forestell and Kaufman 1994), frequent repetition of disturbances can become common.

Typical causes for extinction in terrestrial animals have been human presence that excludes animals from prime habitat and forces them into sub-optimal conditions. The concentration of whale watching and the operation of vessels conducting whale watching may well have the possibility of degrading habitat for cetaceans.

It is the conservation status of whale populations, the numerous and rapid changes in the ocean environment, and the animal's dependence on critical habitat which concentrates them and whale watching activities, that makes these wild animals particularly vulnerable to human presence. Within all species some individuals, or components of a population, are more vulnerable at certain times in their lives, such as while caring for young, resting, nursing or feeding.

THE GROWTH OF WHALE WATCHING IN CANADA

Whale watching is generally regarded as a non-consumptive activity. However we now know that non-consumptive human presence, such as visits to national parks (Parks Canada 2000), can substantially degrade habitat for wildlife and ecosystem integrity. The public's interest in whale watching has been increasing over the past two decades.

Whale watching has become the fastest growing wildlife-based industry in the world. In 1991 in the United States there were an estimated total of 3,430,225 whale watchers that spent $46.25 million U.S. dollars on the activity. By 1994 that had climbed to 4,074,195 whale watchers spending over $65.75 million U.S. dollars a year (Hoyt 1995). Numbers in Canada in 1991 were 185,200 whale watchers on commercial tours that paid $5.75 million U.S. dollars. In l994 the number had climbed to 462,000 spending $14.20 million U.S. dollars (Hoyt 1995). By 1998 Hoyt (2000) estimates that there were over one million whale watchers in Canada. Osborne *et al.* (1999) estimate direct revenues in Haro Strait alone at $12 million dollars in 1999.

Table 1 presents the number of commercial whale watch companies by province and the main species of cetacean which they target. Vessels used range from fast inflatables to 450 passenger ships and very fast 150 passenger catamarans. Modified fishing vessels and sailing ships are also used. In addition, there are thousands of recreational boaters who spend significant amounts of time engaged in whale watching. All whale watchers focus their activities in specific habitat areas where whales concentrate.

It is estimated from auto exit polls in 1997 that 44.5% of all visitors to Newfoundland from June through September participate in whale watching on boat tours. Whale watching tours in Newfoundland carry from 120,000 - 150,000 passengers per year and are the key to a growing marine ecotourism business (Lien 1999). In Quebec, over 300,000 visitors per year come to see whales in the Saguenay-Saint Lawrence Marine Park (Gilbert 1998). A single, isolated beluga whale in Nova Scotia was the subject of thousands of visitors per year (Frohoff and Kinsman undated). Recently DFO estimated that 200,000-300,000 commercial whale tours occur each year along the British Columbia coast (E. Lochbaum and G. Ellis, pers. comm.).

Commercial whale watching today has an economic value that rivals major fisheries. In 1998 it was estimated that a million people may have taken a whale watching excursion in Canada (Lien 1999). Costs of a trip range from $25-$80. Thus, direct revenue from whale watching may approximate $50,000,000. per year in Canada.

Whale watching stimulates additional tourism activities contributing economically to coastal communities and encouraging related industries. Duffus and Dearden (1993) estimated that whale watchers at Johnstone Strait spent $370-$400. per whale watching trip. But the total true value of whale watching is not adequately reflected in such figures (IFAW 1997).

Much of the impact of whale watching can be very local. In Churchill, Manitoba, for instance, there are two major tour boat operators that use several large vessels and many small ones for whale watching. It is estimated that approximately 2,500-2,700 whale watchers come during two summer months to participate in boat trips. That attraction helps to keep restaurants and hotels filled; the summer business is the basis for the entire years economy (Lien 1999). It is important to protect and encourage an industry like whale watching that makes such an important contribution to coastal economies. And there are additional social/economic benefits as well, including recreational, scientific and educational benefits (IFAW 1997; 1997 b).

Whale watching can be an important educational experience for people (Lien 1999). Whale watching provides the opportunity to become familiar with issues involving endangered and threatened species, to become aware of the ocean environment and animals that live there, and to learn about the whales themselves (IFAW 1997). People report that they learn about the whale's behaviour and biology. Many participants also report that whale watching is an emotional experience. In an early study 75% of whale watchers reported that "whale watching is one of the most fantastic wildlife experiences that I have ever had". Even more (86%) indicate that seeing whales in the wild greatly increased their support and commitment to the cause of whale conservation (Tilt 1986). In many areas whales become a symbol of a communities heritage, and of a communities relationship to nature (Lien 1999).

Although additional documentation of the educational and psychological benefits of whale watching should be done, it seems clear that exposure to wild whales through whale watching tours can have important benefits to the animals themselves in that people learn more about them, care more about them, and are willing to support programmes that help the animals. Of marine wildlife, whales and dolphins are the group of animals Canadians care about above all others (Lien 1999). It is likely that some of this concern was engendered during commercial whale watching tours and direct exposure to the animals. A caring, informed public that will support conservation management is a clear asset for the animals.

There are in some cases scientific benefits from whale watching. Some commercial whale watching operators have developed long-term monitoring programmes of whale populations. A good example is that of Leaper *et al.* (1997). Catalogues of identified individuals are developed and maintained by some operators. Others serve as platforms for a variety of research efforts. The science conducted by these operators is largely funded by the whale watchers themselves.

The management goal for the Department of Fisheries and Oceans is to ensure that socio-economic, scientific and educational benefits of whale watching are sustainable and conducted without disrupting the life processes of the animals.

PROTECTING LIFE PROCESSES

The intent of Section 7 of the Marine Mammal Regulations under the *Fisheries Act* is to prevent harm to the animals. When whale watching is included in these regulations they must ensure human activities do not prevent an animal from carrying out life processes. If an animal cannot carry out its life processes its own survival may be at risk. If disruption occurs to a particular segment, or to a significant number of individuals within a population, it follows that conservation may be at risk.

To survive a whale must rest, forage, feed, avoid predators, communicate and socialize with its group, mate and care for young. Disturbing animals engaged in such activities prevents the animal from carrying out life processes. Whale watching regulations are designed to limit and minimize activities by whale watching vessels that, in the short-term, interfere with these behaviours. Any one instance of such disruptions would not likely be too serious. If such disturbances were permissible, however, given concentrations of whales and whale watching and the growing popularity of this activity, they could well become frequent, repetitive and persistent. This could cause serious conservation risks for the animals. The likelihood of frequent and repetitive disturbances has been increasing rapidly over the past several years as popularity of whale watching grows with the general public and recreational boaters, and as the whale watching industry expands the number of vessels which operate and

develops in new areas (Lien 1999).

