

# Report on Observations and Preliminary Assessment at Boudewijn Seapark Dolphinarium in Brugge, Belgium

*\* Condensed Version \**

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**Report to:**  
*Global Action in the Interest of Animals (GAIA) with the support of the World Society for the  
Protection of Animals (WSPA)*

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*Please note: These observations were not conducted as part of a complete or official inspection. They were made only as an expert on captive dolphin facilities and dolphin behavior (especially dolphin stress in captivity and in the wild) who observed as a visitor over a period of two days and a total of approximately four hours of nine captive bottlenose dolphin (*Tursiops truncatus*) viewing time. This report therefore intends to highlight areas that warrant further attention at this facility and the potential need for improvement. By no means should they be considered as a substitute for a proper inspection. The assessment is not exhaustive and only the most salient and observable points are summarized here – especially in this “Condensed Version”. Multiple, peer-reviewed, scientific references to substantiate the interpretations and assessments made here can be made available upon request as well as video and photo documentation of some behaviors.*

## INTRODUCTION

In June of this year, the Belgian Parliament voted to approve a resolution opposing the creation of new dolphinaria and establishing a special commission to review the current standards on captive dolphin maintenance (Doc 51 1430/004). **My observations at this facility and professional assessment support the Chamber’s statements about dolphins and the need for improvement in the protection of dolphin welfare in Belgium. This resolution is a highly commendable and much-needed due to the relative lack of current requirements and the unique needs of dolphins.** Based on the expressed intentions of the Parliament - and based on my expertise, observations, and best available science - I offer the following observations and assessments in this report to the government towards these goals.

Part of this document (see Table 1) evaluates this facility relative to **international standards and regulations** of the United States, the United Kingdom, Brazil, and Italy. It was impossible to determine the complete situation for the dolphins given the brief observation time and inability to see how they are maintained when the facility is closed to the public. **However, I was surprised to see what I determined to be so many critically dangerous and sub-standards occurrences of poor dolphin welfare in such a short period of observation time.**

All of these regulations specify *minimum* required standards, as opposed to situations that are necessarily optimal or best for the animals' psychological and physical welfare. It is clear that each standard or regulation was developed for a very convincing reason, or they would not have been implemented in the first place – especially given opposition to some regulations by many facilities. **However, even compliance with these minimum standards does not mean that a facility provides a suitable environment for the dolphins.**

Concerns about these issues are not limited to those of animal welfare advocates: scientists, government management agencies, and conservationists have also demonstrated many levels of concern about the impacts of captivity on dolphin individuals as well as populations in the wild. Therefore, this issue is one of global concern and impact. This is reflected in the numerous laws to protect them. I have provided a few examples of several countries and states that have legally prohibited the capture, captive maintenance, and/or public display of dolphins and have also completely prohibited or highly regulated physical interaction (including feeding and touching) of captive dolphins.

**It is my professional opinion that the welfare of the dolphins at this facility is poor and severely compromised and that this facility is unsuitable for meeting both the psychological and physiological needs of these dolphins.** All of these opinions are based upon current research done by myself and many other scientists and also veterinarians (references and video footage are available upon request).

**I observed numerous indications of physical dangers to the dolphins as well as psychological distress that are referred to in the scientific literature.** Scientists and veterinarians have published research associating such situations as associated with physical illness, emotional and physical suffering, and death in captivity.

Both psychological and physical stress are related - and in captive dolphins can manifest themselves through a variety of behavioral abnormalities and physiological parameters of poor health. **However, the literature on animal welfare reveals that merely the absence of what we know to be stress-related behaviors should *never* be used to confidently conclude that an animal is not suffering (e.g., Dawkins 1990, Frohoff 1994, 2000). This is particularly relevant to dolphins, whose morphology is not conducive to human-like indicators of stress and whose behavioral expression of suffering may only be exhibited through very subtle and unique behaviors (relative to terrestrial mammals).**

There are many sources of stress that wild animals encounter in the wild. However, bottlenose dolphins typically travel long distances and diverse environments (averaging daily movements of 33-89 km yet sometimes much more than this) and have complex environments. Even coastal dolphins in more shallow waters have the choice of multiple options regarding distance, depth, retreat, and diversity within their habitat (Wells *et al.*, 1999). **These animals have unique needs because for millions of years they have adapted to a complex three-dimensional aquatic environment in which they are far-ranging and have the opportunity for extensive individual choice of habitat, social associates, and a complex environment for exploration and movement. They are also extraordinarily intelligent (they have even been observed to exhibit culture and tool use), extremely acoustically sensitive, socially complex, and should be treated and viewed as the non-domestic/wild animals that they are - regardless of training or captive breeding.**

**Therefore, the physical and psychological stressors that dolphins face in captive environments are particularly extreme and abnormal because most do not even closely approximate their natural environment (e.g., Frohoff 1994, Waples and Gales 1990, Sweeney 1990) – but this facility in particular was particularly unnatural.** Further, well-being has been defined as a function of an animal's ability to control his or her environment (Wiepkema 1985). Not only can a lack of control lead to stress in an organism (Sapolsky 1990), but it is one of the most stressful events that an organism can encounter (Toates 1987). Dolphins, in particular, may be unusually and sensitive to both the lack of choice and the acoustic implications of their captive environments.

**Even subtle signs of physical or psychological stress that are chronic or particularly acute can have the greatest impacts on welfare, health and mortality. For example, research by Waples and Gales (2002, pg. 6, 7, 18) determined that “Even without overt aggression, the consequences of chronic stress from subordination and presence of a dominant individual can lead to loss of fitness, immunosuppression and even death.” “Unsuitable social groupings in captivity may lead to a higher incidence of disease, aberrant and aggressive social behaviors, and poor success in calf rearing”. They reported that “Social stress from association changes, loss of companionship, and partial ostracism during feeding sessions may have led to an increased susceptibility in illness”.**

**It has also been found in my own research and studies conducted by others that “For captive dolphins, instability in social relationships may occur when new animals are introduced or when individuals reach maturity and need to establish their position and relationships within the social group. Both instances have resulted in aggression, illness, and mortality among captive dolphins ...” (Waples and Gales, pg. 20). Consequently, I am particularly concerned about Boudewijn Seapark, because many of the dolphins here are juveniles and are in the process of maturing as well as being concerned about the introductions of new animals into this facility due to births or acquisition from other facilities.**

**My observations according to relevant scientific research revealed that many of the indications of stress observed in these animals may be ongoing and chronic and perhaps acute at times. Therefore, they are also likely causing harm to the physical health and survivorship of the dolphins. In very brief summary, this appears to be primarily due to (but not limited to):**

**a) The facility itself appears to be sub-standard compared to many facilities around the world that a) provide a more naturalistic environment for dolphins and b) adhere to international governmental regulations (see Table 1). This is especially notable due to the extreme noise and reverberation that is characteristic of an indoor facility (and in particular this one that plays such loud music and encourages loud sounds from the audience as well). In fact, this was the loudest facility of the many that I have visited – and in my opinion, is completely unacceptable and constitutes cruelty to these animals who are well-known for their exquisitely sensitive hearing. Further, the ambient and reverberating noises of the indoor facility pumps and maintenance systems may produce continuous noise from which the dolphins cannot escape. This is so important that the U.S. standards are in the process of being refined to**

specifically address the issue of noise for captive dolphins. UK standards specify, “Cetaceans shall be protected from harassment, including excessive noise” and Brazilian regulations state, “The structure and location of the enclosures must be such as to minimize the effect on the animals of excessive noise and any other causes of stress”.

