



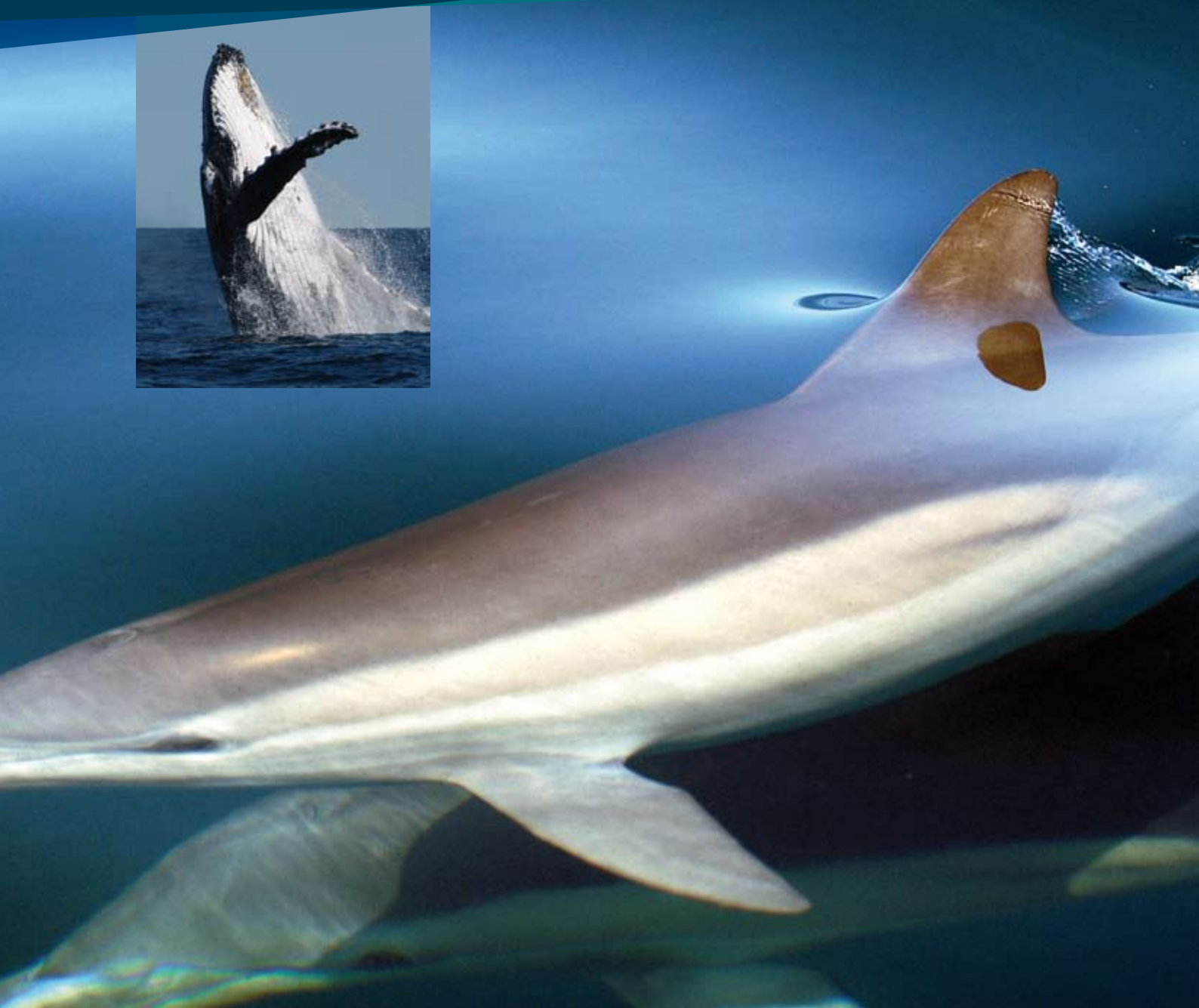
Australian Government

Department of the Environment, Water, Heritage and the Arts

CONSERVATION AND VALUES

Global Cetacean Snapshot

A PROGRESS REPORT



This is a progress report on research commissioned by the Australian Government and undertaken by the Southern Cross University Whale Research Centre and Syneca Pty Ltd, Sydney, Australia. The findings draw from a wide range of current literature, notably the reports of the World Conservation Congress (IUCN) and the International Whaling Commission (IWC). In the interests of brevity, references have not been included in this report although they can be obtained from the Australian Government Department of the Environment, Water, Heritage and the Arts on request. A full list of references will be provided in the final report to be available in 2009.

Acknowledgments

Research and analysis provided by: Dr Peter Harrison, Christine Fury, Daniel Burns and Greg Luker, Southern Cross University Whale Research Centre; and, Peter Dempster and Ron Groenhout from Syneca Consulting Pty Ltd. The researcher consulted Dr Bill Perrin and Dr Nick Gales in the development of this report.

June 2008

Designed by Levitate Graphic Design

Printed on 100% recycled paper



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Conservation and Values

Australia's support for whale conservation is well known. Australia's position is based on economics, science and ethics. To ensure that the global debate about the future of whales is informed by the latest information, the Australian Government has commissioned an overview of the conservation status of whales, dolphins and porpoises and how they are valued. The following questions were considered:

- What is the conservation status of the world's whales, dolphins and porpoises (cetaceans)?
- What threats affect cetaceans?
- If better conservation management tools were to be developed, how should they be targeted?
- What contributes to a successful whale watching industry?
- What have been the patterns of economic development based on living cetaceans around the world and what are the prospects for future growth?

The following progress report presents the answers so far. The report will be updated and finalised following the 2008 meetings of the International Whaling Commission and the World Conservation Congress.

Key findings

Conservation of the world's whales, dolphins and porpoises is a complex and challenging task. Our generation needs to synthesise the best available information to understand and protect these key indicator species of the health of the oceans, and to enable those species that were subject to massive historical over-exploitation to recover to viable levels.

This progress report summarises what is known about the global conservation status of cetaceans and the main threats to their survival, and reviews their economic values as represented through whale watching activities. It has found compelling evidence in favour of continuing and increasing international research efforts to address the many unknowns, and for developing comprehensive conservation management strategies, particularly to alleviate the growing pressures on threatened species and populations.

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A few species, and some populations, have started to recover from commercial whaling. However, there are relatively few conservation successes, while many cetacean populations, and species, face increased threats, particularly river and coastal dolphins and porpoises. While there is simply not enough information to determine the status of almost half of the 86 cetacean species, 14 species are threatened:

- 5 Vulnerable species: the humpback whale; sperm whale; boto (Amazon River dolphin); beluga; and harbour porpoise.
- 7 Endangered species: the North Atlantic right whale; North Pacific right whale; sei whale; fin whale; blue whale; South Asian river dolphin (Ganges and Indus River dolphins); and Hector's dolphin.
- 2 Critically Endangered species: the baiji (Yangtze River dolphin); and the vaquita (Gulf of California porpoise).

Some fragile populations face growing pressures from fisheries, habitat changes, pollution, climate change and other threats.

These threats are likely to overwhelm some species and populations, which may be driven to extinction in the near future. The greatest concentration of threatened species, or 'hot spots', occur in the North Pacific and North Atlantic regions:

- In the northwest Pacific, up to ten threatened species occur in the Sea of Okhotsk (east of Siberia), and up to ten species in both the Sea of Japan and across the Bering Sea to Alaska.
- In the North Atlantic up to eight threatened species occur in the Labrador Sea between Canada and Greenland, and up to seven species occur along the east coast of North America.
- Up to seven threatened species occur along western Europe, in the North Sea and Norwegian Sea.

Many people now value whales, dolphins and porpoises as unique living resources that have important roles in marine and other aquatic ecosystems. This is best illustrated by whale and dolphin watching, which continues to be characterised by strong growth. Around 100 million people from high income countries have participated in whale watching at some time, a figure that is increasing by 10 million each year.

High income countries continue to claim a major share of this activity, which may indicate that future growth could offer sustainable development opportunities in middle and low income countries, provided the right preconditions are in place. Some species that support whale watching industries are classified as threatened, suggesting that appropriate regulation of whale watching is required to allow these species to recover and the industry to continue to expand.

