

continue in order to enforce marine wildlife protection laws. To fill this gap, Watson founded the Sea Shepherd Conservation Society.

To this day Paul Watson still leads both the ships and dedicated volunteers of the Sea Shepherd Conservation Society into seas worldwide where marine wildlife need protection. Watson is a relentless activist, a prolific author, an educator and a politician. While his contributions specifically to marine recreation and tourism are fairly indirect, he has done a tremendous amount for the protection of marine wildlife, both practically and in terms of attracting worldwide public and media attention to their plight.

Patrick T. Maher

**Wave** Waves are caused by the friction of wind passing over **water**, and are composed of a series of crests and troughs, the distance between crests being the length of the wave. Although waves are perceived as moving forward, they are actually the result of vertical, circular action. As the crest of the wave passes, water particles are momentarily pulled slightly forward, but the trough pulls them back, leaving them in essentially the same place. Ocean waves are caused by wind velocity, the length of time the wind has been blowing on the water and the distance the wind has blown across the water. When ocean waves approach the shore they encounter the increasingly shallower bottom and rise in height, coming to a crest as they strike the shore or **beach**. **Surfing** is popular in places where ocean waves tend to have a consistent height and spacing. Competitive surfing and other activities related to waves are popular tourist attractions.

**Related internet source**

Surfing information: <http://www.surfing-waves.com>

Nancy Chesworth

**Wave Wake:** see **Propeller Wash**

**WDCS:** see **Whale and Dolphin Conservation Society**

**Welfare of Captive Marine Wildlife**

**1. Mammals**

Interest in the welfare of captive marine mammals, particularly cetaceans, has burgeoned

over the past few decades (Bekoff, 2007). A growing and convincing body of research documenting indications of pain, fear, stress, sentience, suffering and emotion in a wide variety of animal taxa has challenged previously held assumptions about appropriate treatment of these animals. The implications of such research have been far-reaching, and are currently altering definitions of what is considered to be humane, justifiable, responsible, legal and ethical marine tourism in captive display facilities.

Defining 'welfare' involves more than simply looking at what an animal can endure or survive, although these are certainly important aspects of well-being (Frohoff, 2005). Assessment of welfare considers the mental, physical and physiological condition of the animal. The welfare of an animal refers to the degree of well-being or suffering that the animal experiences. Well-being refers to a positive subjective state while suffering refers to a prolonged or acutely negative subjective state. Well-being is threatened by, and suffering may result from, being subjected to aversive stimuli or from being deprived of certain stimuli or behavioural opportunities. Assessment of an animal's welfare is optimally conducted by combining behavioural data with physical and physiological data (Sweeney, 1990). Yet the science of marine animal stress is relatively new, and marine species often exhibit behavioural indicators of poor welfare in ways that are not easily observable to humans.

It is debatable whether marine animals can be maintained in public display facilities while maintaining their well-being, let alone survival (e.g. Rose *et al.*, 2006; Bekoff, 2007). A paper in *Nature* by Clubb and Mason (1993) assessed the welfare of 35 species of wide-ranging terrestrial carnivores in captivity and determined that: 'The keeping of naturally wide-ranging large carnivores should be either fundamentally improved or phased out'. They emphasized how animals such as **polar bears** disproportionately exhibited behavioural and physiological indicators of stress such as stereotypes, poor health and impaired breeding success. Since most marine mammal carnivores share the traits that the authors used to determine the species assessed in this study, these recommendations could reasonably be applied to large marine mammal carnivores.

Captive marine animals traditionally have been on display or used to perform trained behaviours for public performances (see Figs W1 and W2). More recently, the popularity of interactive programmes allowing tourists to **swim-with**, wade-with, touch-and-feed captive cetaceans has increased the international market for captures of these animals from the wild. With the proliferation of new facilities designed for tourists to interact with marine animals, regulation of these activities is typically in-existent or lags far behind their expansion, often resulting in the decreased welfare and fatal consequences for the animals (Frohoff and Peterson, 2003).