A PRECAUTIONARY APPROACH

The International Whaling Commission (I.W.C.) has recognized "the need for precautionary measures to ensure that the continuing development and expected expansion of whale watching activities does not adversely affect cetacean populations, individual animals, or their environment, or significantly increase the risk to the survival or ecological functioning of such populations" (IWC 1997; 1997 b). Section 30 of the *Oceans Act* requires Canada to move to an integrated management approach also based on sustainable development and the precautionary approach (DFO 1997).

The precautionary approach may shift the burden of proof (FAO 1995a, 1995b). In the past the burden of proof was to show environmental harm before corrective management was implemented. This approach has been shown to have considerable conservation risks (Norse 1993; FAO 1995a, 1995b). The precautionary approach requires that the exploitation of any resource does not proceed faster than knowledge about the impact of exploitation, and that it is done in a cautious manner which proactively avoids environmental harm. Thus research is required to show that a resource is not threatened by an activity if it is to proceed (FAO 1995 b).

The Scientific Committee of the I.W.C. has established principles for whale watching based on informed scientific opinion (Table 2).

EVIDENCE ON THE EFFECTS OF WHALE WATCHING

SCIENTIFIC STUDIES

Whale watching has developed relatively recently in Canada, and throughout the world (Hoyt 1995), and concern about its impact on the animals recognized even more recently. Existing scientific studies which examine how whale watching affects the animals are less sufficient than one would wish and typically examine short-term effects. Information in some of these studies indicates that vessel activities disrupt and prevent animals from conducting their normal activities (Findlay 1997). There are some difficulties in interpreting these results as most are observational studies and scale the presence or absence of whale watching, or the amount of vessel activity, but do not control other physiological and environmental variables or prior whale activity. Because cetaceans are difficult to study there is much that is not known about their 'normal' behaviour and what constitutes disturbed behaviour

Studies of long-term impacts of whale watching are not available to date and there is no evidence of significant long-term negative impact on individual cetaceans, groups or populations (IFAW 1995). The amount and quality of information will change over time as there are studies underway which will yield information on long-term effects. The I.W.C. is at present systematically gathering available evidence and organizing empirical long-term impact evaluations (IWC 1997; 1997 b).

Whales and dolphins are difficult to observe as most of their behaviour occurs underwater. Behaviour at the waters surface is only a sample of how the animals are reacting to a vessel or human presence. The behavioural disturbances typically reported as a consequence of human presence and activity include the following (GBRMPA 2000):

- changes in swimming speed or direction;
- changes in dive depths or duration;
- changes in breathing rates;
- cessation of particular activities such as vocalizing, feeding, resting, nursing, socializing;
- leaving an area; and,
- beginning or ceasing aerial behaviors such as lob-tailing, flippering, or breaching.

What appears clear at present is that large numbers of vessels which persistently approach whales too closely, or move too quickly, or operate too noisily, or pursue the animals may interrupt their short–term performance of life processes (GBRMPA 2000). Because many individual whales, groups or populations exhibit fidelity both within and between years to specific areas and these are areas where whale watching occurs (Clapham *et al.* 1992), whale watching may disproportionately impact a few individuals or special groups of whales.

EXPERT OPINION

Even with the limited scientific study available at present, marine mammal experts who study whales from vessels and have had extensive experience approaching and following the animals

during their studies much like whale watchers, have the opinion that short-term disturbances are easily caused by some vessel activities, and if they are persistent can produce harmful conservation impacts (IWC 1997). This consensus has lead to precautionary management actions.

As a result, *ad hoc* rules, codes and regulations which govern whale watching activities have been made in most places where whale watching occurs (Carlson 1996). Typically such rules seek to implement a common-sense, precautionary approach. Regulations generally involve: minimizing vessel speeds and noise, avoidance of abrupt changes in speed, direction or noise, avoidance of pursuit, no encirclement or splitting of groups, specification of appropriate approach angles; consideration of cumulative impacts on the animals from number of vessels and length of exposure; and, allowing the whales themselves to control the nature and duration of the interaction (IFAW 1995). Carlson (1996) has reviewed regulations around the world and notes that most countries with commercial whale watching have them, and concludes there is a convergence on the activities which they attempt to control.

WILD ANIMALS AND HUMAN PRESENCE

In the absence of specific scientific studies, an approach to reasonably predicting the long-term impacts of human presence on cetaceans has been to look at comparable studies on terrestrial mammals. Wild animals react in various ways to noise and other aspects of human presence (IFAW 1995). Because terrestrial animals are more accessible, easier to study and, in many cases, have been subjects for wildlife viewing for many decades, we know more about the long-term impacts of human presence on this group of wild animals. From such studies of other mammals it is possible to infer some of the likely impacts of human presence on cetaceans.

Some individuals in some species quickly habituate to human presence. Typically, however, wild animals are unlikely to habituate to close approaches, or pursuit or when abrupt or unusual human activities occur. On the other hand, some species do not tolerate human presence; they simply move to different locations (IFAW 1997). Not all species are alike.

Another common finding from terrestrial mammal studies indicates that reactions to human presence varies with individuals (IFAW 1997). Such variance in individual reactions can be due to reproductive state, age, the animals nutritional status, its previous experiences with human activities or previous or current activities. The typical expression of reaction to human presence can also vary between individuals, groups and species. Some animals can become aggressive, others flee or change their activities. Not all individuals are alike, and even the same individual does not always behave in same way.

It is known that human presence disturbances to terrestrial mammals can cause serious long-term harm. Their energy budgets can be seriously compromised by disturbances which require additional movement. Foraging for prey can become ineffective. Increased vigilance required during human presence can produce debilitating stress which inhibits reproduction or fosters medical conditions. Typically, it is simply habitat loss due to human activities that causes declines in terrestrial mammal populations. Introduction of structural changes, human presence, and continuing disturbances force animals from prime habitat into sub-optimal areas that are unable to support them adequately (IFAW 1997).