The benefits of whale watching also extend beyond direct market values. Successful whale watching can raise awareness, increase our scientific understanding of cetaceans and create financial incentives for conservation of the marine environment.

Some cetaceans are migratory animals that depend on diverse marine ecosystems, while others have very restricted geographic ranges. It is clear that historic and ongoing threats, have restricted the geographic range of some species, leading to an increase in population subdivision and a greater risk of extinction compared to larger more widespread populations. Their future status will undoubtedly depend on new approaches and international cooperation, guided by the latest available information, to prevent further population declines or species extinctions.

Conservation

There are at least 86 species of whales, dolphins and porpoises – the extraordinary marine mammals collectively known as cetaceans. The International Whaling Commission (IWC) Scientific Committee and the IUCN Cetacean Specialist Group are likely to recognise some new species as morphological and genetic knowledge emerges, including some taxa that are currently categorised as subspecies. However, one species – the baiji (Yangtze River dolphin) – has probably recently become extinct. Since many other cetacean populations are seriously threatened or have been extirpated from significant areas of their former range, more species may become extinct.

Cetaceans are iconic mammals with key ecological roles, including as apex predators in marine and other aquatic ecosystems.

They also have a wide range of socio-economic and cultural values. During the 20th century, commercial whaling was the main economic value of cetaceans. Today, ecotourism – as whale and dolphin watching – is the main economic value, forecast to grow to over \$3 billion, and to attract a further 10 million people annually.

Cetaceans are a diverse group. Baleen whales (Mysticeti) filter feed large volumes of small prey such as krill, plankton or small fish; toothed cetaceans (Odontoceti) capture larger prey including fish and squid. The smallest (the vaquita porpoise and Hector's dolphin) grow to 1.5 metres; the largest (the blue whale) can exceed 30 metres in length and is the largest animal that has ever existed on Earth.

Most cetaceans are marine, but a few specialised river dolphin species inhabit some of the world's major rivers. Some have highly restricted distributions – the critically endangered vaquita exists only in the northern Gulf of California – while others are cosmopolitan and found throughout the world's oceans, such as orcas (killer whales) and humpback whales. Many species are rarely seen or recorded, and very little is known about their distribution, abundance or ecology. Status assessments and conservation management decisions for these species are especially difficult.

SOME EXTRAORDINARY CHARACTERISTICS OF CETACEANS

- sperm whales have the largest brain and dive to below 2000m
- toothed cetaceans use echolocation to detect prey and scan habitats
- blue whales' low frequency vocalisations are audible for hundreds of km
- humpback whales and gray whales migrate up to 17,000 km annually
- orcas and sperm whales live in complex societies
- diverse and elusive beaked whales dive for up to 2 hours
- male humpback whale songs evolve over time and space
- bowhead whales have 50cm blubber and can live to 125 years or more in Arctic waters.

STATUS AND TRENDS

Although some cetaceans have been closely studied, relatively little is known about the biology, ecology and status of many species and populations. The IUCN Cetacean Specialist Group has been assessing cetacean status since the 1980s and will update assessments for many species in late 2008. The 2008 IWC Scientific Committee meeting will also review substantial new information. For these reasons, a full list of species and their status has not been included in this report. The final version of this report will incorporate new data and status changes.

The IUCN categorises species as: Extinct; threatened (Critically Endangered; Endangered; Vulnerable); lower risk (Near Threatened; Least Concern); Data Deficient; or Not Evaluated. At mid-2008, the IUCN cetacean listings indicate that 14 species, or 16%, are threatened; 28 species (33%) are in the lower risk categories; 44 species (51%) are Data Deficient or Not Evaluated. See Table 1.

In summary, at the species level, the most threatened cetacean species are:

- 5 Vulnerable species: the humpback whale, sperm whale, boto (Amazon River dolphin), beluga and harbour porpoise.
- 7 Endangered species: the North Atlantic right whale, North Pacific right whale; sei whale, fin whale, blue whale, South Asian river dolphin (Ganges and Indus River dolphins) and Hector's dolphin.

- 2 Critically Endangered species: the baiji (Yangtze River dolphin) and the vaquita (Gulf of California porpoise). The baiji is likely to be the first cetacean species to become extinct in recorded history. For the vaquita, a 2007 estimate suggests only about 150 remain.

There are significant gaps in our understanding of many cetacean species. History shows that it would be wrong to assume that species for which there is an absence of information on abundance and population trends are not at risk. Some populations that had not been evaluated, or were Data Deficient as recently as the 1990s have since been confirmed as Critically Endangered or Endangered.

The IUCN threat category listing for at least nine cetacean species has changed in recent decades as indicated in Table 2. At the species level, the status of sei whales, fin whales, South Asian river dolphin, baiji, vaquita and Hector's dolphin declined, coincident with increased pressures from human activities. The threatened status has improved at the species level for the bowhead whale and humpback whale. However, within these species, some populations have not improved or have declined, and therefore at the population level, the threat status has increased to a higher category.

Most cetacean species exist as a number of more or less discrete and often genetically differentiated populations. There is increasing recognition of the importance of conserving populations within each species, to maintain genetic diversity and the role of species in regional ecosystems. Therefore, the IUCN Cetacean Specialist Group has also identified threatened populations or stocks of some species in order to identify key threats and to facilitate their management. At a population level, a further nine populations of six species are listed as Critically Endangered, seven populations of five species are Endangered, and five populations of four species are Vulnerable.

While the conservation status of some species has improved, the status of some populations has declined.

The primary cause is human activity.

The number of threatened cetacean species and populations is likely to increase without immediate action taken to reduce or remove key threats, and substantially improve conservation planning and effective management.

Table 1: Summary of Cetacean Families and numbers of species listed by categories from IUCN Red List of Threatened Species

	Species	Not listed	Near Threatened, Least Concern	Data Deficient	Vulnerable	Endangered	Critically Endangered
Baleen whales (Mysticeti)							
Balaenidae (Right whales)	4		2			2 (North Atlantic right whale, North Pacific right whale)	
Neobalaenidae (Pygmy right whale)	1		1				
Eschrichtiidae (Gray whale)	1		1				
Balaenopteridae (Rorquals)	8	1	2	1	1 (humpback whale)	3 (sei, blue, fin whales)	
Toothed cetaceans (Odontoceti)							
Physeteridae (Sperm whale)	1				1 (sperm whale)		
Kogiidae (Diminutive sperm whales)	2		2				
Platanistidae (South Asian river dolphin)	1					1 (South Asian river dolphin)	
Pontoporiidae (Franciscana)	1			1			
Lipotidae (Chinese river dolphin)	1						1 (baiji)
Iniidae (South American river dolphin)	1				1 (boto)		
Monodontidae (Monodontids)	2			1	1 (beluga)		
Phocoenidae (Porpoises)	6		1	3	1 (harbour porpoise)		1 (vaquita)
Delphinidae (dolphins)	36	2	15	18		1 (Hector's dolphin)	
Ziphiidae (Beaked whales)	21	2	4	15			
Total number of species	86	5	28	39	5	7	2

Table 2: Summary of Threatened Cetacean Species and Populations from IUCN Red List Threat Categories: Current status, abundance, trends