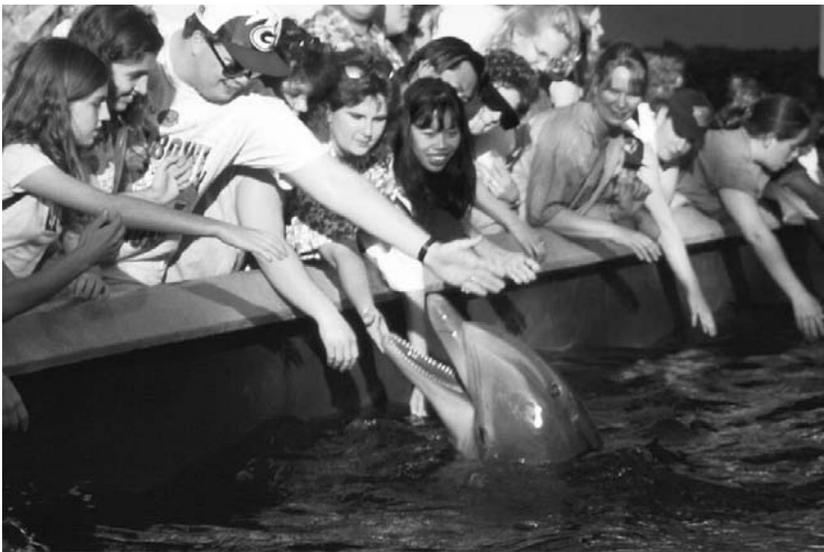
### Captivity

Capture from the wild and transport are stressful and dangerous for marine mammals – one study found that mortality rates of bottlenose **dolphins** increased by sixfold immediately after capture from the wild for approximately 5 days, and did not drop to the base captive mortality rate for up to 35–45 days (Small and DeMaster, 1995). **Sea otters** are notoriously susceptible to death due to shock during capture and transport. Recent studies found that survivorship rates in bottlenose dolphins and orcas through the

mid-1990s remained persistently lower than those of these species in the wild (although the differences ceased to be statistically significant for bottlenose dolphins) (Small and DeMaster, 1995). Although this indicates that dolphin husbandry has improved over the years, it has not done so to the extent that cetaceans live longer in captivity.

Most of the facilities examined in these analyses were in North America, where captive standards have generally been superior, staff are more experienced and where regulations are often stricter than in other countries. Rose *et al.* (2006) noted research revealing that the overall mortality rate of captive orcas was at least 2.5 times (and up to six times) as high as that of orcas in the wild. This is notable, considering that one would expect captive dolphins to live longer because of access to veterinary care, consistent food availability and protection from natural predators and other threats faced in the wild.

The data indicate that the stress associated with captivity is an important reason why cetaceans do not live as long or longer than their wild counterparts (Frohoff, 2005; Rose *et al.*, 2006). Numerous peer-reviewed publications have related capture and captivity with physiological and mental stress, evidenced by physiological indications of stress such as



**Fig. W1.** Captive dolphin displayed in a touching/feeding pool (photograph courtesy of T. Frohoff).



**Fig. W2.** Orca feeding programme at Marineland, Niagara Falls, Canada (photograph courtesy of M. Lück).

hormonal changes (e.g. elevated adrenocortical hormones), diminished immunological response related to stress, illness and death (Sweeney, 1990; Couquiaud, 2005; Frohoff and Peterson, 2005). Behavioural abnormalities include: (i) stereotyped behaviour; (ii) unresponsiveness; (iii) excessive submissiveness; (iv) excessive aggressiveness (directed towards conspecifics as well as humans, including their trainers – in one case involving an orca and the death of a trainer); (v) excessive sexual behaviour (towards people or other dolphins); (vi) self-inflicted trauma and self-mutilation; and (vii) stress-induced vomiting.