**Similarly important are the inadequate light conditions that can create poor psychological and physical conditions.** These aspects of dolphin welfare are so important that they have been regulated in various countries (Table 1).

**One of the physical dangers for the dolphins I noted was an incident in which a gate between pools was being lowered while a dolphin was still underneath the gate (the gate was used to move dolphins from one enclosure to another). The dolphin appeared to be temporarily “pinned” between the gate and the bottom.** The dolphin escaped immediately and I could not see if the dolphin incurred any injury but he/she appeared to behave ‘normally’ afterwards. However, **this is unacceptable and significant, especially because it is not uncommon for captive dolphins to be killed by enclosure apparatus (drowning in ropes, getting stuck in gates and fences, etc.).**

**Also, adequate space for dolphin does not seem to comply with all international regulations and is also questionable** since it is not known whether large numbers of dolphins are kept in particularly inadequately small pools (Table 1). For example, Brazilian standards require that “The animals shall have access to the biggest aquatic space possible, for at least 90% of the day”.

**b) This facility unnecessarily jeopardizes both dolphin and humans safety due to risks of injury and disease in several ways. Children were encouraged to feed fish to the dolphins. Public feeding of dolphins has been documented in studies as being highly dangerous to both people and dolphins due to dolphins that injure people as well as disease transmission** (which is apparently common according to government reports and research). Table 1 notes that several countries legally and completely prohibit all touching and feeding of dolphins while others have special and specific regulations for such activities. Members of the audience were also encouraged to have physical contact with the sea lions who “kissed” audience members on the face. Sea lions have also injured people – even their own trainers – and can obtain diseases from these people which could be transmitted to the dolphins with whom they share the water.

Incidentally, a child appeared to be mildly, although perhaps temporarily, injured during part of a performance in which dolphins were trained to hit balls into the audience (sometimes at high speed, for long distances, and bouncing off the top of the enclosure), so this part of the show is not only hazardous for people, but also an example of how this performance is not one consistent with naturalistic education.

**c) Aggressive and submissive behavior was observed between dolphins. Even during my very short observation time of the dolphins in the “isolation pool”, I observed dolphins displacing (pushing), snapping at, and slamming into other dolphins. Such behavior in the confines of captivity, especially in a facility like this one, does not give the dolphins a reasonable opportunity to escape** – therefore such interactions have been scientifically demonstrated to be associated with suffering, illness and even death (see Frohoff 1993, Sweeney

1990, Waples and Gales 2002) (for example, one young dolphin reportedly died due to dolphin aggression at this facility).

**d) I was surprised that I observed so many other forms and frequencies of stress-related behavior in the short amount of time in which I observed the dolphins in the isolation pool, separate from the main performance pool. Such behaviors included stereotyped circling, stereotyped abrupt body slaps, chuffing (sharp and repetitive exhalations), repeated “begging”, stereotyped “beaching” outside of water, “open jaw” displays towards audience members, abrupt head ‘jerks’, and even doing the same tricks as the performing dolphins were requested to perform – but unlike the others, they were virtually ignored.** They were also typically deprived of the fish and toys to play with (balls), and attention from trainers that the other dolphins received during the performance (although I saw that some were fed shortly afterwards, although not all, even among those who appeared to be “begging”). (With respect to begging behavior, I note that it is likely more stressful for wild animals than for domestic animals, since the latter have had an opportunity to adapt to this behavior, as well as a human-controlled environment in general. Additionally, this and many of the other behaviors appeared during almost every performance, indicating that they are chronic and therefore more potentially harmful). My definition and interpretation of these behaviors was based on scientific, peer-reviewed research. I also tried to give consideration that these behaviors may be indicative of other internal states whenever appropriate.

**e) There seems to be a strong need for environmental enrichment** (at least from what I could observe in the isolation pool, but likely when the dolphins are not even on exhibit, based on available information). Exploration and object manipulation have been found to be extremely important to these highly inquisitive and intelligent dolphins, where in the wild, they inhabit a highly diverse environment and can exert a high degree of control. **So in such a bare environment in which they are forced to live, options for social, environmental, and social enrichment should be a priority – but I did not see evidence of that during my limited observations.**

**f) Other important regulatory aspects** such as air quality and ventilation, water quality, feeding, sanitation, social grouping and separation, attendants and employees, veterinary care, and emergency protocols were not possible for me to observe (however, I have reasons to believe that at least some of these aspects are inadequate based on conversations with staff members, etc.).

**g) The education in this facility is most questionable. The dolphin show appeared to be much more of a comedic circus act for the purpose of entertainment/recreation than an educational show** due to displaying dolphins in a subservient and exploitive manner and elicited to behave more like clowns than dolphins. In fact, there are data indicating that the “education” that visitors receive from shows such as these may actually be more detrimental to the public knowledge and respect for the natural history of these animals which could translate to a decreased concern for their protection in the wild (see below).

**h) By capturing or even importing dolphins already in captivity, whether wild-caught or captive-born, Belgium would still be responsible for contributing to a largely environmentally irresponsible and inhumane market in dolphin trade and capture.**

**Because of the poor conditions for dolphins in this facility, continuing to breed dolphins here could perhaps cause additional problems for the dolphins already in this facility and consequently be considered irresponsible for different reasons** (please see below for more information about this).

## **RECOMMENDATIONS**

Towards the recognition of the unique behavior and biological needs of dolphins based on current, objective, and best available science *and* the recent and progressive efforts on behalf of regulating Belgian officials to improve protection for dolphins, the following recommendations are offered to the Belgian officials regulating dolphins:

**1) To establish an official committee** for the sake of objectivity, knowledge of best and most objective available research, and representation of the public that is comprised of a) international scientists specializing in captive and free-ranging dolphin stress, behavior, health, and husbandry who are not financially or professionally affiliated with, or benefit from, the captive dolphin industry, b) at least one dolphin specialists from the Alliance of Marine Mammal Parks and Aquaria (AMMPA) or the European Association for Aquatic Mammals (EAAM), recognizing that their perspective would be linked with the financial interests of this facility/industry (preferably someone from Boudewijn Seapark who is most familiar with the dolphins there), c) relevant Belgian government officials, and d) a limited number of stakeholders who have demonstrated an interest in dolphin protection in Belgium/Europe.