Family Group	Species (Population)	1980s	1990s	2000s	Estimated abundance	Trend	
Baleen whales (Mysticeti)	Right whales	Southern right whale	VU	VU	NT*	>8,000	
		North Atlantic right whale	EN	EN	EN	~300-350	
		North Pacific right whale	NE	EN	EN	Low 100s	?
		Bowhead whale	EN	VU	NT*	~12-14,000?	↑
		(Spitsbergen stock)	NE	EN	CR	10s	
		(Baffin Bay-Davis Strait stock)	NE	VU	EN	~1,230	
		(Okhotsk Sea subpopulation)	NE	NE	EN	A few 100s	
	Gray whale	Gray whale	NE	NE	NT*	~20,000	
		(NW Pacific stock)	NE	EN	CR	~120	?
	Rorquals	Sei whale	NE	VU	EN	?	
		Blue whale	EN	EN	EN	5,000-12,000?	
		(Antarctic Blue whale)	NE	EN	EN	~2,300	
		(North Atlantic Blue whale)	NE	NE	VU	600-1,500?	
		Fin whale	VU	VU	EN	?	
	Humpback whale	EN	VU	VU	~70,000?		
Toothed cetaceans (Odontoceti)	Sperm whale	Sperm whale	NE	VU	VU		
	South Asian river dolphins	South Asian river dolphin	VU	VU	EN		↓
		(Ganges River subpopulation)	VU	EN	EN	~1,500	↓
		(Indus River subpopulation)	EN	EN	EN	~965	↓
	Marine river dolphins	Franciscana	IK	IK	DD	~42,000	
		(Rio Grande/Uruguay subpopulation)	NE	NE	VU		↓
	Chinese river dolphin	Baiji	EN	CR	CR	functionally extinct	↓
	South American river dolphins	Boto	VU	VU	VU		?
	Beluga and narwhal	Beluga or white whale	IK	IK	VU		
		(Cook Inlet population)	NE	NE	CR	~207 adults	
	Porpoises	Vaquita	VU	CR	CR	~150	↓
		Finless porpoise	NE	IK	DD		
		(Yangtze River finless porpoise)	NE	EN	EN	<2,000	
		Harbor porpoise	IK	IK	VU		
	Marine dolphins	(Baltic Sea stock)	NE	NE	VU		
		(Black Sea stock)	NE	NE	VU		
		Irrawaddy dolphin	IK	IK	DD		
		(Songkhla Lake subpopulation)	NE	NE	CR	<50	↓
		(Mekong River subpopulation)	NE	NE	CR	<50	↓
		(Malampaya Sound subpopulation)	NE	NE	CR	<50	↓
		(Mahakam River subpopulation)	NE	NE	CR	<50	?
		(Ayeyarwady River subpopulation)	NE	NE	CR	<50	↓
	Hector's dolphin	IK	VU	EN	~7,873	?	
(Maui's dolphin subpopulation)	NE	NE	CR	<100	↓		
Common dolphin	Common dolphin	NE	IK	LC			
	(Mediterranean subpopulation)	NE	NE	EN		↓	

* IUCN List records these species as Lower Risk (Conservation Dependent)

IUCN Category	Code	Species	Populations
CRITICALLY ENDANGERED	CR	2	9
ENDANGERED	EN	7	7
VULNERABLE	VU	5	5
INSUFFICIENTLY KNOWN, DATA DEFICIENT	IK, DD	39	
NEAR THREATENED, LEAST CONCERN	NT, LC	28	
NOT EVALUATED	NE	5	

GLOBAL PATTERNS

The IUCN data summaries provide detailed information on the status of species and some populations. Global data can also be used to examine the biogeographic patterns of distribution in order to identify 'hot spots' containing numerous threatened species. This sort of information could form the basis of future internationally coordinated conservation action.

At a global scale, there is broad overlap in the ranges of at least five threatened species – blue, fin, sei, humpback and sperm whales, throughout the Indo-Pacific and Atlantic Ocean regions as shown in Figure 1. The global distributions of Vulnerable, Endangered and Critically Endangered cetacean species are shown in Figures 2, 3 and 4 respectively. The greatest concentrations of threatened species occur in the North Pacific and North Atlantic regions: see Figure 1.

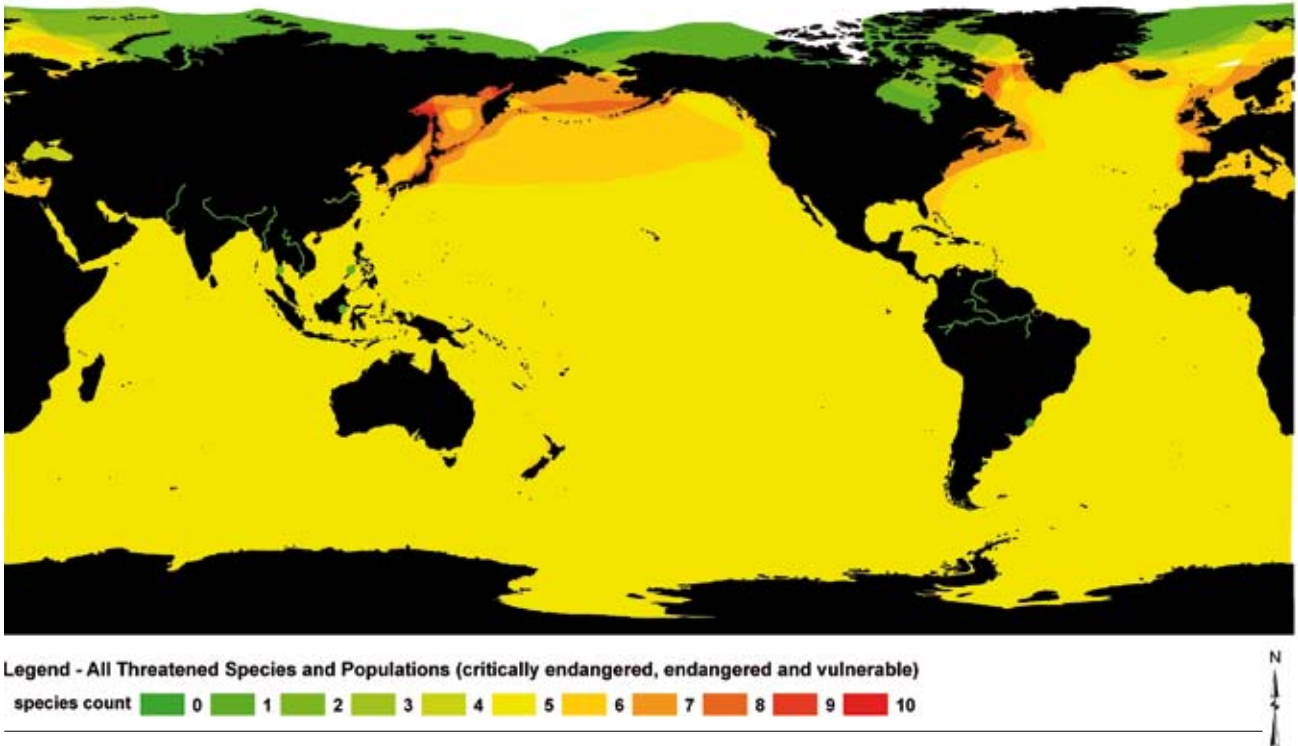


Figure 1 Map showing the distribution of all IUCN listed threatened cetacean species and populations.