Causes of death associated with captivity include: (i) physical injury; (ii) shock; (iii) ingestion of foreign objects; (iv) ulcers; (v) heat stroke; (vi) exposure to chemicals; (vii) lack of escape from environmental hazards such as **hurricanes**; (viii) poor veterinary care; (ix) drowning due to **entanglement**; and (x) other dolphins or objects in the enclosure.

Also, several studies have documented that zoonotic disease transmission from humans to

marine mammals (and conversely, as well) is a serious issue, raising concerns about programmes in which the public are allowed physical contact with the animals (Mazet *et al.*, 2004). For example, in a report prepared for the US Marine Mammal Commission, a survey consisting primarily of people who worked with marine mammals was conducted. Fifty-two per cent had received a traumatic injury as a result of contact with marine mammals. Fewer respondents reported contracting an illness or injury as a direct result of marine mammal contact. For example, 23% of respondents associated a skin rash or other dermal condition with contact with marine mammals, and a much smaller number of people reported respiratory diseases and other illnesses.

Captive enclosures are often designed with regard to the appeal of human visitors (Couquiaud, 2005), and are inadequate to allow marine mammals to exhibit a normal range and quality of behaviours and social groupings. For example, most marine mammals have evolved for millions of years to be in naturally diverse and far-ranging environments in terms of both horizontal distance as well as depth. Artificial pools can present numerous challenges to marine mammals, including unnatural **sound** reflection – especially when loud music is played and audiences are encouraged to make loud noises, as is often the case. Chemical sanitation of the water in the pool can cause physical irritation to the skin and the eyes (Couquiaud, 2005). This is often evidenced in touching/feeding pools, where dolphins may not be able completely to open their eyes due to irritation from the extra chemicals in the water introduced to counteract the pathogenic **impact** of frequent contact with the public (Frohoff and Peterson, 2003).

Although many facilities are making attempts to improve their captive display enclosures and environmental enrichment, a proliferation of new and expanded facilities often reflects a lack of experience and low level of professionalism in the maintenance of these animals. Just a few examples include a facility in Japan where 73 polar bears were kept in underground cells only 1×2 m in size; dolphins confined to small swimming pools and even shallow holes dug into dirt and lined

with plastic without filtration systems; **sea lions** and dolphins used in travelling road 'shows', and **Arctic** animals such as polar bears and beluga **whales** not infrequently placed in abnormally hot or otherwise inappropriate climates (Rose *et al.*, 2006). Sea pens in which dolphins are fenced in natural water facilities might appear to be better for the dolphins in the public eye. Yet, the lack of environmental controls with respect to **water quality** and pollution, excessive temperatures, anthropogenic acoustic and physical hazards and climatic events often renders them inadequate for the maintenance of dolphins (Couquiaud, 2005; Dudzinski and Frohoff, 2008).

### *Interactive programmes*

Interactive programmes pose additional stressors to captive marine mammals (Bekoff, 2007). Yet, these programmes are proliferating due to huge tourist revenues, much of which are generated from the **cruise industry** that brings tourists to **dolphinaria** as part of their recreational itinerary. Bottlenose dolphins are most frequently used in these facilities, but beluga whales, **dugongs**, sea lions and other marine mammals are also used. The animals are typically afforded little or no control over the presence of human 'visitors' in their enclosures: increased noise, environmental stimuli and disruption of rest, as well as greater risk of disease, harassment and physical injury from the public are additional sources of stress, in addition to those already encountered in the captive environment (Frohoff, 2005).

All three of the studies conducted that focused on the behavioural indicators of stress in captive dolphin swim programmes, and one on touching/feeding programmes, used in these activities reported stress-related and avoidance-related behaviours in the presence of swimmers – some indicative of negative long-term physiological impacts. Some of these researchers recommended that these programmes be modified or prohibited (Frohoff and Peterson, 2003). Preliminary research assessing hormonal stress reactions of captive cetaceans to interactive programmes did not reveal extreme stress in the animals, yet further research is needed for this research to be

considered definitive. Attempts to use captive dolphins for therapeutic purposes are referred to as **dolphin-assisted therapy**. This activity has become increasingly popular and lucrative, and is responsible for the acquisition of additional captive cetaceans and the creation of new facilities in many areas around the world.