This committee would be ideally charged with immediately developing the following recommended regulations/laws for enactment to:

**a) Require that a complete, regular, and unannounced inspection of the facility be required on a regular basis** conducted by experts in both dolphin behavior and veterinary care.

**b) Require the facility to provide quick and easy to implement enrichment improvements for dolphins to improve their welfare in the short term** involving behavioral/social (intra- and inter-specific with trainers) enrichment and environmental enrichment of dolphins. Subsequently, plans for more extensive improvements to the facility would ideally be required (assuming if the facility and dolphins are to remain – and even if this is not known, plans can be developed in the interim). The need for this was made evident upon my visit to the facility during which time it appeared that the dolphins were chronically exposed to many sub-standard and dangerous conditions. (Please see Recommendation #2 (below) for a brief summary of recommendations that appear to be the most warranted.)

**c) Dramatically improve the existing Belgian recommendations and create enforceable, comprehensive regulations for the maintenance of captive dolphins in Belgium** - *based at a minimum* - upon the most current and comprehensive regulations for captive dolphin maintenance implemented in other countries (even if only for the interim, if there is a possibility that the government decides to eventually close or phase out the facility due to reasons explained in item) (d) immediately below. In this way, the current Belgian recommendations would no longer be out of date and antiquated and would be based upon objective and best available research. The need for this recommendation is related to that directly above in item (B). **I would recommend**

**that regulations prohibit all physical interactive contact with dolphins, including dolphin feeding. I would also recommend that regulations require that any research or unusual procedures done on captive marine mammals (which has even the potential to induce suffering of any kind due to exposure to unusual types or levels of stimuli) be described and submitted in writing to the Belgian government and the recommended committee for approval and available to the public for review.**

**d) To draft and implement *enforceable* laws enacted to 1) completely ban additional facilities in Belgium and 2) require the closure of the existing facility if it cannot comply with improved and up-to-date standards.** Consideration of this recommendation is due to the concerns expressed about dolphin welfare and the addition of new facilities per the Belgian Parliamentary Resolution (Doc 51 1430/004) and the fact that the UK closed all existing facilities because they could not comply with implemented regulations (per recommendation “2”) above. If the existing facility cannot comply with modern regulations, the dolphins should be exported to more suitable permanent facility/facilities (perhaps those which are able to provide natural seawater, sunlight, and have objectively demonstrated minimum standards in a country that requires current and comprehensive regulations). (Legal requirement specifying that movement be approved to a *permanent* facility would be important, since Belgium would be responsible if dolphins were exported to ‘suitable’ facilities temporarily only to be subsequently exported to inappropriate and substandard facilities (as is sometimes done in the international dolphin trade). Also, the described committee (above) should also critically evaluate the potential for extensive rehabilitation, assessment, and potentially successful release to the wild). This recommendation is important to establish – and ensure - that it is the humane treatment of dolphins that is more important to the Country’s legislators than the profits received by the owners of this business (the dolphin-park).

**e) Implement an enforceable prohibition of the addition of new facilities in Belgium, the addition of new dolphins in Belgium (e.g., the existing facility) (including a ban on both captive breeding and imports of dolphins from other countries), as well as a ban on dolphins captured from the wild.** This is based, in part, on my brief observations as well as my previous research and that of others such as (Waples and Gales, pg. 20), who found that “For captive dolphins, instability in social relationships may occur when new animals are introduced or when individuals reach maturity and need to establish their position and relationships within the social group. Both instances have resulted in aggression, illness, and mortality among captive dolphins ...” (Waples and Gales, pg. 20). **Based on what I and other researchers have observed, I am especially concerned about the addition of dolphins at Boudewijn Seapark, because many of the dolphins here are juveniles who are maturing, already exhibiting what may be unusually high levels of stress related individual and social stress-related behavior, all of which would increase the likelihood of social problems, pathology, and even mortality.**

This latter recommendation would require the current male juvenile dolphin to be exported to another facility, but only when he is of an age which is considered humane and generally accepted as normal for male dolphins of this species to leave their mothers in the wild *and* to be exported to a facility that has objectively demonstrated minimum standards in a country that requires current and comprehensive regulations. The prohibition on captive breeding would serve to improve the quality of life – and the length of life - for existing dolphins in the facility so that there is neither social disruption, decreased available space for each animal, and so that the

need to transport any dolphins to another facility is not necessary - all of which have been associated with increased stress and risk of death in the scientific literature (see text within document).

**2. General facility recommendations (this is not an exhaustive list, but merely a sample of a few things that I believe should be done to improve conditions for the dolphins at this facility immediately):**

a) **Immediately mitigate the aforementioned problems as described throughout this document and respond to observed needs from proper inspections.**

b) **Provide behavioral, social, and environmental enrichment for the dolphins immediately based on best available science and expert recommendations.**

**3. Explore alternatives to captivity**

**Alternatives to captivity exist and may prove to be more educational, sustainable, profitable from a tourism perspective, pose fewer dangers to people and dolphins and represent a more sophisticated and responsible tourism that the public has reported growing preference for.** These alternatives include high-tech multi-media experiences including virtual reality opportunities, recordings of dolphin sounds, dolphin imagery, hydrotherapy with people relaxing in warm water, responsible marine animal watching in the wild, and various combinations of these. Some of these alternatives have shown demonstrable clinical results and safety for all involved - and are also relatively affordable - so that such therapy is not limited to the privileged.

Numerous studies (see Samuels *et al.* 2003 for discussion), suggest that people do not require close interactions with cetaceans in order to be satisfied by their experience – responsible dolphin and whale watching in the wild offers relatively unparalleled opportunities. However, to be humane, sustainable, and to be considered a form of environmentally responsible tourism, it is critical that cetacean-related activities do not impact individuals or populations and regulations protecting dolphins in the wild and in captivity are needed to accomplish this (Carlson and Frohoff, in press).

In fact, a recent study concluded that, *that when conducted in a responsible and precautionary manner*, viewing cetaceans in the wild offers more benefits, and fewer negative impacts, - to both cetaceans and people- than viewing them in captivity and can provide a uniquely important form of tourism and income to local communities (Frohoff and Carlson, in press).

**REGULATIONS PROHIBITING CAPTURE AND/OR CAPTIVE DISPLAY IN OTHER COUNTRIES**

This is not an exhaustive list but an overview of examples:

- “In Australia, the state of Victoria banned the issuance of permits for keeping cetaceans for display or collecting them for export.” (Corkeron 2002, pg. 194)
- There has not been a capture of bottlenose dolphins in the U.S. since 1989 (Corkeron 2002). The last captive display in the UK facility closed in 1991.