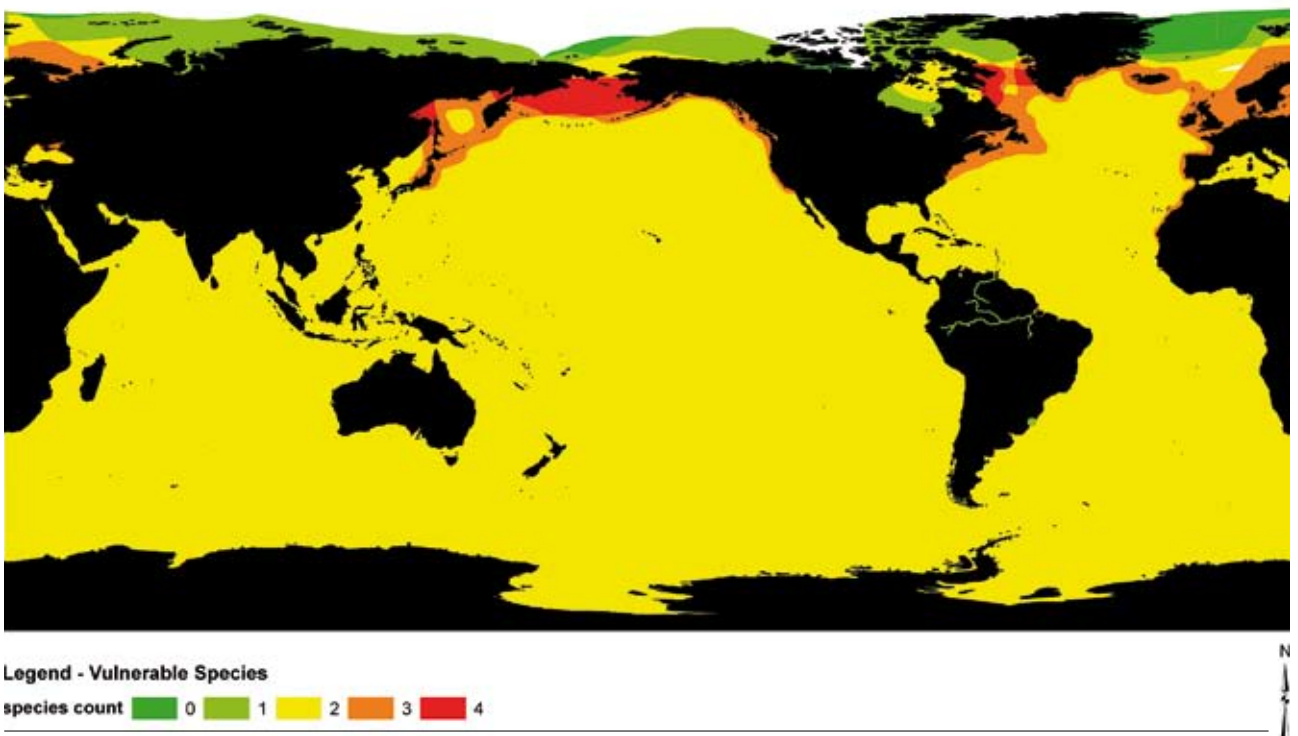


Figure 2 Map showing the distribution of all IUCN listed Vulnerable cetacean species and populations.

- Northwest Pacific: the greatest concentrations of threatened species and populations occur in this region; with up to ten threatened species occurring in the Sea of Okhotsk (east of Siberia), and up to ten species in the Sea of Japan and across the Bering Sea to Alaska.
- North Atlantic: up to eight threatened species and populations occur in the Labrador Sea between Canada

and Greenland, and up to seven species occur along the east coast of North America.

- North Sea and Norwegian Sea: similarly, up to seven threatened species and populations occur along western Europe, in the North Sea and Norwegian Sea.
- The Mediterranean Sea: six threatened cetacean species and populations.

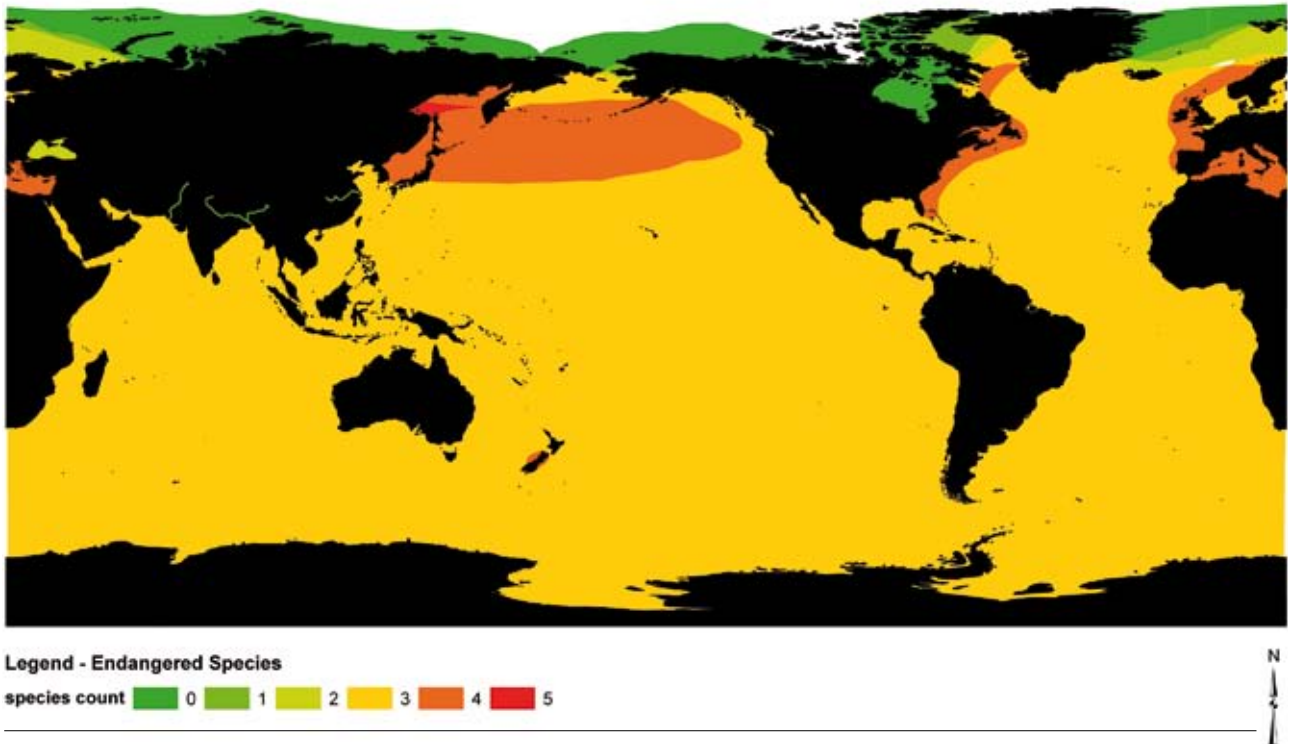


Figure 3 Map showing the distribution of all IUCN listed Endangered cetacean species and populations.

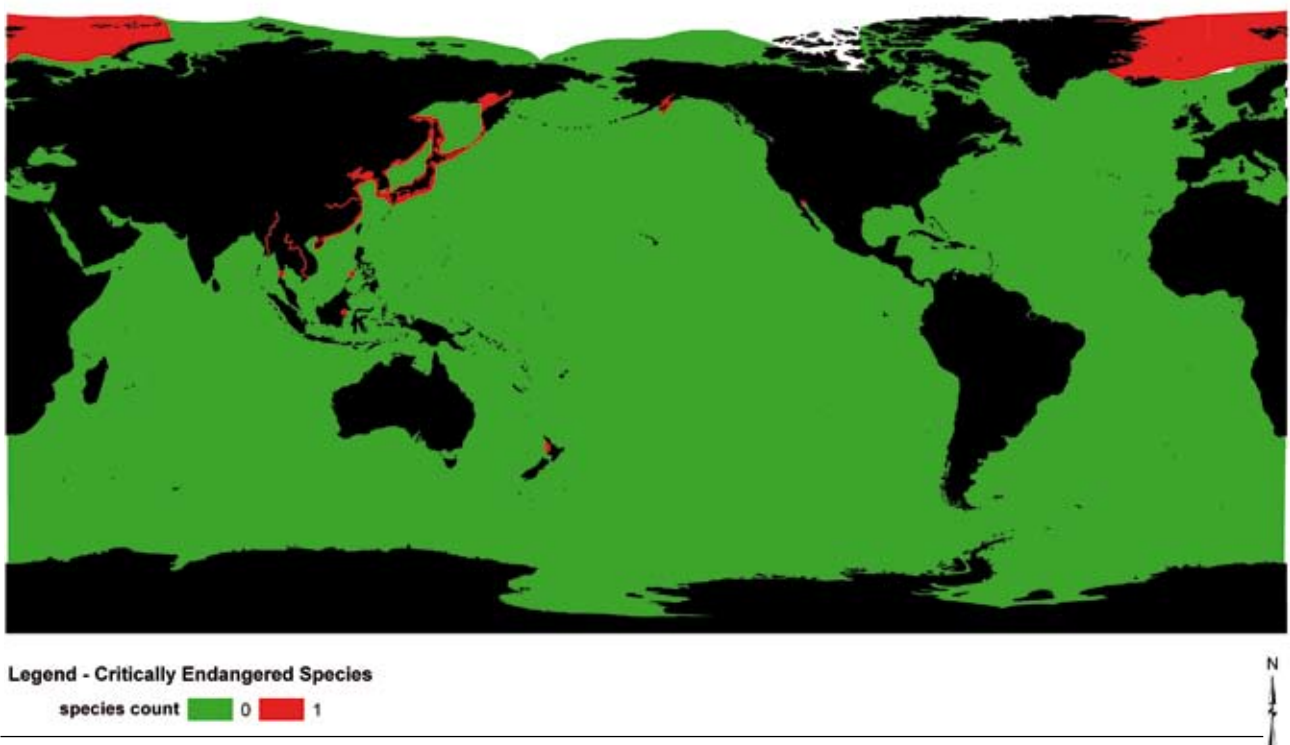


Figure 4 Map showing the distribution of all IUCN listed Critically Endangered cetacean species and populations.