### *Implications of captures*

Capturing of marine mammals from the wild can do far more than harm the targeted animals. As has been noted by the US **National Marine Fisheries Service** and the **IUCN**, live captures can threaten the welfare and survival of remaining individuals and entire populations. As stated in an IUCN document, 'Live-capture activities involving bottlenose dolphins ... have taken place in various countries during recent years without adequate assessment of the wild populations and with little or no public disclosure of the numbers taken' (Reeves *et al.*, 2003).

For example, approximately 100 Indo-Pacific bottlenose dolphins in the Solomon Islands were captured for public display and export, despite a lack of scientific surveys of the local population. Captures of bottlenose dolphins have been increasing in Cuba and the Caribbean without the proper studies to document the impacts of such activity on the population(s). In fact, perhaps the most inhumane method of capturing cetaceans is the **drive fishery** in Japan, in which thousands of cetaceans have been pursued and killed with sharp objects such as knives and spears over many decades. In Taiji in 2003, almost 80 cetaceans were sold to captive dolphin facilities and in Futo, in 2005, a hunt of approximately 100 cetaceans was renewed with the stated intent of acquiring some individuals for public display. These 'drives' are clearly inhumane for the animals killed, as well as those who survive long enough to be sold to dolphinaria. Further, the payment of large sums of money for live animals appears to be perpetuating the continuation of this practice that might otherwise be discontinued.

### *Policy*

When regulations for captive marine mammals exist, they typically do not regulate the welfare

of captive marine animals closely enough to accommodate their complex and unique needs, and are generally poorly enforced (Frohoff and Peterson, 2003; Couquiaud, 2005). For example, there are rarely any special provisions enforced to protect dolphins from the additional sources of stress that are encountered in interactive programmes. However, some countries such as Chile prohibit the capture or confinement of cetaceans while others, such as Italy and Brazil, prohibit interactive programmes involving physical contact and public feeding. An increasing number of countries have denied permits for capturing dolphins from the wild or for importing or exporting marine mammals for public display (including Mexico, which has recently banned these practices).

### *Justification*

There do not appear to be any peer-reviewed studies documenting significant educational **benefits** of captive facilities or interactive programmes. Some professionals, such as members of the International Marine Animal Trainers Association, maintain that captive facilities provide a unique opportunity for viewing and learning about marine mammals. Others argue that such facilities are little more than aquatic circuses or petting-zoos, providing mostly recreational opportunities oriented towards cruise ship tourists and others seeking entertainment (see Frohoff and Peterson, 2003; Rose *et al.*, 2006).

The quality of information that is imparted to people who visit these facilities has been scrutinized for being misleading or even dangerous. For example, a US government biologist stated: 'There is growing concern that feeding pools, swim programs, and other types of interactive experiences with marine mammals in captive display facilities may perpetuate the problem of the public feeding and harassment of marine mammals in the wild' (Frohoff and Peterson, 2003). Further, the justifiability of **dolphin-assisted therapy** is highly controversial among scientists, as there does not appear to be any peer-reviewed research demonstrating that interaction with dolphins is any more therapeutic than interaction with domestic animals (Frohoff and Peterson, 2003; Bekoff, 2007).

The only comparison of viewing marine mammals in captivity with those in the wild appears to be in an editorial review conducted by two specialists in marine mammal-related tourism (Carlson and Frohoff, documented in Dudzinski and Frohoff, 2008). They concluded that: 'When conducted in a highly responsible and **precautionary** manner, viewing cetaceans in the wild seems to offer more benefits, and fewer negative impacts – to both cetaceans and people – than viewing them in captivity; and can also provide a uniquely important form of tourism and income to local communities'. They determined that the degree to which revenues obtained from captive facilities helped or hindered local businesses varied widely, in particular because facilities are sometimes owned by foreigners and few observable benefits are extended to local communities.