- This year, the country of Chile prohibited the capture of dolphins for public display and, also prohibits holding and export. Importation of dolphins for display is already prohibited. In fact, the new regulations prohibit commercial display of all sea lions, marine turtles and seabirds such as penguins.
- Dolphins have been given full protection in Nicaraguan waters following the recent passing of legislation that prohibits their capture and display. In 2005, the Netherland Antilles announced a prohibition of dolphin exhibits.
- Some countries such as Cyprus, Hungary, India, Argentina have prohibited or restricted imports. Others such as the Solomon Islands and Malaysia have prohibited exports. Several countries have banned the capture of cetaceans for public display from their waters; including Mexico, Australia, China, Thailand, The Philippines, Singapore, and Malaysia.

## **GENERAL INFORMATION ABOUT CAPTIVE DOLPHINS**

Given the mounting scientific data, it is clear that the concerns regarding the public display of captive dolphins cannot be dismissed as an emotional issue. Even the most rudimentary review of the published scientific literature demonstrates that capture and/or maintenance of captive dolphins presents a plethora of risks to the dolphins' psychological and physiological well-being and supports the connection between psychological trauma and physical impacts (some of which manifest into illness and death). Furthermore, it cannot be reasonably said that these concerns are limited to those of animal welfare advocates: scientists, government agencies, conservationists have also demonstrated many levels of concern about the impacts of captivity on dolphin individuals and populations.

**It is clearly debatable whether empirical evidence demonstrates that dolphins can be “successfully” held in captivity.** In fact, Rose (2004; p.2) has stated, “In short, the preponderance of hard evidence should lead to the conclusion that captivity and its related practices are ethically *and* scientifically unjustified”. And a recent paper in “Nature” assessed the well-being of 35 species of wide-ranging terrestrial carnivores and determined that “the keeping of naturally wide-ranging large carnivores should be either fundamentally improved or phased out” (Clubb and Mason 2003, p. 473). Since most marine mammals share the traits that the authors used to determine inclusion of species in this study, these recommendations could reasonably be applied to marine mammals as well.

Veterinarians and researchers have made it evident that there are measurable, physiological pre-pathological and pathological conditions related to psychological stress in dolphins (e.g., Waples and Gales 2002). Indicators of stress include changes in adrenal and thyroid hormones and changes in blood chemistry and cell characteristics (Dierauf 1990). Other indications of stress associated with captivity include suppressed immunology sometimes resulting in susceptibility to infections, decreased appetite, and the onset of other serious health problems, sometimes leading to death (e.g., St. Aubin and Dierauf 2001; Sweeney 1990). Other causes of death associated with captivity include physical injury, shock, ingestion of foreign objects, ulcers, heat stroke,

exposure to chemicals, poor veterinary care, and drowning due to entanglement or injury from other dolphins or objects in the enclosure.

**One of the most observable sources of stress in captive dolphins (in addition to transport – even for dolphins already in captivity) results from stressors from social interactions (e.g., Samuels and Spradlin 1995, Waples and Gales 2002). Sometimes these are evident in the injuries that some dolphins inflict on others, as evidenced by rake marks, bruising (harder to detect in dolphins), and even death. It is clear that dolphins can be aggressive with one another in the wild. But by forcing them to live in relatively miniscule captive enclosures, dolphins that normally would have the options to escape from more dominant, aggressive dolphins do not have this option so they may suffer psychologically and physically. The psychological stress of being exposed to dominance-related behavior in other dolphins can have long-term physiologically impacts (e.g., Frohoff 2000, 2004, Samuels and Spradlin 1995, Sweeney 1990, Waples and Gales 2002). In fact, Waples and Gales (2002, pg. 23) stated that “Enclosures should be as large as feasible and should be designed to allow individuals to, at the least, be out of the sight of others and not be trapped in corners.” They also said, “Active presence of aggressive individuals may put others at risk”.**

**Behavioral abnormalities in captivity include stereotyped behavior; unresponsiveness; lack of appetite, excessive submissiveness or aggressiveness, excessive sexual behavior (towards people or other dolphins); self-inflicted trauma (e.g., obsessive cribbing/biting on objects, sometimes to the point where teeth are worn down); stress-induced vomiting, consumption of foreign objects (dolphins known to be “nervous” seem to do this more) (e.g., Defran and Pryor 1980; Sweeney 1990). Submissive behaviors such as retreat and avoidance have been associated with intimidation by other dolphins, especially in captivity where dolphins are forced to remain in contact with more dominant and aggressive animals (Sweeney 1990, Waples and Gales 2002).**

For example, it has been well-established by Wells *et al.* (1998) and others that bottlenose dolphins typically travel long distances (averaging daily movements of 33-89 km yet sometimes much more than this), often dive deeply, and have large ranges. Even coastal dolphins in more shallow waters have the choice of multiple options regarding distance, depth, retreat, and diversity within their habitat. Dolphins are highly gregarious, with both consistent and fluid social relationships (Ballance 1990). For example, while the group size of bottlenose dolphins is highly variable, most groups average fewer than 10 to 25 individuals (Leatherwood and Reeves 1983). The gender, relative age, and identities of companions often change throughout an individual dolphin’s lifetime (Wells 1991). The behavior of free-ranging dolphins reflects a dynamic interplay of aggression, social and sexual interactions, alimentary and exploratory behavior, play, flight and predator avoidance, and assisted locomotion (Shane 1990). Aggressive behavior among wild dolphins is not uncommon (Norris 1967; Pryor and Shallenberger 1991). Large ranges in the wild allow for inter-individual separation that may serve to avoid agonistic encounters (Hediger 1955; Saayman and Taylor 1979). **The natural environment allows for dolphins to disperse from one another during social tensions, reducing the stress of direct conflict** (Frohoff 2004b, Sweeney 1990, Waples and Gales 2002).

## **CAPTIVE-BORN DOLPHINS**

Once in captivity, one might think that the welfare of dolphins born in captive facilities is better than that of dolphins in captivity that have already been captured from the wild. However, it appears that once already in captivity for at least several months, the welfare of captive-born dolphins may not be much better than for those captured from the wild. For example, **dolphin calf mortality in captivity is not much less than for calves born in the wild** (Woodley et. al 1997). **This number appears especially disturbing since one would expect that captive-born calves would exhibit higher survival rates since they have veterinary care and protection from natural predators. However, sources of mortality for captive-born calves in captivity include exaggerated aggression from other dolphins (including the calves' mothers) and poor maternal skills and these are likely related to captive-related stress.** In fact, according to GAIA's report (see references), at Boudewijn Seapark, one of the calves was apparently died in the midst of an aggressive encounter between the calves' mother and another female. It is an important fact that dolphins – even captive-born and well-trained – are wild animals and are not domestic by any generally accepted definition of the word. Therefore, captive-born dolphins may be just as susceptible to the stresses of captivity as those born in the wild.