THREATENED SPECIES AND POPULATIONS

The following examples of threatened cetacean species and populations highlight the range of threats and their recorded impacts on cetaceans of varying conservation status.

Critically endangered and endangered dolphins and porpoises

Baiji (*Lipotes vexillifer*), or Yangtze River dolphin

Status: Critically Endangered, possibly Extinct

Location: Yangtze River, China

Size: About 2.5 m and 170 kg

Population: Last counted in tens, last sighted 2001 but now considered likely to be extinct.

Threats: Fisheries bycatch from longline hooks, nets and electric fishing; vessel collisions and increased traffic; habitat modification through damming, blasting and pollution, and likely reductions in fish prey.

Response: Attempts to capture and translocate baiji to more protected reserves have failed, mainly due to their very low abundance.

The finless porpoise subspecies, also endemic to the Yangtze River, is listed as endangered and its population is declining rapidly with fewer than 2,000 remaining.

Vaquita (*Phocoena sinus*), or Gulf of California porpoise

Status: Critically Endangered

Location: Northern Gulf of California, Mexico (a highly restricted range)

Size: 1.5 m and 50 kg

Population: Estimated at 500 in 1997, but the current estimate is about 150

Threats: Entanglement and bycatch in gillnets.

Response: Declaration of a refuge over much of its known range; some compensation to commercial / artisanal fishers to reduce fishing pressure; improved management to prevent entanglements has been identified as essential for the vaquita's survival.

Hector's dolphin (*Cephalorhynchus hectori*)

Status: Endangered South Island subspecies; Critically Endangered North Island subspecies

Location: Endemic to New Zealand coastal waters

Size: 1.5 m and 55 kg

Population: South Island subspecies estimated at 7,200 and the North Island subspecies at about 110.

Threats: Entanglement in gillnets; pollution; vessel strikes; disease; habitat modification and boat disturbance from dolphin watching tours.

Response: One declared sanctuary and four new sanctuaries proposed; restrictions on fishing activities to reduce bycatch, and developing acoustic pingers for use on gillnets.

Endangered great whales

North Atlantic right whale (*Eubalaena glacialis*)

Status: Endangered

Location: North Atlantic

Size: Up to 17 m and 90 tonnes

Population: Western North Atlantic population (from the Gulf of Mexico to Iceland) estimated at about 300-350. Eastern North Atlantic stock likely to be functionally extinct. Current mortality rates exceed sustainable levels, and the species appears to be in decline.

Threats: Almost extinct by the early 20th century due to commercial whaling. Current threats: ship strikes; entanglement in fishing gear; mineral exploration; coastal runoff.

Response: Excluded from commercial whaling; ship traffic management arrangements in some areas.

North Pacific right whale (*Eubalaena japonica*)

Status: Endangered

Location: Coastal waters of Japan, Korea and Russia (western stock), with small numbers in the Gulf of Alaska and the Bering Sea (eastern stock)

Size: Up to 17 m and 90 tonnes

Population: No reliable estimates, but probably in the low hundreds or less for the eastern stock.

Threats: Historic threats from intensive commercial whaling in the 19th century and illegal Soviet whaling in the

1960s, particularly of the eastern stock. Current threats: entanglement (western stock); development of oil leases in the Bering Sea (eastern stock); ship strike; noise; pollution and climate change.

Responses: Excluded from commercial whaling.

Blue whale (*Balaenoptera musculus*)

Status: Endangered

Location: Cosmopolitan. Three recognised subspecies: Northern Hemisphere and Southern Hemisphere true blue subspecies, and a pygmy blue subspecies mainly in the Southern Hemisphere.

Size: Over 30 m and up to 180 tonnes

Population: Antarctic blue whale estimated at 150-840 in the early 1970s, increasing to 860-2900 by 1996. Now very rarely sighted in areas previously subject to whaling off South Georgia and Japan. Present status is poorly known.

Threats: Whaling reduced most blue whale populations by up to 99%; more than 350,000 blue whales were killed in the Southern Hemisphere from 1904 to 1967; more than 8,000 pygmy blue whales were also taken by illegal Soviet whaling after 1967. Feed almost exclusively on krill and thus particularly vulnerable to climate change impacts on the productivity of food webs.

Responses: IWC protections in the North Atlantic in 1955, the Southern Hemisphere in 1965 and the North Pacific in 1966.

Variable recovery rates among great whales

Some great whale species are showing signs of recovery from large-scale commercial whaling, but the status of some populations of these species has not improved or has become worse.

As some species of cetaceans exist as discrete and often genetically differentiated populations it is becoming apparent that recovering populations do not replace those that have been depleted.

This seems to apply to humpback whales and gray whales in particular.

Humpback whale (*Megaptera novaeangliae*)

Status: Vulnerable

Size: Up to 17 m and 35-40 tonnes

Location: Cosmopolitan. Highly migratory from winter tropical breeding and calving to summer polar feeding areas.

Population: Largely discrete Northern and Southern Hemisphere populations. The North Atlantic population estimate was about 11,500 in 1992-1993. The North Pacific population is estimated to include about 18,300 non-calves. The Southern Hemisphere estimate is 41,500 drawn from circumpolar surveys of the Southern Ocean from 1991 to 2004. Populations that migrate along either side of Australia have shown annual increase rates of around 10%. Other populations (from New Zealand, South Pacific, South Georgia and the southern Caribbean) have shown very little or no recovery.

Threats: Intensive 20th century whaling in the Southern Hemisphere killed more than 200,000 humpbacks, causing most populations to collapse. Illegal Soviet whaling between 1947 and 1973 killed more than 48,000 humpbacks, with over 25,000 humpbacks killed in waters south of New Zealand and Australia from 1959-1961. Current threats: entanglement in fishing gear.

Responses: Since the species was protected in the Southern Hemisphere in 1963, and globally in 1966, some populations have shown strong signs of recovery, while others remain heavily depleted. Due to their migratory patterns and behaviour, humpbacks are the focus of whale watching activities in many areas.



Humpback calf (*Megaptera novaeangliae*)
Photograph © Dan Burns, Southern Cross University Whale Research Centre

Southern right whale (*Eubalaena australis*)

Status: Downgraded from Vulnerable to Lower Risk (Conservation Dependent) as the species has shown signs of recovery.

Size: Up to 17 m and 90 tonnes

Location: A circumpolar distribution around Antarctica, spending summer feeding in Sub Antarctic waters, then migrating to temperate coastal breeding grounds in the Austral winter.

Population: Total estimated abundance of about 7,500 in 1997.

Threats: Commercial whaling in the 19th century almost caused extinction. Illegal Soviet catches in the 20th century further retarded recovery. Current threats: ship strikes, habitat degradation, climate change, pollution and entanglements, especially in the coastal waters of South Africa, Brazil and Australia.

Responses: Largely research, monitoring and habitat protection by individual range states, which could be better coordinated.

Gray whale (*Eschrichtius robustus*)

Status: Lower Risk Eastern Pacific stock, Critically Endangered Western Pacific stock

Size: 15 m and up to 35 tonnes

Location: Only two North Pacific populations remain: an eastern population that winters along the coast of Baja California, Mexico and migrates to summer feeding grounds in the Bering, Chukchi and Beaufort seas; a western population that feeds in summer in the Sea of Okhotsk and migrates to unknown breeding grounds, probably off southern China.

Population: The eastern and western populations are genetically and geographically distinct. The eastern population may have declined from about 29,000 to about 18,000 in the past decade. Based on 2007 estimates, the western population survives as a small remnant population of about 121 non-calves.

Threats: Historically, commercial whaling was a major threat. Current threats to the eastern population are: coastal developments affecting food sources; climate change; entanglements; ship strike; oil and gas exploration; indigenous hunting. Current threats to the western population are: fisheries bycatch; ship strike; directed hunting; oil and gas drilling in their only known feeding habitat off Sakhalin Island.