PREDICTING IMPACTS FROM GENERAL BIOLOGY

Another approach to understanding and predicting the impact of human presence on cetaceans has been to examine general behaviour, biology and ecology of populations and identify particular sensitivities and vulnerabilities (Donovan 1986; IFAW 1995). Cetaceans that exhibit site fidelity, for instance, are much more vulnerable to concentrated disturbances than animals that are dispersed and vary their distribution locations. Humpback and right whales show some site fidelity for feeding areas. Prolonged feeding visits occur to the same areas year after year. Some gray whales on Vancouver Island exhibit strong site fidelity (Darling 1984). Some coastal minke whales restrict their activities to exclusive home ranges (Dorsey 1983) and exhibit fidelity to these areas between years (Borggaard *et al.* 1999). Some whale species return repeatedly to specific calving areas. Where there are specific site or area dependencies, animals are more vulnerable to human interference.

In some species, such as long-finned pilot whales and killer whales, mothers and calves maintain long-term relationships that are critical for the survival of young. Such groups may depend on

coordinated feeding, resting or migration, which can be more easily disrupted than if these behaviours are more solitary. Cetaceans generally maintain contacts within their community by means of vocalization. Noisy, intrusive human activities can easily disrupt effective underwater communication.

While scientific data that specifically evaluates anthropogenic impacts is the best guide to responsible management, marine resources can be sustainably managed by careful attention to general biological information (Johannes 1978; Donovan 1986; IFAW 1996). Much of the general biology of cetacean species and the characteristics they exhibit suggest strongly that they may be extremely vulnerable to human activities. In such scenarios, unfettered development of activities that could prevent animals from completing critical life processes would recklessly risk conservation impacts.

OBSERVED WHALE WATCHING IMPACTS BY SPECIES OF CETACEAN

Cetacean species are diverse in their biology and behaviour. It is therefore likely that reactions to whale watching will vary by species. There is scattered information from a variety of scientific studies which suggests short-term effects of human presence and vessel activity in some species. In this section aspects of the biology of species targeted by whale watching in Canada that make them more vulnerable to conservation impacts will be discussed, and studies that indicate disturbances of life processes by whale watching will be presented.

HUMPBACKS

Humpbacks are migratory in both Atlantic and Pacific Oceans spending a portion of their annual cycle in warmer southern waters where they breed and calve, and summers in Canadian waters when food is most abundant. Thus, foraging and feeding are primary activities during which the animals accumulate sufficient blubber reserves to survive winter periods when they do very little feeding in less productive waters. Feeding is frequently done in cooperative groups so animals act in unison to herd small fish or zooplankton into tight schools, and to the surface. This feeding is frequently concentrated in rich, productive ocean areas. Following heavy feeding humpbacks rest near the surface. Calves, who are often curious and playful, accompany their mothers during summer periods while they learn to find and capture food but also are fed by mothers, at least in early summer. Humpbacks are a primary target species for much of Atlantic whale watching.

Whitehead (1987) in his COSEWIC status report on humpbacks notes the social nature of humpback aggregations. Humpbacks attract other humpbacks. He concludes that human disturbances may cause shifts to other areas. Whitehead and Moore (1982) have noted this in West Indian humpbacks in winter. Herman *et al.* (1980) also found compelling evidence for such shifts due to human interference. In Hervey Bay, Australia changes in habitat use have been observed as whale watching has developed (Corkeron 1995a; 1995b). Todd (S.Todd, pers. comm.) relates how in 1999 vessels would key in on concentrations of humpbacks at which the whales would leave and move to another location. As boats found them in the new location, the whales left and returned to their original area. Disturbance of humpbacks in feeding areas has been suspected to influence changes in distribution and abundance of animals on Stellwagen Bank and in Southeast Alaska (IFAW 1995) where the U.S. National Park Service implemented regulations on number of vessels in the area in an attempt to halt declines in humpback numbers.

There have been short-term behavioural impacts of whale watching (Corkeron 1995 b; Corkeron and Bryden 1998). There are indications that humpbacks react more strongly to whale watching vessels than fishing vessels; this is attributed to whale watchers tendency to follow the whales. Whale watching vessel activity can also result in disruption of resting, feeding and diving behaviour, and dispersal of groups including animals exhibiting coordinated feeding (Lien *et al.* 1992). Very close approaches and pursuit by vessels were observed to produce “wheezing” blows, shortened surface times and abrupt changes in direction (Lien *et al.* 1992). Schilling *et al.* (1989) found that humpbacks approached within 30 m or approached aggressively showed a variety of changes in behaviour.

Several studies indicate changes in surface-active behaviours with vessel presence (Baker and Herman 1989; Baker 1988; Green and Green 1990; Lien *et al.* 1992). Baker (1988) examined the behaviour of humpbacks to vessels within a 400 m operating zone. Whales responded to the close proximity of vessels by decreasing blow intervals, increasing dive times, and moving away from the vessels path. Changes in whale behaviour were correlated with the speed, size, distance, and

numbers of vessels within this zone. It has been observed that noise from vessels can interrupt feeding (McCauley *et al.* 1996). Green and Green (1990) found that surface behaviour decreased and changes in direction of movement increased while a vessel was within 1/2 mile of animals. Effects of vessel presence lasted for 20 minutes after its departure.

Relationships between noise from vessels and the animals activities may also occur as hearing is the dominant sense of cetaceans (Watkins and Wartzok 1985). Short-term reactions to noise by cetaceans have been commonly observed (Richardson *et al.* 1995). Watkins (1986) observes that the primary cause of reactions to vessels were apparently underwater sound. Negative reactions to sounds typically occurred when whales were within 100 m of the source, or when there were sudden increases in sound levels (> 12 dB). It is difficult, however, to demonstrate if reactions are to vessel presence or noise in most cases as they are typically confounded. Todd *et al.* (1996) studied humpbacks reactions to industrial activity producing large amounts of noise. The whales showed no immediate behavioural reaction to dredging, vessels and even explosions. However, entrapments in fishing gear increased apparently due to impaired orientation. In subsequent years, significantly fewer of the individual animals that were exposed to those disturbances were re-sighted in the feeding area (Todd *et al.* 1996). Habituation to noise has also been commonly shown (Richardson *et al.* 1995). Habituation does not necessarily mean no negative impact on the animals.