#### *Acquisition of Already Captive Dolphins*

**Even the importation/acquisition of dolphins already captured from the wild – and still those who were born in captivity - can result in depletion of wild dolphin populations** by contributing to the increased market demand for additional dolphins captured from the wild, despite advances in captive breeding. Thus, such acquisitions would still be contributing to additional captures, likely from areas in which dolphin populations are already being depleted without sufficient research on the impacts of such captures on the populations (such as “non-detriment” findings as required by The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)).

**Furthermore, importation of any dolphins (captive-born or otherwise) into Belgium** would contribute to the scientifically documented increased risk of death (which increases six-fold following transport, even for dolphins already captive (as described elsewhere in this text). **Additionally, the welfare and survival of the existing dolphins at Boudewijn Seapark would be put at additional risk by additions or removals of dolphins** since the social stability of the current group would be disrupted which has been shown to increase the likelihood of psychological and physiological stress and likelihood of mortality (Waples and Gales 2002) (the exception to this is the separation of a dolphin that has been shown to repeatedly or notably exert domination or harm to other dolphins). Therefore, by capturing or even importing dolphins already in captivity or captive-born, Belgium would likely be accountable for contributing to – and supporting -an environmentally irresponsible and inhumane market in dolphin trade and capture.

Direct capture from the wild and transport are inarguable stressful and dangerous for dolphins – even those who have already been captured from the wild and have been in captivity – yet are transported. Physiological indications of stress associated with capture and captivity include elevated adrenocortical hormones (St. Aubin and Geraci 1988; Thompson and Geraci 1986). And Small and DeMaster (1995a) found that mortality rates of captured bottlenose dolphins shoot up six-fold immediately after capture (and did not drop down to the base captive mortality rate for up to 35-45 days).

### Direct Capture from the Wild

Capturing dolphins from the wild can do far more than harm the individuals captured – it can threaten populations, many of which are already depleted. In fact, this is why concerns about captive marine mammals have not only been expressed by animal welfare advocates but also by conservationists and population biologists. The capture of even a few animals can result in the death or injury of many more dolphins, since the capture activities involve intensive harassment of a group or groups. In addition, it negatively impacts already depleted dolphin populations by removing breeding (or otherwise important) members from the group (Buchanon 2004, NMFS 1989, Reeves *et al.* 2003, Reaves and Mead 1999, Wiles 2004).

## **SURVIVORSHIP OF CAPTIVE DOLPHINS**

**As summarized in the animal welfare section in this document, quantity does not necessarily indicate quality. However, although the ability to survive and reproduce are certainly incises of welfare, these are certainly only among the most extreme examples of quality of life and the absence of suffering. In the wild, “Female common bottlenose dolphins live to more than 50 years and some males have reached 40-45 years of age.”** (Wells and Scott 1999). “The reproductive life span for *Tursiops truncatus* is prolonged: females up to 48 years of age have since given birth and raised young” (Wells and Scott 1999). The maximum documented age of bottlenose dolphins in captivity is 46 years (Reaves and Mead 1999). Age for of maturity varies but “females typically reach sexual maturity at 5-13 years, sexual maturity for males tends to occur at 9-14 years.” (Wells *et al.* 1990).

**The studies on captive dolphins have demonstrated higher annual mortality rates and shorter life spans in captivity. “The lifespan (longevity) of whales and dolphins in captivity is generally shorter than that of cetaceans in the wild”** (Mead and Gold 2002, pg. 38). Capture from the wild and transport are inarguable stressful and dangerous for dolphins. Physiological indications of stress associated with capture and captivity include elevated adrenocortical hormones (St. Aubin and Geraci 1988; Thompson and Geraci 1986). And Small and DeMaster (1995a) found that mortality rates of captured bottlenose dolphins shoot up six-fold immediately after capture (and did not drop down to the base captive mortality rate for up to 35-45 days).

Two of the most recent and well-respected studies (Small and DeMaster 1995b and Woodley *et al.* 1997) determined that **survivorship rates in bottlenose dolphins through the mid-1990s remained persistently lower than in free-ranging animals** (although the differences were no longer statistically significant). **Although this indicates that dolphin husbandry has improved over the years, it has not done so to the extent that dolphins live longer in captivity. This is notable, considering that one would expect that captive dolphins would live longer because of access to veterinary care, consistent food availability, and protection from natural predators and other threats faced in the wild. Further, most of the facilities examined in these analyses were in North America where captive standards have generally been better and regulations stricter than in other countries.** And new facilities with less experienced staff are generally regarded as having reduced husbandry success with their dolphins as compared to facilities with more experienced staff.

**Consequently, the data indicate that the stress of captivity is a significant reason why cetaceans don't live as long or longer than their wild counterparts.** As discussed in detail in various publications (e.g., Aubin and Dierauf 2001; Curry 1999; Frohoff 1993, 2004; Mayer 1998; Sweeney 1990; Waples and Gales 2002), capture and captivity has often been related to physiological and mental stress in cetaceans that has often been associated with behavioral abnormalities, illness, diminished immunological response, and mortality. In fact, it is not uncommon for facilities to routinely administer ulcer medication and antibiotics (Sweeney 1990).

## **BENEFITS OR DANGERS TO HUMANS (INTERACTIVE PROGRAMS, DOLPHIN-ASSISTED THERAPY, RISK OF HUMAN DISEASE AND INJURY, AND EDUCATION)**

**In summary, there do not seem to be any scientifically documented benefits of captivity on dolphins. Although some dolphin facility professionals theorize that allowing captive dolphins to interact with members of the public may provide a form of stimulation to alleviate boredom, there is no evidence of this of which I am aware. On the contrary, there is much evidence that members of the public sometimes inadvertently injure, frighten, or be unintentionally cruel to dolphins. The argument that people become educated about dolphins in captivity has yet to be scientifically demonstrated (see below) and may not serve to inspire people to protect dolphins in the wild as is often claimed by the captive public display industry.**

### **Education?**

Captive facilities often maintain that captive dolphins not only educate people but also motivate them to protect them in the wild. However, I am not aware of any *peer-reviewed*, scientific research that demonstrates the educational value of captive dolphins or interactive programs. However, I have heard it said that the 'save the whales' movement was possibly the largest animal conservation movement in the world and it was accomplished without people seeing whales in captivity, let alone swimming with them.