Response: Western gray whales are protected internationally.

Antarctic minke whales (*Balaenoptera bonaerensis*)

Status: Near Threatened

Size: 11 m and 9 tonnes, it is among the smallest of the baleen whales

Location: After breeding in the warmer waters during the Austral winter, Antarctic minke whales are known to migrate up to 5000km or more to feed in the highly productive waters of the Southern Ocean during the Austral summer. They are known to occur close to and in the Antarctic ice.

Population: The abundance of Antarctic minke whales is not well established, but there are likely to be several hundred thousand. Due to this uncertainty, much effort has gone into estimating the total population, and new information is expected to be presented at the 2008 International Whaling Commission Scientific Committee meeting.

Threats: Antarctic minke whales were largely ignored in the early days of commercial whaling, but as populations of other larger whales were successively depleted, minke whales were increasingly subject to commercial whaling from the early 1970s until the ban on all commercial whaling was put in place from 1985/86. However, since 1987, Japan has steadily increased its annual "scientific" whaling of Antarctic minke whales. Due to their proximity and dependence on the Antarctic, other modern threats are likely to include the impact of climate change on their food supply and oceanic changes.

Response: Southern Ocean Sanctuary established by the IWC in 1994. Research including long run sightings surveys coordinated by the IWC, to be expanded through an Australian-led Southern Ocean Whale research partnership a multi-disciplinary, coordinated research effort to determine how whales live within the dynamic Antarctic sea-ice environment.

KEY THREATS TO CETACEANS

Cetaceans are threatened by a wide range of natural processes and increasingly by human activities. Key threats include:

- Hunting and commercial whaling
- Fisheries activities including accidental mortality (bycatch), entanglement and deliberate culling
- Habitat degradation or loss from coastal development and associated pollution
- Noise disturbance and ship strike
- Disease
- Depletion of food resources; and
- Climate change.

When two or more of these threats operate simultaneously, the impacts can be compounded.

Historically, the greatest threats to cetaceans were from exploitation through hunting and commercial whaling. Commercial whaling over the past few hundred years resulted in massive reductions in the abundance and distribution of many species, and extirpation from some areas of their former ranges. Whaling initially focused on coastal populations of slow moving large species such as right whales, but as vessel construction and navigation skills improved, exploitation of pelagic whales increased, culminating in the killing of more than two million whales in the Southern Hemisphere during the 20th century. Many baleen whale species were reduced to less than 10% of their original abundance, and in some cases to less than 1%. In addition, large-scale illegal whaling into the early 1970s in the North Pacific, Indian and Southern Oceans retarded the recovery of some populations.

The impacts of this largely unregulated use of great whales are still apparent today, in the number of species and populations that remain threatened. Although most nations have ceased commercial whaling, some whaling continues under 'objection' to the IWC moratorium on commercial whaling that came into effect in 1986, or under 'special permit' whaling for ostensibly research purposes. In addition to exploitation of great whales, many medium-sized and smaller cetaceans have been hunted for hundreds of years. Drive fisheries for smaller cetaceans still occur in some regions, probably leading to substantial declines in some local populations.

The removal of millions of whales and smaller cetaceans that are important top order species in marine ecosystems is likely

to have profoundly affected the trophic balance in marine food webs. Removal of large numbers of top predators such as sharks and commercially important fish species is increasingly recognised as having consequences on marine ecosystems, in some cases leading to trophic cascades that have significant effects on species at lower trophic levels in food webs.

The extent to which removing millions of whales and other cetaceans has disrupted other important functional groups in marine ecosystems is largely unknown, but may lead to significant ecosystem changes and altered carrying capacities.

The global expansion of fishing activities since the 1960s to meet the demands of the rapidly expanding global human population has led to serial depletions of fish stocks in most areas of the world. This in turn has greatly increased the frequency and intensity of negative interactions between cetaceans and fisheries. Incidental mortality from fisheries, referred to as bycatch, is probably the greatest immediate threat to many cetacean populations (Table 3). The capture and death of millions of dolphins in the eastern tropical Pacific Ocean purse seine tuna fishery led to unsustainable mortality and significant declines in dolphin populations. Improved fishing methods and release of dolphins have substantially reduced bycatch mortality, but populations of spotted and spinner dolphins are not showing clear signs of recovery in some areas.

Every year many thousands of cetaceans also become accidentally entangled and die in coastal gill nets, drift nets, purse seine nets, long-lines, trawl nets, trap lines and other types of fishing gear, which are also a serious threat to non-target fish, turtles, and seabirds. Gillnet mortality is recognised as the major threat to the Critically Endangered vaquita and Maui's dolphin, the Endangered Hector's dolphin, and many other threatened cetaceans (Table 3). Other direct fisheries impacts include incidental capture for bait, and culling of cetaceans that are regarded as competitors for fisheries resources or to reduce damage to fishing gear.

Expanding human populations along most coastal areas of the world are increasingly modifying coastal environments, leading to habitat degradation or loss of critical habitats for some coastal cetaceans. Similarly, damming and other river modifications can degrade or eliminate freshwater habitats for river dolphins, prevent migrations and fragment populations into smaller isolated groups that face increased risk of local extinction.

Coastal development and industrialisation has contributed to increased aquatic and marine chemical pollution, physical pollution through increased sedimentation and turbidity,

Table 3: Summary of Recognised Threats to IUCN threatened species

Species (Populations)	Category	DIRECT HUMAN IMPACTS					INDIRECT HUMAN IMPACTS					INTRINSIC FACTORS			
		Fishing bycatch	Collision/ship strike	Boat disturbance	Harvesting for food	Whaling/harvesting for trade	Habitat loss	Water pollution	Climate change	Acoustic pollution	Changed prey/food base	Disease	Restricted range & dispersal	Poor recruitment/recovery	Inbreeding & low densities
Baiji dolphin	CRITICAL	Y	Y		Y	Y	Y	Y		Y	Y		Y		Y
Vaquita	CRITICAL	Y					Y			Y			Y		Y
Bowhead Whale (Spitsbergen stock)	CRITICAL							Y	Y						
Gray whale (NW Pacific stock)	CRITICAL	Y	Y	Y		Y		Y	Y		Y			Y	
Beluga whale (Cook Inlet subpopulation)	CRITICAL				Y	Y			Y					Y	Y
Hector's dolphin (Maui's dolphin subpopulation)	CRITICAL	Y		Y			Y	Y			Y				
Irrawaddy dolphin (Songkhla Lake subpopulation)	CRITICAL	Y					Y	Y			Y				
Irrawaddy dolphin (Mekong River subpopulation)	CRITICAL	Y		Y		Y	Y				Y				
Irrawaddy dolphin (Malampaya Sound subpopulation)	CRITICAL	Y						Y			Y				
Irrawaddy dolphin (Mahakam River subpopulation)	CRITICAL	Y	Y				Y	Y			Y				
Irrawaddy dolphin (Ayeyarwady River subpopulation)	CRITICAL	Y					Y	Y							
North Atlantic right whale	ENDANGERED	Y	Y						Y						
North Pacific right whale	ENDANGERED	Y	Y						Y						
Sei whale	ENDANGERED		Y			Y			Y						
Blue whale	ENDANGERED					Y		Y	Y						
Fin whale	ENDANGERED		Y			Y			Y						
Hector's dolphin	ENDANGERED	Y	Y	Y				Y							
Bowhead whale (Baffin Bay/Davis Strait stock)	ENDANGERED	Y	Y	Y	Y			Y	Y						
Bowhead whale (Okhotsk Sea subpopulation)	ENDANGERED								Y						
Blue whale (North Pacific blue whale stock)	ENDANGERED					Y			Y						
Common dolphin (Mediterranean stock)	ENDANGERED	Y					Y	Y	Y		Y				
Finless porpoise (Yangtze River subpopulation)	ENDANGERED						Y	Y		Y	Y				
Blind river dolphin	ENDANGERED	Y			Y	Y	Y	Y			Y				
Blind river dolphin (Ganges River dolphin subpopulation)	ENDANGERED	Y			Y	Y	Y	Y							
Blind river dolphin (Indus River dolphin subpopulation)	ENDANGERED	Y			Y	Y	Y	Y			Y				
Humpback whale	VULNERABLE	Y	Y			Y			Y	Y					
Beluga whale	VULNERABLE			Y		Y		Y	Y						
Sperm whale	VULNERABLE	Y				Y								Y	
Boto/Amazon River dolphin	VULNERABLE	Y					Y	Y							
Harbor porpoise	VULNERABLE	Y				Y		Y							
Bowhead whale (Hudson Bay-Foxe Basin stock)	VULNERABLE								Y		Y				
Blue whale (Pygmy blue whale subpopulation)	VULNERABLE					Y			Y						
Franciscana dolphin (Rio Grande do Sul/Uruguay subpopulation)	VULNERABLE	Y						Y			Y				

and noise pollution. Some chemical pollutants, such as oil hydrocarbons are directly toxic or may coat baleen feeding plates. Other persistent pollutants such as organochlorine PCBs are bio-accumulated and may reduce reproductive success through hormone disruption, or increase susceptibility to disease through impairing immune defences. Increased incidence of viral and bacterial diseases are being reported in cetaceans, including morbillivirus epidemics that have caused mass mortality in three dolphin species and pilot whales.