Humpback mothers and calves are sighted most often in the most productive feeding areas (Lien *et al.* 1992) where whale watching activities also concentrate. They may be especially sensitive to human presence. Salden (1988) found cow/calf pairs moved away from areas presumed to be favored habitat where human activities were common. In Hawaii, mothers and calves use shallow, protected waters for resting, nursing and possibly avoiding sharks and disturbance by other whales. In recent years they have been moving offshore which may be due to increased human activities in shallower coastal areas (Glockner-Ferrari and Ferrari 1985, 1990; Glockner and Venus 1983; Green and Green 1990).

Habituation to the presence of vessels has been shown with repeated exposure (Watkins 1986) and the gradual development of 'vessel friendly' humpbacks is well known. If groups or populations of humpbacks are exposed to well-behaving vessels and that exposure is gradual, they may show an increase in investigative behaviour toward vessels (Watkins 1986). Watkins (1986) noted that in the early days of whale watching humpbacks reacted strongly to the presence of whale watching vessels, often engaging in agonistic responses. However, "On several occasions during recent years, when we were listening and observing humpbacks near Stellwagen Bank, the whales suddenly stopped their underwater activities, became silent and began slowly swimming at the surface. At the same time, we began hearing the distant sounds of one of the whale watching vessels on our hydrophones …. Although it was still 8-10 km distant, the three humpbacks remained at the surface and appeared to wait for the boat. When it stopped, they swam closely around and under the boat until engines were restarted. Then, before it was away from the area, the whales had returned to their previous activities, including vocalizations."

Other studies, which have examined responses to human presence, have found no consistent responses. It should be remembered that in addition to the presence of a whale watching vessel the animals are also experiencing other influences on their behaviour, including social and physiographic conditions, physiological states and past experiences. Because only observational studies are available, and it is difficult to evaluate results because of such confounding of variables. Additionally, behaviour of the animal is the usual measure of disruption or habituation to whale watching activities, but this may not necessarily indicate the degree of physiological stress caused by whale watching.

MINKE WHALES

Minke whales are the smallest baleen whale. Some occur in Canadian waters year-round but there is also a migration into Canadian waters from the south, which begins in May each year. Males may migrate further northward and females segregate further south. There is a southward migration, which occurs in winter, but because near shore records during this period are scarce, it is believed to occur further offshore (Stewart and Leatherwood 1985). A similar pattern is recognized in both the Atlantic and Pacific. Their heaviest feeding period is during these summer months. Some minkes are known to establish exclusive, individual home ranges during this period and restrict their activities to specific coastal areas (Dorsey 1983). They feed on a variety of prey species. Because they are a small whale, and spend very brief periods at the surface, and their

surfacing pattern is erratic and difficult to predict, this species is typically not a primary target for whale watching if larger whales are present but is rather an incidental attraction or a 'back-up' species for whale watching.

Watkins (1986) reports that early observations of minke responses to vessels off Cape Cod were either positive, in the sense they would approach the vessel, or the animals were uninterested. Only occasionally were their reactions to vessels negative. Minkes, however, did not allow vessels to approach them. Over time interest in vessels decreased. The I.W.C. Scientific Committee (1982) on the other hand has noted that there is some evidence of vessel avoidance in other populations. Still other studies have shown that minkes do not react strongly to the presence of vessels (Leaper *et al.* 1997). The reaction of whales to vessels or whale watching activities may be a function of the animal's previous experience with human presence. Humans could be perceived as a novelty, boring or a threat.

FIN WHALES

Fin whales occur in both the north Pacific and the Atlantic. Whale watching targeting this species occurs primarily in the Gulf of St. Lawrence, although they are the incidental focus of vessels in all Newfoundland waters, in Nova Scotia coastal waters, and in areas of the Bay of Fundy. There are some reports of this species in coastal waters of British Columbia (Meredith and Campbell 1988). The appearance in British Columbia waters mostly consists of migrating animals moving between winter breeding grounds off southern California and high latitude feeding areas in the Bering and Chukchi Seas although some feeding is also observed. In the Atlantic summer feeding concentrations occur in nearshore waters off all Maritime Provinces. A small group occurs regularly at a confluence off Tadoussac, Quebec (Edds and Macfarland 1987). Because of past depletion by whaling this species is listed on Appendix I of CITES (Klinowska 1991) and is classified as 'vulnerable' by COSEWIC (Meredith and Campbell 1988).

Individual fin whale exposure to boats varies but some populations receive intense attention from whale watchers. One VHF tagged animal was accompanied by an average of 12 boats (maximum 26) during an 8 hour period of observation. The mean number of boats accompanying whales during sightings in the Saguenay River Estuary was 10, but varied from 1 to 12 (Michaud and Giard 1997; R. Michaud, pers. comm.).

Watkins (1986) reports fins initially were consistently wary of vessels. Initially they appear to react strongly to low-frequency ship sounds and can seldom be approached. On approach they usually move rapidly away, not surfacing again until well away from the vessel. However over time, reactions to vessels appear to habituate somewhat such that in later years vessels could pass as close as within 30 m. When vessels are near finbacks, vocalization is interrupted and animals generally remain quiet (Watkins 1986). Near Tadoussac fin whales are frequently surrounded by boats, boats obstruct their paths and on occasion even collide with them (Gilbert 1998; N. Menard pers comm.). Habituation to vessels could foster risky behaviours by the animals. Using VHF telemetry to monitor fin whales Michaud and Giard (1997, 1999, 2000) have shown that the whales exposed to boats change their behaviour, reducing deep bottom excursions which could easily limit the time spent capturing their prey. Noise and speed of vessels, and especially fast personal water craft, have also been noted as a problem in the Saguenay-St. Lawrence Marine Park (Gilbert 1998). Edds and MacFarlane (1987) found that fin whales moved away from vessels at distances of over 1 km. Others have found that fins show reduced surfacing, less blowing and shorter dive durations when whale watch vessels were in the vicinity (Stone *et al.* 1992).

Fin whales are often present along with other baleen whales in the Gulf of St. Lawrence, all of which are targeted by whale watchers. Mitchell and Ghanini (1982) made 232 sightings of baleen whales in the St. Lawrence, 172 as their vessel passed within 500 m of the animals. In some of these sightings the authors conclude that vessel presence modified the animals behaviour (Mitchell and Ghanini 1982). Avoidance ofboats is perhaps in some cases based on past experiences. However, in the Saguenay-St. Lawrence Marine Park area since 1992 there have been 22 reported incidents involving collisions between vessels and whales, or animals with fresh vessel wounds (N. Menard, pers. comm.). It is possible that habituation to boats encourages animals to engage in risky behaviour.