However, there is clearly a great need to reveal further implications about the welfare of marine animals used in all tourist-related ventures, both in captivity and in the wild. Future research will shed more light on the welfare of captive marine animals and how related **policy** and public opinion affects related tourist opportunities.

*See also:* Adventure Tourism, Advocacy, Aquaria, Cetacean, Code of Ethics, Cruise Community, Dolphin, Dolphinarium, Dolphin-assisted Therapy (DAT), Marine Park (Oceanarium), Polar Bear, Sea Otter, Swim-with-dolphins Tour/Programme, Whale Watching.

### **Related internet sources**

World and Dolphin Conservation Society: <http://www.wdcs.org>

The Humane Society of the USA: <http://www.hsus.org>

TerraMar Research: <http://www.TerraMarResearch.org>

Toni Frohoff

## **2. Non-mammals**

Captive display of numerous species of **reef** fish, **sharks** and rays, **penguins** and other marine birds, **invertebrates** such as octopus and starfish, and marine **turtles** are commonly accessible to tourists in facilities around the world. Numerous attempts to

exhibit marine species that could not survive in captivity have recently been attempted, with controversial results. Captive sharks have been particularly attractive to tourists, yet also raise serious concerns about related suffering and mortality. For example, the survival of the great white (approximately 200 days) and some other species of sharks (such as whale sharks) has been highly limited in **oceanaria**. Tourists to marine parks around the world are also afforded numerous opportunities to touch, swim with and feed numerous species of rays, sharks and other marine species.

More recently, the public has also been offered an ever-increasing amount of commercial opportunities to encounter sharks, rays (see **ray tourism**) and other marine species in the wild, which has raised concerns about **impacts** to individuals as well as on populations. For the less adventurous 'touch tanks' are a common sight, where it is typically invertebrates that may be touched and manipulated on a continuous and daily basis. Such practices contradict guidelines, such as those of the Canadian Council on Animal Welfare, that state that fish should be handled and taken out of the water only when necessary. However, such guidelines do not replace the lack of legislation providing for the protection and welfare of non-mammalian marine wildlife in captivity (see previous paragraph).

Recently, the welfare of non-mammalian marine animals such as fish, **crustaceans**, marine birds such as penguins, and invertebrates such as octopuses has also come under increased public and scientific scrutiny (Chandroo *et al.*, 2004a, b; Bekoff, 2007). A growing and convincing body of research documenting pain, fear, stress, sentience, suffering, a high level of intelligence and emotion – and even tool use and cultural traditions in a wide variety of fish and other marine animal taxa – has challenged previously held assumptions about appropriate treatment of these animals (see Fig. W3). This recent research is far-reaching and slowly beginning to impact considerations of tourist-related activities involving these animals with respect to their welfare, including that of their maintenance in captivity (Brown *et al.*, 2006; Bekoff, 2007). Consequently, definitions of



**Fig. W3.** This penguin, at an aquarium, has lost a large number of feathers and generally shows signs of stress and illness (photograph courtesy of M. Lück).

what is considered to be humane, justifiable, responsible, legal and ethical marine **tourism** are changing.

In fact, a new era of researchers, such as University of Edinburgh's Culum Brown, has written that fish are much more intelligent than most people think and that, in many areas such as memory, their cognitive powers match or even exceed those of 'higher' vertebrates, including non-human primates. Brown and the other authors of what may be the first book devoted to fish cognition write: 'The erroneous view that both behavioural and neural sophistication is associated in a linear progression from fish through reptiles and birds to mammals, is largely attributable to a heady mix of outdated and unscientific thinking' (Brown *et al.*, 2006, p. 1).