If anything, it has been increasingly argued that exhibiting dolphins in captivity serves more as a form of entertainment than a vehicle for increasing respect for these animals and their environment and may even impart a misleading image of them (Bekoff 2002). There is growing concern that a false and potentially harmful message is imparted to the public by displaying marine mammals in captivity. It may teach people by example that marine mammals are not inextricably linked to their natural environment from where they have evolved and to which they belong – and therefore foster little – if less - respect for their natural environment. Public display of captive dolphins may also serve to advocate a message of dominance and even cruelty to wild animals – since as the public become accustomed to seeing these oceanic animals in tanks, they may 'learn' that it is acceptable to treat them as domestic or circus animals and thereby decrease their respect for them as wild animals that are an important part of an ecosystem.

Studies have found that visitors have also expressed that viewing – or having contact with - marine mammals in captivity is sometimes a disturbing experience for them because of their concerns for the animals living in confined and unnatural conditions (e.g., Kellert 1991; 1999). Furthermore, since it is not uncommon for captive dolphins to exhibit aggressive and sexual

behaviors towards people, people interacting with them (especially children) can have very negative experiences.

A preliminary study in the U.S. conducted by a Stephen Kellert of Yale University (1999; pg. 18) determined that “some four-fifths of the national sample believed zoos and aquariums should not be permitted to display marine mammals unless major educational and/or scientific benefits resulted, a finding nearly identical to that reported in a 1991 study of the Canadian public”.

Providing the public with opportunities to touch or feed marine mammals can also result in harassment and dangerous behavior towards wild dolphin populations. For example, a biologist with the U.S National Marine Fisheries Service has 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, p. 67).

At an educational conference, the (then) President of the Zoological Society of Philadelphia stated in a speech that “*The surveys we have conducted ... show that the overwhelming majority of our visitors leave us without increasing either their knowledge of the natural world or their empathy for it. There are even times when I wonder if we don’t make things worse by reinforcing the idea that man is only an observer of nature and not part of it.*” (Donaldson 1987).

From the limited data, one evaluation concluded that the educational benefits of responsible whale and dolphin watching in the wild including formal educational programs clearly outweigh those obtained in captivity and do not carry the same risks of imparting unnatural images and exploitive educational messages about cetaceans (Carlson and Frohoff, in press). Existing data suggest that watching dolphins and whales in the wild can “foster more appreciative and concerned attitudes toward whales” (Kellert 1999; pg. 16). When conducted responsibly and when including a formal educational program, these tours educate people about the importance of maintaining the habitat of these animals and inspire greater involvement in conservation efforts (IFAW 1997). Socio-economic benefits of whale watching to local communities also appear to be superior to those of captive facilities, although a rigorous comparative analysis has yet to be conducted.

### **Research**

Does the research on captive dolphins really contribute to their protection in captivity or in the wild? There appears to be only a very small percentage that directly contribute to the protection of dolphins (e.g., Rose 2004) . Also, does the research entail potential suffering of any kind due to exposure to unusual types or levels of stimuli or procedures? I recommend that this information should be submitted in writing to the Belgian government and available to the public for review.

### **Interacting with Captive Dolphins**

The number of facilities which use captive dolphins to interact with paying members of the public are increasing in many parts of the world – although they are also being prohibited in other countries. They are a common reason for dolphins being captured from the wild ... or being purchased from breeding programs, sometimes using wild-caught dolphins. It has been

demonstrated repeatedly that dolphins and humans encounter risks of illness, injury, and even rarely, death from interacting with cetaceans (as will be briefly described below).

Too frequently, a most fundamental question is overlooked - *how do these encounters affect the dolphins* – the individuals as well as the populations? The commercialization of captive dolphins – especially those used in ‘swim with the dolphin programs’ - has resulted in a surge of exploitation of dolphins internationally. In the process, dolphins are being captured from the wild, harassed, harmed, and even inadvertently killed – just so that people can be close to them. These programs may seem harmless from the surface. But when you go below the surface – you can see that they cause dangers to people, dolphins, and the environment. As a result, they have become highly controversial among scientists, regulatory agencies ... as well as animal protectionists and conservationists.

**Interactive programs with captive dolphins present additional stressors and risks to dolphins in addition to those they already are forced to encounter in captivity.** Dolphins are typically afforded little or no control over the intrusion 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 danger.

*“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 ... ”.*

(United States National Marine Fisheries Service Agent quoted in Frohoff and Peterson 2003, p. 67.)

Public and scientific concern about the welfare of dolphins used in these programs, as well as captivity in general, has been increasingly highlighted in articles in tourist publications such as National Geographic Traveler Magazine, the title of which reads, “A Flap over Flipper”: Caribbean islands are rushing to accommodate tourists dying to swim with dolphins. But are the dolphins dying?

### **Feeding and Touching Programs**

The only research yet conducted on feeding/touching programs determined that the welfare of dolphins – as well as humans – is seriously compromised in these programs (Frohoff 2003; Maas 1999). As a result, the authors of this study recommended that all interactive programs involving public feeding and touching captive marine mammals be prohibited.

Even when people interact with dolphins from outside of the pool and in facilities that are often considered among the best in the world, humans often become injured just by touching dolphins from the outside of the pool. In a recent report (WDCS and HSUS 2003), *Biting the Hand that Feeds: The Case Against Dolphin Petting Pools*, it was written that "...[M]edia reports and historic government records reveal a range of serious injuries caused to visitors by captive dolphins in interactive programs, including cuts, bruises, broken bones, bites and rakes. Because of the sheer size of dolphins and their concentration in petting pools, abrupt movements and occasionally aggressive competition for food can put visitors at risk of physical harm."

### **Legal Standard on Touching Dolphins**

Italian regulations specify "..., nor must they [the dolphins] come into physical contact with the public. During demonstrations, there must be continuous surveillance to prevent visitors touching the specimens ..." (A,III,38).

UK regulations state: "Precautions must be taken to prevent visitors transmitting any pathogens to the animals." (15, H (b))

### **Legal Standards on Public Feeding of Captive Dolphins**

UK standards state: "Feeding by the public shall only be permitted on veterinary advice and must only be done in the presence and under the supervision of at least two experienced, uniformed staff. Only food supplied by the establishment may be fed to animals." (9, FO (d))

Italian regulations state: "The dolphins may not be fed by the public, nor must they come into physical contact with the public. During demonstrations, there must be continuous surveillance to prevent visitors touching the specimens or throwing objects into the tanks." (A,III,38).

Brazilian regulations state: "The visiting public will be forbidden to feed the animals; ..." (Chapt. IX, Art. 12, Sec. VIII).

### **Swim Programs**

Only three studies of captive swim programs have been published and one study of petting/feeding pools has been conducted and all three studies indicate that these programs are not humane for dolphins and can be dangerous for people. My study, which was conducted at one facility in the United States, found that captive dolphins directed behaviors towards swimmers that were related to stress and aggression (Frohoff 1993; Frohoff and Packard 1995; Frohoff and Benson 1996). A second study conducted at four facilities in the United States observed similar high risk behaviors and found that captive dolphins frequently behaved submissively to swimmers even when the swimmers were small in stature, minimally mobile, and did not behave aggressively (Samuels and Spradlin 1995). These studies both observed obvious stress-related behaviors in dolphins that were related to potentially long-term negative physiological effects. We also note that these studies were carried out in U.S. facilities which are often considered to be superior to those found elsewhere in the world.