BLUE WHALES

In the north Atlantic records indicate that blue whales winter as far south as the Carolinas and Florida but others winter in the Gulf of St. Lawrence feeding on prey that is abundant at the edge of ice. During the summer they range to

Davis Strait and Greenland. The major area for whale watching activities is near Mingan and Anticosti Islands, and along the North Shore of the Gulf of St. Lawrence. The group in this area has been well studied for the past twenty years by a research/whale watching group (Sears *et al.* 1987). It is known that this group of blue whales consists of about 300 individuals. Individually identified animals from this group have been sighted in the Gulf of Maine (Wenzel *et al.* 1988) and in Davis Strait off Greenland (Anon. 1990), but little is known of their movements. It is believed that movements of this huge animal occur in relation to plankton fronts (Yochem and Leatherwood 1985). Feeding and foraging migrations are the primary activities of this species during the period (August - October) when whale watching occurs.

In the Pacific blue whales migrate to high latitude feeding grounds in spring and summer after wintering in waters off California and Baja, California. The northward migration begins in April and May along the west coast of North America, and then split into two groups, one moving to the Queen Charlotte Islands and the other heading west towards the Aleutian Islands (Yochem and Leatherwood 1985). Several hundred Pacific blue whales have been individually identified (Klinowska 1991).

Populations of blue whales were severely depleted throughout their range by commercial whaling and there is insufficient information to confirm any population increases achieved since they were given total protection (Klinowska 1991). Yochem and Leatherwood (1985) estimate there are between 1,100 – 1,500 individuals in the north Atlantic; 1,400 - 1,900 in the north Pacific.

The only review of impact of whale watching on blue whales is from Richard Sears (R. Sears, pers. comm.). Movements, feeding, foraging, socializing and rest can be disrupted by close approaches of whale watching vessels, by direct approaches or by pursuit. Even a single disturbance can cause an animal to vacate an area. Several boats around a blue whale can cause departures of blue whales from an area, disrupt surface feeding and split groups.

GRAY WHALE

Gray whales occur in the Pacific migrating inside shelf waters between California and Mexican waters where they winter and high latitude areas in the Bering, Chukchi and western Beaufort Seas. A few individuals remain scattered along the west coast of North America (Wolman 1985). A summer population of 50-70 remains along the west coast of Vancouver Island with some individuals returning year after year (Darling 1978, 1984; Reeves and Mitchell 1988). Viewing migrating gray whales from land is common and one of the mainstays of whale watching in British Columbia (Malcolm and Lochbaum 1999).

Duffus *et al.* (1998) have measured only small changes in activities of gray whales in response to whale watching vessels as did Jones (1988). In areas of whale watching some individual gray whales begin to exhibit 'friendly' behaviour toward vessels, approaching them and even soliciting touching. With increases in boat traffic it has been reported that gray whales begin to avoid boats (Donovan 1986). Gray whales react negatively, however, to the noise of vessels. They are known to avoid ensonified areas (Malme *et al.* 1988; Tyack 1988), and to alter communication and surface behaviours in the presence of vessel noises (Dahlheim 1988; Jones 1988).

RIGHT WHALES

North Atlantic right whales number about 300 individuals and are the most endangered large whale species in Canada. They are classified as 'endangered' by COSEWIC (Hay 1985; Gaskin 1987). Right whales have been infrequently seen off British Columbia but this species is not a target for whale watching there. In the North Atlantic winter distribution is dispersed on the continental shelf and along the coast off Georgia and the Carolinas. Summer distribution is primarily in the Bay of Fundy where the animals feed on zooplankton (Murison and Gaskin 1989) with occasional individuals sighted in the Gulf of St. Lawrence and around Newfoundland (Lien *et al.* 1989). The southern Scotian Shelf functions as a summer and fall feeding and mating area for a high percentage of juveniles and adults. However, only a few cow/calf pairs have been observed there (Brown *et al.*1995). Both the Grand Manan Basin and Roseway Basin are critical habitat for right whales during summer and fall.

The present population of right whales is seriously threatened by incidental captures in fishing gear and by ship strikes (Kraus 1990). Because of the level of mortality from these sources special marine protected areas in the Bay of Fundy have been designated (Brown *et al.* 1995; A. Potter, pers. comm.). Because of the seriousness of the threats to this species, and the inability of these animals to avoid vessels, the U.S. has recently approved a 500 m exclusion zone for vessels around right whales.

Watkins (1986) reports that right whales he observed were less easily disturbed than fins and humpbacks. Kraus *et al.* (1988) list whale watching as a potential threat to right whales and mention that it is difficult to monitor activities of private boats whose operators may not be aware of the right whales extreme vulnerability. The animals are frequently engaged in multi-directional surface foraging and in social behaviours during which they appear unaware of boats (Mayo and Marx 1990). This very likely makes the risk of vessel strikes higher than for other species. Kraus *et al.* (1988), however, report that there are no data on effects of human presence on right whales. There have been reports of inadvertent and intentional harassment of right whales in New Brunswick (McAlpine *et al.* 1994).

KILLER WHALES

Whale watching that targets killer whales occurs primarily on the West Coast of Canada. Key areas for watching are in Johnstone Strait and urban areas around Sidney, Victoria and the Gulf Islands and the Haro Strait area (Duffus and Dearden 1993; Malcolm and Lochbaum 1999). Up to 190 northern resident killer whales use Johnstone Strait each summer, primarily to feed on salmon. Studies have shown that 90% of the killer whales in Johnstone Strait use the Robson Bight Michael Bigg Ecological Reserve, spending up to 20% of their time in the area to socialize, rest and rub on pebble beaches (BC Parks and DFO 1992). Much of the focus of whale watching of southern Vancouver Island is on the southern resident population of approximately 80 animals that was recently classified as 'threatened' by COSEWIC. If killer whales occasionally move into a whale watching area that typically targets other species, while present they usually become the focus of attention.