Recent research indicates that anatomically, physiologically and biologically, the pain system in fish is virtually the same as in birds and mammals. Fish cry out in both pain and

fear. Chandroo *et al.* (2004a, p. 225) found that teleost fish, such as those of the family salmonidae, ‘simultaneously demonstrate functional similarities and a level of cognitive development suggestive of sentience’. Their research on anatomical, pharmacological and behavioural states in fish signified that pain and the conscious experience of fear and psychological stress are likely to be experienced by fish in ways similar to those of other animals, including mammals – and that ‘fish have the capacity to suffer’.

Research has shown that marine invertebrates are also highly intelligent (Bekoff, 2007). Octopuses are considered the most intelligent of these, and have been equated to the domestic cat in this respect. They are able to open jars by learning from observation; they have exhibited behaviours described as play, and are known to escape from their **aquaria** either to socialize or eat other aquarium animals. Fear and stress in fish may be characterized through aversive behavioural responses, branchial responses, alarm pheromone-initiated responses and stereotyped behaviour (Chandroo *et al.*, 2004a). Highly publicized welfare concerns have been raised regarding great white sharks in captivity because of serious self-inflicted wounds associated with their bumping into the sides of the enclosure, as well as fatal attacks on shark tank-mates (in addition to unusually high mortality).

As Yue *et al.* (2004, p. 352) have stated: ‘Taken together with the recent evidence that fish can suffer in other ways, e.g. by experiencing pain . . . the results suggest that fish may be worthy of more moral consideration than they have had in the past’. Much of the research on welfare in fish has concluded that such implications should be taken into account for captive farmed fish, and recommendations have been made to include the welfare of fish used in **aquaculture**, many of which are relevant to fish captured for, and displayed in, oceanaria.

A US government-sponsored document (see web site below) noted that fish need to be maintained in a controlled environment, with limitations on stress and that: ‘Traumatized animals (including fish) may show signs of abnormal physiological, behavioural, and ecological responses’. Similarly, in 2005, The Canadian Council on Animal Care published

guidelines on the care and use of fish in research, teaching and testing. This document included recommendations for the design of captive environments to meet the physical and behavioural requirements of fish in terms of social groupings and other factors. This document acknowledged that the sociable behaviour of fish can be quite complex, and noted physiological signs of acute stress. However, none of these guidelines or recommendations are legally required or enforceable.

Despite the many scientific recommendations and guidelines, legislation protecting non-mammalian marine wildlife is virtually absent in most countries. In fact, the US Animal Welfare Act, and legislation in some other countries, specifically excludes captive birds, fish and other cold-blooded animals from protection.

See also: Advocacy, Aquaculture, Aquaria, Fishing, Fish Watching, Marine Park (Oceanarium), Ray Tourism, Shark.

#### **Related internet sources**

AWIC/USDA Information Resources on Fish Welfare: <http://www.nal.usda.gov/awic/pubs/Fishwelfare/fishwelfare.htm>

Canadian Council on Animal Care Guidelines on the Use of Fish: <http://www.ccac.ca>

Toni Frohoff

**West Indies** The term West Indies originated with **Christopher Columbus**, who thought that he had discovered the ‘Indias’ when sailing west. Today’s definition of West Indies is that of the **archipelago** of about 7000 **islands** found between North and South America. These islands form an arch from Florida to Venezuela, and stretch for over 2400 km. They establish the border between the **Caribbean Sea** and the North **Atlantic Ocean**. The West Indies are also known as the Antilles, with the Greater Antilles made up by the four larger islands: Cuba, **Hispaniola** (today’s Haiti and Dominican Republic), Jamaica and Puerto Rico; and the Lesser Antilles by the rest of the islands. The Lesser Antilles are further divided into the **Leeward Islands** and **Windward Islands**. In some cases, Trinidad and Tobago, Barbados and the islands off the northern coast of Venezuela are considered separate from the rest.