Recently, a study on captive swim programs in New Zealand observed that dolphins spent significantly more time in a "refuge" area where human swimmers were prohibited during swim programs than during times in which there were no swimmers in the enclosure (Kyngdon *et al.* 2002). This indicates that the dolphins may have been actively avoiding swimmers. Consequently, all of the studies conducted of these programs observed various stress-related behaviors indicating that these programs may have both short- and long-term negative psychological and physiological effects on the participating dolphins.

### **Legal Standards on Swimming with Captive Dolphins**

Italian standards state that: "Swimming with the dolphins is prohibited, with the exception of the trainer. The vet, biologist and carer are permitted to get into the water with the dolphins for the purposes of caring for them and inspecting the structures. Other individuals may be authorised,

for scientific purposes only, by the CITES Management Authority, having heard the opinion of the CITES Scientific Authority” Italy (I, III,37).

U.S. Regulations for swimming with captive dolphins are detailed in Section 3.111 of their standards.

### **Dolphin-Assisted Therapy (DAT)**

With regard to dolphin-assisted therapy, there does not appear to be *any* peer-reviewed research demonstrating that interaction with dolphins is any more therapeutic than interaction with domestic animals. Dolphin-assisted therapy is highly controversial in the scientific community. Perhaps it is only more lucrative and glamorous than therapy involving domestic animals. Given the risks to both human and dolphin participants, many researchers question the justifiability of dolphin-assisted therapy and have written critiques of claims made about these programs (e.g., Marino and Lilienfeld 1998; Iannuzzi and Rowan 1991). Ironically, even the founder of DAT, Dr. Betsy Smith (see below for details), has chosen to discontinue DAT and now only works with and teaches about therapy using domestic animals (Smith 2003).

### **Dangers to Humans**

Marine mammals are wild animals and unpredictable, even when well trained. There is also a very real potential for disease transmission to humans. Thus, interacting with captive dolphins poses a true danger to humans (e.g., Frohoff 2004b). Even trainers with extensive experience with the dolphins with whom they have worked have been seriously injured (Norris 1967; Defran and Pryor 1980). In one study, 52 percent of respondents reported marine mammal-inflicted injuries and more than a third of the injuries were considered severe (Mazet *et al.* 2004).

Disease transmission is also a serious concern, since dolphins carry diseases that can be transmitted to humans (and conversely, as well) (Buck and Schroeder 1990; Geraci and Ridgeway 1991; NMFS 1990; Mazet *et al.* 2004). In a recent report to the U.S. Marine Mammal Commission, it was found that 23 percent of respondents of those who physically interact with marine mammals (which consisted primarily of workers) reported a physical ailment suspected to be related to their contact with the animals. Respiratory diseases such as tuberculosis were reported in roughly a fifth of marine mammal workers (Mazet *et al.* 2004)

## **SUMMARY OF RELEVANT REFERENCES**

*\*Due to time constraints and since this is a condensed and preliminary report, all cited references are not listed or not listed completely, but are available upon request.*

Information from GAIA was obtained primarily through their 2005 report, “De tragiek achter de glimlach van de dolfijn/La tragedie derriere le sourire des dauphins”.

Ballance, L.T. 1990. Residence patterns, group organization, and surfacing associations of bottlenose dolphins in Kino Bay, Gulf of California, Mexico. Pages 267-284 in S. Leatherwood and R. R. Reeves, eds., *The Bottlenose Dolphin*, Academic Press, Inc., San Diego, California.

Brensing, K., Linke, K. 2003. Behavior of dolphins towards adults and children during swim-with-dolphin programs and towards children with disabilities during therapy sessions. *Anthrozoos* 16(4):315-331.

Brensing, K., Linke, K., Todt, D. 2003. Can dolphins heal by ultrasound? *Journal of Theoretical Biology* 225: 99-105.

- Carlson, C. and Frohoff, T.G. In press. Opportunities for responsible marine mammal ecotourism in Costa Rica in *Marine Mammals of Costa Rica*. The University of Florida Press, Miami.
- Corkeron, P. 2002. Captivity. Pages 192-196 in W.F. Perrin, B. Wursig, and J.G.M. Thewissen, eds., *Encyclopedia of Marine Mammals* in Academic Press, New York.
- Dawkins, M. S. 1990. From an animal's point of view: Motivation, fitness, and animal welfare. *Behavioral and Brain Sciences* 13:1-61.
- Defran, R. H., Pryor, K. 1980. The behavior and training of cetaceans in captivity. Pages 319-364 in L. Herman, ed., *Cetacean Behavior: Mechanisms and Functions*. John Wiley and Sons, New York.
- Dierauf, L.A. 1990. Stress in Marine Mammals. *CRC handbook of marine mammal medicine: Health, disease, and rehabilitation*. CRC Press, Boston, MA.
- Donaldson, W.V. 1987. Welcome to the conference on informal learning in P. Chambers, ed., *Proceedings of the Conference on Informal Learning*. Philadelphia Zoological Garden, Philadelphia.
- Dudzinski, K.M. and Frohoff, T.G. 2004. Pages 500-510 in M. Bekoff, ed., *Dolphin Behavior and Communication*. *Encyclopedia of Animal Behavior*. Greenwood Press, Westport, Connecticut. 1274 pages.
- Frohoff, T.G. In press. Stress in Captive Marine Animals. *The Encyclopedia of Tourism in Marine Environments*, CABI Press.
- Frohoff, T.G. 2004. Stress in dolphins. Pages 1158-1164 in M. Bekoff, ed., *Encyclopedia of Animal Behavior*. Greenwood Press, Westport, Connecticut. 1274 pages.
- Frohoff, T.G. and Dudzinski, K.M. 2001. Odontocete-human interactions: Practical management. Page 85-87 in *Viewing Marine Mammals in the Wild: A Workshop to Discuss Responsible Guidelines and Regulations for Minimizing Disturbance*, 14th Biennial Conference on the Biology of Marine Mammals, Vancouver, B.C., 28 November, 2001.
- Frohoff, T.G. 2000a. The Dolphin's Smile. Pages 72-73 in M. Bekoff, ed., *The Smile of a Dolphin: The Emotional Lives of Animals*. Discovery Books, New York. 224 pages.
- Frohoff, T.G. 2000b. Behavioral Indicators of Stress in Odontocetes During Interactions with Humans: A Preliminary Review and Discussion. *International Whaling Commission Scientific Committee, SC/52/WW2*.
- Frohoff, T.G. 1996. Behavior of Bottlenose (*Tursiops truncatus*) and Spotted Dolphins (*Stenella frontalis*) Relative to Human Interaction. *Doctoral Dissertation*, The Union Institute, Cincinnati, Ohio.
- Frohoff, T.G., Packard, J.M. and Benson, R.H. 1996. Variation in whistle type and rate produced by captive dolphins relative to in-water interactions with humans. *Journal of the Acoustical Society of America* 99(4):2558.
- Frohoff, T.G. and Peterson, B. 2003. (Eds.) *Between Species: Celebrating the Dolphin-Human Bond*. Sierra Club Books/University of California Press, San Francisco. 361 pages.
- Frohoff, T.G. and J.M. Packard. 1995. Human interactions with free-ranging and captive bottlenose dolphins. *Anthrozoös* 8(1):44-54.
- Frohoff, T.G. 1993. Behavior of Captive Dolphins (*Tursiops truncatus*) and Humans During controlled In-Water Interactions. M.S. thesis, Texas A&M University, College Station, Texas.
- Hediger, H. 1955. *Studies of the psychology and behavior of captive animals in zoos and circuses*. Criterion, New York.