The human presence is intense. Ford (1995) concluded that it did regularly affect the activities of the animals. Baird *et al.* (1998) reports that 80 commercial whale watching boats operate in Haro Straits and an average of about 20 boats (only a quarter of which were commercial boats) were always with pods as they passed in front of one land-based observation site. This represents an increase from an average of 5 boats with each pod during 1990 (Osborne *et al*. 1999*).* Osborne *et al.* (1999) report 400 incidents in 1998 and 560 in 1999 in which vessels violated the voluntary code of conduct for whale watching in the area.

Baird *et al.* (1998) indicates, however, that during eight years of study of boat/whale interactions no impacts on the whales have been documented. But other studies in BC have concluded that there is short-term disturbance of the whales, especially from viewing and photographic activities, and that as the level of these activities increases so will whale disturbances, especially in the absence of effective control (BC Parks and DFO 1992). Osborne (1988) has observed reductions in sleep/rest behaviour during daylight hours. Kruse (1998) in studies from a land viewpoint observed whales in Johnstone Strait when vessels were present (within 400 m) and absent. When vessels were present pods swam 1.4 times undisturbed speeds. Swimming speed was correlated with the number of vessels present. Orientation of the swimming was not affected by boat presence, number of boats or their characteristics.

There is some evidence that the resident killer whale populations may be more accustomed to the presence of boats than transient animals. Ford *et al. (*1994) report collisions by powerboats and ships with northern resident animals, which have caused serious injuries. Transient killer whales are reported as much less tolerant to close approaches (Felleman *et al.* 1998) and require more space to hunt and kill their mammal prey.

Killer whale pod members share the same call repertories with each pod possessing its own dialect (Ford and Fisher 1982) and communication within pods is an essential biological activity. Bowles *et al.* (1980) observed changes in vocalization in a captive killer whale during and after human contact.

BELUGA WHALES

There are a number of populations of white whales in Canada which are the target of whale watchers. The Saguenay population in the Gulf of St. Lawrence is classified as 'endangered' by COSEWIC and a recovery plan is being implemented (SLBRC 1998). This population may be showing some signs of recovery (Kingsley 1996) although others have failed to detect significant increases in the population (Michaud and Béland 2001). At least one animal in this population has been known to stray from the Saguenay area to Nova Scotia but records of isolated beluga in Newfoundland waters are from Arctic populations. These stray individuals often attract massive amounts of attention from whale watchers (K. Kinsman, pers. comm.; Frohoff and Kinsman undated). An additional area where beluga watching occurs is in Hudson Bay, near Churchill, Manitoba. This activity focuses on beluga in western and southern Hudson Bay where this population is believed to be stable in

size and is not listed by COSEWIC (Richard 1993).

The population in Hudson Bay is hunted by First Nations people and is therefore wary of boats and anthropogenic noise. Sjare and Smith (1986) studied activities in another Canadian Arctic population and found alarm reactions which involved rapid mass exodus from estuarine areas were triggered by polar bears, boat noise or human activity on land. Brodie (1989) notes that calves swim in specific positions next to females which is an adaptation to decrease costs of swimming and that positions may not be secure during disruptions. In the Churchill River area where Canadian whale watching is done beluga appear to accommodate well to shore and vessel activity (M. Macri, pers. comm.).

Caron and Sergeant (1988) studied movements in the mouth of the Saguenay Estuary over 10 years and found a decline of 60% in passages of beluga between 1982-1986 which correlated with an increase in recreational boat traffic. Blane and Jaakson (1994) similarly found vessel effects. Scheifele *et al. (*1997) and Lesage *et al.* (1999) have studied vocalization changes in the presence of noise and vessels operating in the Saguenay River Estuary area. Reactions of the animals varied somewhat by type of vessel. However, changes included dramatic decreases in the rates of calling, increases in some specific all types, and shifts in the frequency bands of calls (Lesage *et al.* 1999). Erbe's studies on impacts of vessel noise (Erbe 1997, 1999 ; C. Erbe, pers. comm.) indicate that the sounds of icebreakers are audible at distances of 60 km and belugas show avoidance behaviour at distances of 40 km. Interference with beluga communication starts as the vessel is within 10 km. Hence, it is not surprising that communication changes occur due to the noise of smaller vessels at very close range.

Frohoff and Kinsman (undated) reported an isolated beluga would frequently approach and follow boats and this resulted in ramming, bumping of the animal. On occasions small boats hit the whale and were over-turned. Propeller injuries to the animal were observed, as was feeding of dead fish which the animal would accept but not eat. Feeding could be disrupted by the close approach of vessels or by following the animal. During an extended period of intense whale watching activity that resulted in vessels attending the whale for up to 13 hours/day the animal began to loose weight (K. Kinsman, pers. comm.). Rest periods were also frequently disturbed by vessels and, at these times, the animal often exhibited agitated and even agonistic behavior. Some of these interactions had serious consequences for this individual whale but it is not likely there would be long-term population impacts because the survival of that particular animal was compromised. But such careful observations on this well-known individual are informative and reactions may parallel reactions of groups of belugas.

LONG-FINNED PILOT WHALES

Long-finned pilot whales are found in North Atlantic waters during summer and autumn months, especially in the southern Gulf of St. Lawrence. Although numbers of this species were seriously depleted by drive fisheries, and there have been substantial decreases in sightings in some areas, it is not listed by COSEWIC (Nelson and Lien 1996). This species was common off the coast of Newfoundland during periods when the Newfoundland bait squid (*Ilex illecebrosus*) was abundant but has been infrequently seen for over a decade. "Potheads" are abundant off Cape Breton Island, NS where whale watching operations target this species (D. Snow, pers. comm.).

During summer months foraging and feeding are primary activities of this species although feeding occurs year-round. It has been estimated that during summer feeding, when squid is abundant, food intake may be 3-6% of body weight (Sergeant 1962). Breeding and calving are also primary activities during summer months. The breeding season of long-finned pilot whales lasts from May through November. Calving is most common in mid-August. Lactation can last for several years and social bonds between calves and cows are enduring. There is some evidence of a matrilineal pod organization.

Pods seen in summer in whale watching areas include mature males and females, juveniles and calves. Actions within the pod are coordinated and feeding occurs in dispersed groups (Nelson and Lien 1996). The strong social bonds in this species may account for strandings where even healthy animals beach themselves as a group (Geraci and St. Aubin 1979). During drive fisheries in Newfoundland during the 1960's "potheads" were herded by boats into shallow water until they beached themselves. Recreational boat activity has also been suggested as a factor in mass strandings of pods (McLeod 1982). When traveling, pods exhibit typical structures - older males are usually on the fringes of the pod with females and young in the centers (Weilgart 1984). Both Weilgart (1984) and McLeod (1982) note that vessel type, noise and activity can change vocalizations of pilot whales.