Noise disturbance can significantly disrupt normal behaviour and habitat use, as cetaceans are primarily acoustic animals, and underwater noise can mask their ability to communicate or damage hearing. Seismic testing, underwater explosions, and high intensity sonar can seriously disturb or harm cetaceans and in some cases have been associated with strandings of whales. The global expansion of shipping and increased boating activity along coasts and in rivers has increased noise disturbance and the incidence of vessels colliding with cetaceans. Vessel strike is now recognised as a serious threat to some cetaceans including the Endangered North Atlantic right whale.

Unregulated whale and dolphin watching tours may also potentially disturb cetaceans through increased noise from vessels and inappropriately close approaches. When well managed to avoid significant harassment and behavioural changes, these activities should be sustainable in the long-term. Given the rapidly increasing importance of this form of tourism, it is essential to regulate and manage interactions

with cetaceans carefully through tools that include controlling approach distances, and limiting numbers of vessels interacting with animals and the length of time spent with individuals or groups of whales and dolphins.

Climate change is an increasingly important threat to cetaceans, particularly for baleen whales and other animals that rely on krill. Global warming, resulting in the loss of sea ice, reduces the habitat available for algae used by krill as a food resource. Furthermore, the annual formation and melting of sea ice has profound effects on global ocean circulation, and primary productivity that underpins the productivity of polar marine ecosystems. Reduced productivity of krill and other prey could significantly constrain the recovery of whale and other cetacean populations from overexploitation. In addition, increased sea temperatures are likely to alter productivity and food resources in temperate and tropical marine ecosystems. The accumulation of carbon dioxide concentrations in the upper layers of oceans alters the chemistry of seawater by reducing its pH (a measure of the concentration of hydrogen ions). This 'ocean acidification' is highly significant because it will inhibit calcium carbonate calcification processes of ecologically important groups of phytoplankton and animals, which in turn are important food resources for fish and higher predators such as cetaceans. This process is predicted to particularly affect the Southern Ocean.



An entangled Humpback Whale (*Megaptera novaeangliae*) Photograph © Leighton De Barros Sea Dog Films

Values

HOW DO WE VALUE CETACEANS?

Historically, cetaceans were culturally and economically important because of the commodities obtained from them when dead: oil, bone, teeth and meat. By the late 20th century, these products had been replaced with more readily available alternatives. Now, appreciation is growing of cetaceans economic value for ecotourism industries, and their ecological value as a key part of the wild marine environment. When animals are valued as commodities, their value appears relatively easily estimated. However, when they are appreciated because of their existence or contribution to healthy ecosystems or society, estimating their value becomes more difficult and open to debate. Some estimation of the value of living cetaceans, combined with an assessment of their conservation status, should provide a clearer basis for making decisions that will affect their future status, the integrity of their marine ecosystems, and the capacity for future generations to enjoy them.

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People enjoy and experience living cetaceans in many ways. Active participation can occur from boats and aircraft or simply from a good spot on shore. More passive or vicarious enjoyment can be obtained by those without the direct opportunity or means to watch whales, dolphins and porpoises in the ocean, who appreciate cetaceans through books, and other media, and similarly value their existence.

A considerable research effort¹ over the last 30 years has answered several questions about cetacean watching:

1. What makes a successful whale watching industry?
2. How much whale watching is there and how is it distributed around the world?
3. What are the projected patterns of growth?



Bottlenose Dolphins (*Tursiops truncatus*)
Photograph © Christine Fury, Southern Cross University Whale Research Centre

MAKING A SUCCESS OF WHALE WATCHING

Whale watching is commercially beneficial for local communities, creating jobs and new businesses and adding a new dimension to community identity. Case studies indicate that there are several common factors influencing the development of whale watching:

- Environmental awareness has grown the market for whale watching among tourists, accompanied by media interest in accessible and iconic species
- Chance factors influencing the relative success of whale watching at competing locations include the environmental credentials of local celebrities and entrepreneurs
- The locality needs a market profile and local operators need to be involved in developing that profile
- Environmental accreditations and endorsements are valuable, as are appropriate regulations on the operation and expansion of the industry, to gain the confidence of potential customers.

It is important for whale watching to be commercially successful but it can be much more than that. In *A Blueprint for Dolphin and Whale Watching Development*, 2007, Hoyt noted the whale watching should aim to:

- Provide a prime recreational and educational experience that motivates participants to care about whales
- Add to scientific understanding of cetaceans
- Tell good, accurate stories about whales and their behaviour and encourage urban dwellers to develop their understanding of oceans
- Bring business, researchers, communities and conservation groups together
- Minimise adverse impacts of watching on whales
- Create financial incentives to conserve cetaceans and the marine systems on which they depend.

1 The most comprehensive global accounts of whale watching are studies by Eric Hoyt (Hoyt 1992, 1995 and 2001), the last of which was commissioned by the International Fund for Animal Welfare (IFAW). IFAW has commissioned a further global update that is scheduled for release in mid 2009.

THE DEVELOPMENT OF WHALE WATCHING

As early as the 1960s, a few countries were developing substantial whale watching enterprises. The industry has expanded significantly and by 2000 there were whale watching operations in more than 80 countries and territories.

More can be learned about the development of the whale watching industry by analysing its diffusion throughout the world. Using the World Bank definitions of high, middle and low income countries, the pattern has been that whale watching started in high income countries, and has progressively been taken up in countries with lower incomes. The following overview of past development and future trends is largely indicative – more confident projections will require further analysis and detailed country case studies.

Whale watching in high income countries

The USA hosted 48% of the estimated global total of 9 million whale watching trips in 1998. A second tier of three high income countries – Canada, Canary Islands and Australia – accounted for another 30%. A third tier of 37 high income countries hosted another 10% of global whale watching activity, bringing the total share of high income countries to 88.5% in 1998. The more significant members of the third tier are New Zealand, Ireland, the United Kingdom, Japan and Puerto Rico, each of which accounted for 1-2% of global whale watching.

On the available evidence, it is reasonable to say that the total number of people in high income countries who have experienced whale watching may now be in the order of 100 million, and growing at 10 million per year. A precise estimate requires information about the frequency of repeat visits, which is not generally available. If watching whales has affected these people's attitudes towards the marine environment, this represents a very large group with an interest in conservation.

Table 4 presents the available information on high income country whale watching since 1998. This is a small sample, dominated by countries in the Oceania region, but all six countries returned strong growth.