DOLPHIN AND PORPOISE SPECIES

Dolphin species are diverse in habitat requirements, pod characteristics and biology. Generally dolphin species are believed to be the most cognitively capable cetaceans (Herman 1980) with superior learning abilities and strong social attachments. Dolphin species are not usually the target species for whale watching in Canada but several species are viewed incidentally including white-sided dolphins, white-beaked dolphins, Dall's porpoise, and even harbour porpoise (C. Malcolm, pers. comm.). Reactions of dolphins to vessels and their activity varies greatly. White-beaked dolphins regularly approach boats and ride bow waves. Even when boats move faster, and emit more noise, this species will sometimes move in close association with vessels, at least for a time. Most information on reactions of dolphins and porpoise to human presence comes from research on species not found in Canada.

Bejder *et al.* (1999) found Hector's dolphins were not displaced by either swimmers or boats. The dolphins initially approached boats but after slightly over one hour they were uninterested in the vessel, or actually avoided it. When vessels were present the dolphins bunched together more tightly, perhaps indicating stress at the boats presence. N. Brown (pers. comm.) comparing pre-tourism and tourism impacted dusky dolphins found a shift in habitat and some changes in behavior. Although these species are not found in Canadian waters, impacts of vessel presence on the behaviour of indigenous species may be found to be similar but at present experimental studies are lacking.

Noise, predators, storms are normal stresses for dolphins. In some cases human presence may fit into a normal range of such stresses. However, activities that are benign as isolated and occasional events become much more problematic when they occur repeatedly and persistently. Dolphins have been shown to avoid ships some 10 km away but the reaction depends on the pod's activity mode – resting animals may avoid vessels, foraging animals ignore them and socializing animals approach them. Janik and Thompson (1996) observed significantly fewer surfacings in 70% of observed interactions after whale watching boats approached bottlenose dolphins even though this population had previously been repeatedly exposed. Au and Perryman (1982) observing spotted and spinner dolphins noted that all pods swam away from the projected path of a vessel, some began evading the ship as far as 8 km away. Hewitt (1985) however found only half of dolphins he observed exhibited avoidance behaviour. Evasive behaviours may consist of deep dives, rapid swimming, pod dispersal and changes in course (Weir 2000). Scorpaci (C. Scarpaci, pers. comm.) found whistling increased as boats conducted approaches prohibited under Australian whale watching regulations and suggests that this was to maintain group cohesion in a stressful situation. Further, Scarpaci (C. Scarpaci, pers. comm.) has found that, in the presence of tour boats and vessels, her dolphins spent significantly less time feeding. In a population of about 100 bottlenose dolphins 4% were injured by boat collisions over a 13 year period (Wells and Scott 1997). Some populations of bottlenose appear to be habituated to small vessels (Wells 1998). Noise from airplanes can explosively disperse some dolphin schools (Scott and Perryman 1991; B. Bowman pers. comm.)

CONCLUSIONS

There is some evidence that the presence of, or specific actions of whale watching vessels changes the behaviour of targeted cetaceans. Some of these changes could be viewed as adaptive responses to threats which removes the whale from danger of a ship collision, for instance. But other common short-term changes seem more clearly disruptions of the normal activities of the animals. These disruptions may interrupt or prevent animals from completing life processes. There are data that show interference with communication, residential behaviour, movement, and feeding. There is also evidence of direct harm in some populations because of collisions with whale watching vessels. However, there is also evidence that, in some cases, the animals habituate to human presence, and accommodate to it. Habituation could occur and still produce negative impacts on the animals.

What is clear at present is that when there are large numbers of vessels, when some approach too closely, move too quickly, operate too noisily, or pursue animals, the completion of life processes in wild cetaceans may be disturbed.

The relationship between short-term disturbances and the long-term impact of these disturbances is not clear. But given the intensity of whale watching on a number of populations of cetaceans in Canada it is reasonable to conclude that short-term disturbances occur frequently, are repetitive on the same individuals and within some groups, and that these disturbances persist

through periods while the animals must complete specific activities required for their survival. If condoned or permitted these disturbances would be likely to become widespread and even more common. It is precisely through such repetition that short-term disturbances may become long-term conservation impacts. In some of the targeted Canadian whale species at risk who live in a rapidly changing environment and have specific biological constraints, vulnerability to such disturbances is extremely high.

Where there is a risk, or may be a risk of negative conservation impact, the precautionary approach may shift the burden of proof so that an activity must show itself benign before it proceeds. Regulations which minimize whale watching vessel activities which are most likely to interfere and prevent completion of life processes are necessary.

Studies of both short-term and long-term impacts of whale watching are currently underway which should clarify much about changes in whale behaviour which result from whale watching. Changes perceived now with suspicion may be shown to be unimportant, or they may be shown unrelated to long-term conservation impact. However, it is at least equally likely that some changes will be shown to clearly interfere with completion of life processes. Precautionary regulation of whale watching should adaptively respond as this new information becomes available by adjusting rules of conduct.

RECOMMENDATIONS ON MANAGING WHALE WATCHING

1. It is a matter of some urgency that the DFO formulate and initiate plans to manage whale watching activities in Canada. The rapid development of this industry and its present size have been accompanied by inadequate monitoring or evaluation of its impact on the target animals. It has now grown into a major ecotourism industry and an extremely popular leisure time activity for Canadians. From every indication it will continue to grow. There are clear problems which now occur regularly and are recognized by field personnel in the Department, by scientists and by tour operators. If whale watching is to be sustainable management actions are necessary.

2. The life processes of whales must be protected. The intent of regulations for whale watching is to ensure that human activities do not prevent an animal from carrying out life processes. To survive a whale must rest, forage, feed, avoid predators, communicate and socialize with its group, mate and care for its young. Disturbing animals engaged in such activities prevents the animal from carrying out life processes. If an animal cannot carry out its life processes its own survival may be at risk. If such disruptions to life processes occur to a particular segment of a population, or to a significant number of individuals with in a population, it follows that conservation may be at risk. Vessel activities that cause disruptions must be regulated.

3. While engaged in whale watching some vessel activities must be regulated. Vessel activities most reliably related to short-term disruptions of life processes of whales and dolphins include close and rapid approaches, direct approaches which cut-off whale movements, rapid changes in speed and direction when near animal(s), pursuit and excessive noise. Some animals, such as mothers and calves, that are especially vulnerable to human presence should be given exceptional protection by regulations. Although the conservation impact of any single short-term disruption is impossible to evaluate, vessel activities which cause them are very likely to become standard practice and widespread, making them far more likely to have conservation effects. The objective of establishing regulations for whale watching is to provide a basis for managing human activities that will, or are likely to, affect whale and dolphin populations which occur in Canada's waters. Precautionary control of short-term disruptions is necessary to proactively achieve this objective.

4. Factors that contribute to frequency, repetitiveness and persistence of short-term disturbances should be controlled. The number of vessels near whales should be regulated as, sheer numbers and competitive relationships between vessels, means repetitive disturbances. The duration of time any one vessel can spend in close contact with an animal(s) should be controlled. It is when short-term disruptions become frequent, repetitive and persistent that the likelihood of conservation effects increases.

5. Regulations should be adaptive. While there is inadequate scientific information at present regarding the long-term conservation impact of whale watching, because of initiatives by the I.W.C. and many national jurisdictions, new scientific studies will become available over time. It is important that any regulations and management initiatives be examined and adaptively adjusted in the light of new knowledge of whale watching impacts and experience with the effectiveness of

regulations.

6. DFO should develop programmes to monitor both short-term and long-term impacts of whale watching. Each population of cetaceans targeted by whale watchers, and each whale watching area, exhibits unique characteristics. While management should be guided by scientific studies of all species and from all areas, Canada should initiate on-going programmes to monitor those for which we are specifically responsible. Much of this research can be conducted from commercial whale watching vessels themselves. DFO should encourage partnerships with operators in implementing monitoring research.

7. Emphasis should be on compliance rather than enforcement. The enforcement of regulations on whale watching will be somewhat complicated as most problems occur with recreational boaters rather than commercial operations. Developing evidence sufficient for charges is difficult for many reasons. Clearly regulations and management of whale watching should be presented within a communications and educational programme which provides the public with an understanding of why such management is necessary. Commercial whale watching operators can be very influential and provide leadership here both by example and by their efforts to inform the public of the rules under which they operate. As whale watching typically concentrates in specific areas, commercial operators may also be helpful in enforcement by reporting offending vessels to DFO. However, a public that loves whales, and understands what their personal impact can be on the animals is, or could be, is the best protection for the animals and best insurance that whale watching is sustainable.

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PERSONAL COMMUNICATIONS ACKNOWLEDGEMENTS

At the outset of this review a questionnaire was sent to a wide variety of whale watch operators, marine mammal scientists and managers. Many responded with helpful direction and advice for which I am most grateful. Some I have acknowledged in the text as providing personal communications where I have used specific points which they raised or information they provided. They are listed here along with those that gave general direction and suggestions to the work. I thank them all.

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Table 1. Number of commercial whale watching companies by Canadian province, and the main species which they target.

Province	Number of Commercial Whale Watching Companies	Species of Cetacean Targeted
Newfoundland	47	Humpback, Fin, Minke
Nova Scotia	45	Humpback, Right, Fin, Long-finned Pilot
New Brunswick	25	Humpback, Right, Fin
Quebec	70	Fin, Beluga, Humpback, Blue
Manitoba	2	Beluga
British Columbia	51	Killer, Gray, Humpback

Table 2. General principles for whale watching by the International Whaling Commission Scientific Committee (IWC 1997).

1. Manage the development of whale watching to minimize the risk of adverse impacts:

i. implement as appropriate measures to regulate platform numbers and size, activity, frequency and length of exposure in encounters with individuals and groups of whale;
   - management measures may include closed seasons or areas where required to provide additional protection;
   - ideally, undertake an early assessment of the numbers, distribution and other characteristics of the target population/s in an area;

ii. monitor the effectiveness of management provisions and modify them as required to accommodate new information;

iii. where new whale watching operations are evolving, start cautiously, moderating activity until sufficient information is available on which to base any further development;

iv. implement scientific research and population monitoring and collection of information on operations, target cetaceans and possible impacts, including those on the acoustic environment, as an early and integral component of management;

v. develop training programmes for operators and crew on the biology and behaviour of target species;

vi. encourage the provision of accurate and informative material to whale watchers to;
   - develop an informed and supportive public;
   - encourage development of realistic expectations of encounters and avoid disappointment and pressure for increasingly risky behaviour.

2. **Design, maintain and operate platforms to minimize the risk of adverse effects on cetaceans, including disturbance from noise;**

i. vessels, engines and other equipment should be designed, maintained, and operated during whale watching to reduce as far as practicable adverse impacts on the target species and their environment;

ii. cetacean species may respond differently to low and high frequency sounds, relative sound intensity or rapid change in sound;
   - vessel operators should be aware of the acoustic characteristics of the target species and of their vessel under operating conditions; particularly of the need to reduce as far as possible production of potentially disturbing sound
   - vessel design and operation should minimize the risk of injury to cetaceans should contact occur for.

3. Allow the cetaceans to control the nature and duration of 'interactions':

i. operators should have a sound understanding of the behaviour of the cetaceans and be aware of behavioural changes which may indicate disturbance;

ii. in approaching or accompanying cetaceans, maximum platform speed should be determined relative to that of the cetacean, and should not exceed it once on station;

iii. use appropriate angles and distances of approach; species may react differently, and most existing guidelines preclude head-on approaches;

iv. friendly whale behaviour should be welcomed, but not cultivated; do not instigate direct contact;

v. avoid sudden changes in speed, direction or noise;

vi. do not alter platform speed or direction to counteract avoidance behaviour by cetaceans;

vii. do not pursue, head-off, or encircle cetaceans or cause groups to separate;

viii. approaches to mother/calf pairs and solitary calves and juveniles should be undertaken with special care; there may be an increased risk of disturbance to these animals, or risk of injury if vessels are approached by calves;

ix. cetaceans should be able to detect a platform at all times;
   - while quiet operations are desirable, attempts to eliminate all noise may result in cetaceans being startled by a platform which has approached undetected;
   - rough seas may elevate background noise to levels at which vessels are less detectable.