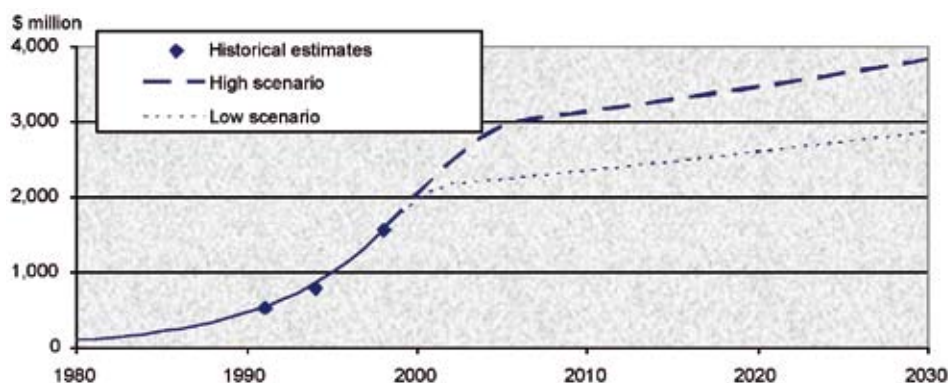
In Australian dollars (comparable to US dollars at the time of writing), by 1998, visitors to whale watching areas in high income countries were spending \$1.5 billion per year to watch whales. As shown in Figure 5, expenditure increased rapidly through the 1990s. Rather than forecasting these high rates of growth to continue indefinitely, it would be more reasonable to expect that whale watching will mature as a sub-sector of the tourism industry.

Figure 5 shows that for high income countries the industry may expand by 50% to 100% on its level in 1998 and then continue to grow at 1% per year as a mature industry. This suggests that, in Australian dollars, visitor expenditure on whale watching will grow to \$3-4 billion per year over the next 20 years.

Table 4: Recent growth of whale watching in 6 high income countries

Location	Whale watchers			Percentage increases	
	1998	2005	2007	1998-2005	1998-2007
Australia (ex. land based)	670,000		1,323,000		100%
French Polynesia	1,000	6,000		500%	
Guam	4,000	84,000		2,000%	
Iceland	30,300		104,000		245%
New Caledonia	1,700	4,900		190%	
New Zealand (international visitors only)	104,000		223,000		115%

Figure 5 Plausible futures for visitor expenditure on whale watching in high income countries (\$AUD million/year)



Whale watching in middle income countries

Middle income countries hosted one million whale watching trips in 1998, about 11% of the global total. Of the 25 such countries involved, South Africa (5.6%), Brazil (1.8%) Mexico (1.2%) and Argentina (0.9%) had the largest industries. The remaining countries are geographically diverse but have a disproportionate representation from South America and the island countries of the Caribbean and Pacific.

Whale watching had a delayed start in middle income countries but their share of global activity grew rapidly during the 1990s, from 0.8% in 1991 to 11% in 1998. To date little information on whale watching trends since 1998 has become available. However, trends from a sample of Pacific Island countries, such as American Samoa, Cook Islands, Federated States of Micronesia, Fiji, Niue, Northern Mariana Islands, Palau, Samoa and Tonga, reveal significant variations.

For those countries where whale watching was established before 1998 there has been enormous growth, as shown in Table 5 for Niue and Tonga. For the remaining countries, where enterprises were established after 1998, the Cook Islands and Samoa were the only ones to record more than minimal levels of activity by 2005.

Table 5: Recent growth in whale watching for Niue and Tonga

Location	Number of whale watchers in 2005	Increase, 1998-2005
Niue	300	440%
Tonga	9,000	290%

Studies of the development of whale watching in the Pacific have offered global lessons, by identifying some preconditions for growing whale watching industries: abundant cetaceans; tourist accessibility; and established

marine-based tourism operators. Early growth has significantly outstripped general growth in tourist activity. Further challenges are to:

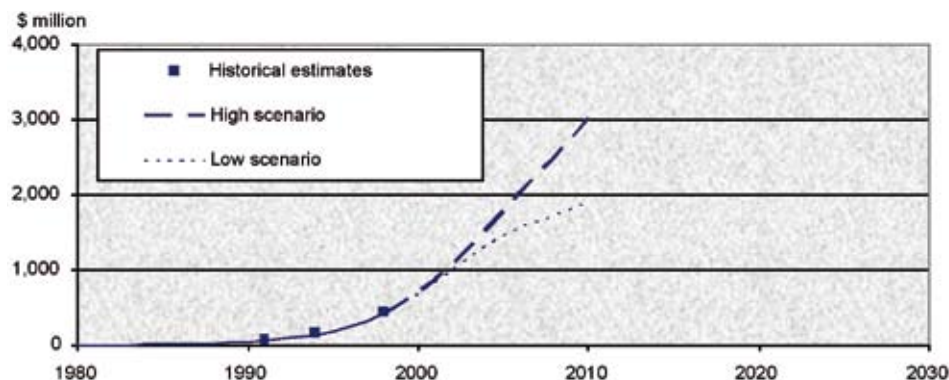
- Continue growing regional tourism markets and developing whale watching to complement existing tourism activity
- Better understand the seasonal cycles and behaviours of cetaceans
- Monitor the sustainability of whale watching operations, particular for evidence of excessive pressure from the number of tourism operators
- Jealously guard the environmental reputations of countries and regions
- Study the economic and financial dynamics of whale watching operations, including benefits to local communities
- Protect territorial waters from the adverse effects of human activity, such as pollution and fisheries bycatch.

Future growth

In 1998, whale watchers spent about \$200 million to watch whales in middle income countries, a 5-fold increase on 1991. It is reasonable to speculate that rapid growth has generally continued beyond 1998 and will continue for some time yet, given the relatively underdeveloped nature of the activity in 1998, indications of further growth since then, and the prospects for strong income growth in many of these countries.

Projecting this growth into the future is presented as an indicative scenario at Figure 6, with the 'mature' stage of this activity not yet in sight for middle income countries.

Figure 6 Plausible futures for visitor expenditure on whale watching in middle income countries (\$AUD million/year)



Whale watching in low income countries

Low income countries hosted 45,000 whale watching trips in 1998, about 0.5% of the global total. All 6 such countries involved were on the Indian sub-continent or in Africa. India was the most significant, with 0.3% of global activity. The distinct lack of information on developments in whale watching for low income countries over the last decade makes this a prime topic for future research, which could identify major potential growth markets for the activity.

WHAT HAVE WE LEARNT?

The success of a whale watching industry depends on a wide range of factors, including the presence of suitable cetacean species, a market profile, the capacities of local operators and regulation motivated by the long-term sustainability of the industry and the populations on which it depends. Some species that support whale watching industries are classified as threatened, such as the blue whale, northern right whale, southern right whale and

humpback whale. Protection measures that allow these species to recover will allow the industries that rely on them to expand.

The benefits of whale watching extend beyond direct market values. Successful whale watching may raise awareness, increasing our scientific understanding of cetaceans and create financial incentives for conservation of the marine environment.

Whale watching continues to be characterised by strong growth. Around 100 million people from high income countries have participated in whale watching at some time, a figure that is increasing by 10 million each year. Of the three main tiers for the distribution of whale watching worldwide, high income countries continue to claim a major share of the global activity, which may indicate that future growth could offer sustainable development opportunities in middle and low income countries, provided the right preconditions are in place.

Next Steps

Analysis undertaken for this progress report reveals that there is considerable knowledge of some aspects of cetaceans, their conservation status, the distribution of threatened species, threats to their viability and their value to society. It is also apparent that there is much more to learn.

Despite the long period of human interaction with whales, dolphins and porpoises, the conservation status for about half of all species is unknown, due to either a lack of current information or because they have not been formally evaluated. 2008 meetings of the IWC and the World Conservation Congress will provide more information to revise the status of some species. Changes to status findings will be reflected in the final report.

Mapping the global distribution of species has revealed that there are 'hot spots' containing up to 10 threatened species. The final report will present another layer to this distributional analysis by showing the overlap of species in each major region with a gradient indicative of the diversity of the region.

It is implicit from the brief account of threats presented in this report that more work should be undertaken to put in place effective threat mitigation strategies to ensure the viability of threatened populations. The broad delineation of 'hot spots' offers a broad target for internationally coordinated strategies. However, this would also require an assessment of the effectiveness of existing conservation strategies, such as marine protected areas, as the basis for such decisions. These issues will be considered further in the final report.

Estimating the value of cetaceans in the past 20 years has largely drawn from analyses of whale watching enterprises as part of tourism expenditures. These studies have been useful and have provided the basis for the analysis above. Further research is underway in this area and is scheduled for completion in 2009. However, such estimates have not addressed the existence value of cetaceans. Methodologies for assessing existence values will be considered in the final report.