- Hughes, B. O., Duncan, I. J. H. 1988. The notion of 'ethological need', models of motivation and animal welfare. *Animal Behaviour* 36.6:1696-1707.
- Humphries, T. 2003. Effectiveness of dolphin-assisted therapy as a behavioral intervention for young children with disabilities. *Bridges*, Vol. 1(6): 1-9.
- Iannuzzi, D. and Rowan, A. N. 1991. Ethical issues in animal-assisted therapy programs. *Anthrozoös* 4.3:154-162.
- Kestin, S. 2004. Marine attractions: below the surface. *Sun Sentinel News*, Miami, Florida.
- Leatherwood, S., Reeves, R.R. 1983. *The Sierra Club Handbook of Whales and Dolphins*, Sierra Club Books, San Francisco, California.
- Marino, L., Lilienfeld, S. 1998. Dolphin-Assisted Therapy: Flawed Data, Flawed Conclusions. *Anthrozoös*: 11(4).
- Markowitz, H. 1990. Environmental opportunities and health care for marine mammals. Pages 483-488 in L.A. Dierauf, ed. *CRC handbook of marine mammal medicine: Health, disease, and rehabilitation*. CRC Press, Boston, MA.
- Mazet, J.A., Hunt, T.D., Ziccardi, M.H. 2004. Assessment of the risk of zoonotic disease transmission to marine mammal workers and the public: Survey of Occupational Risks. Final Report prepared for United States Marine Mammal Commission, Research Agreement Number K005486-01.
- Mead, J.G., Gold, J.P. 2002. *Whales and Dolphins in Question: The Smithsonian Answer Book*. Smithsonian Institution Press, Washington, DC.
- Norris, K. S. 1967. Aggressive behavior in cetacea. Pages 225-241 in C. D. Clemente and D. B. Lindsley, eds., *Aggression and Defense: Natural Mechanisms*. University of California Press, Berkeley, California.
- Oldfield, M. 1988. Threatened mammals affected by human exploitation of the female-offspring bond. *Conservation Biology* 2.3:260-274.
- Pryor, K., Shallenberger, I. K. 1991. Social structure in spotted dolphins (*Stenella attenuata*) in the tuna purse seine fishery in the Eastern Tropical Pacific. Pages 161-198 in K. Pryor and K.S. Norris, eds., *Dolphin Societies: Discoveries and Puzzles*. University of California Press, Berkeley, California.
- Reeves, R.R., Mead, J.G. 1999. Marine mammals in captivity. In J.R. Twiss and R.R. Reeves, eds., *Conservation and Management of Marine Mammals*. Smithsonian Institution, Washington, DC.
- Reiss, D., Marino, L. 2001. "Mirror self-recognition in the bottlenose dolphin: a case for cognitive convergence." *Proceedings of the National Academy of Sciences* 98 (2001): 5937--5942.
- Rose, N.A. 2004. Captive cetaceans: The science behind the ethics. Paper presented at the European Cetacean Society 18th Annual Conference, Kolmarden, Sweden, 29 March.
- Samuels, A. Bejder, L. Constantine, R., Heinrich, S. 2003. Swimming with wild cetacean, with a special focus on the Southern Hemisphere. Pages 277-303 in N. Gales, M. Hindell, and R. Kirkwood, eds., *Marine Mammals: Fisheries, Tourism, and Management Issues*. CSIRO Publishing, Collingwood, Australia.
- Sapolsky, R. M. 1990. Stress in the wild. *Scientific American*, January:116-123.
- Shane, S.H. 1990. Behavior and ecology of the bottlenose dolphin at Sanibel Island, Florida. Pages 245-265 in S. Leatherwood and R.R. Reeves, eds. *The bottlenose dolphin*. Academic Press, San Diego.
- Smith, B. 2003. The discovery and development of dolphin-assisted therapy. Pages 239-248 in T. Frohoff and B. Peterson, eds.: *Between Species: A Celebration of the Dolphin-Human Bond* in Sierra Club Books/University of California Press, Berkeley, California.
- St. Aubin, D. J., Geraci, J. R. 1988. Capture and handling stress suppresses circulating levels of thyroxine (T4) and Triiodothyronine (T3) in beluga whales, *Delphinapterus leucas*. *Physiological Zoology* 61.1:170-175

- Sweeney, J. 1990. Clinical Consideration of Parasitic and Noninfectious Diseases in Zoo and Wild Animal Medicine, pages 785-789 2d edition.
- Sweeney, J. C. 1990. Marine mammal behavioral diagnostics. Pages 53-72 in L. A. Dierauf, ed., CRC handbook of marine mammal medicine: Health, disease, and rehabilitation. CRC Press, Boston, MA.
- Toates, F. 1987. The relevance of motivation and learning to animal welfare. Pages 153-186 in P. R. Wiepkema and P. W. M. van Adrichem, eds., Biology of stress in farm animals: An integrative approach. Martinus Nijhoff Publishers, Boston, MA.
- Waples, K.A. and Gales, N. 2002. Evaluating and minimising social stress in the care of captive bottlenose dolphins (*Tursiops truncatus*). Zoo Biology 21:5-26.
- Wells, R.S. 1991. The role of a long-term study in understanding the social structure of a bottlenose dolphin community. Pages 199-226 in K. Pryor and K.S. Norris, eds., Dolphin Societies: Discoveries and Puzzles. University of California Press, Berkeley, California.
- Wells, R.S., Boness, D.J., Rathbun, G.B. 1999. Behavior. Pages 324-422 in J.E. Reynolds, III and S.A. Rommel, eds., Biology of Marine Mammals. Smithsonian Institution Press, Washington, DC.
- Wells, R.S., Scott, M.D. 1999. Bottlenose dolphins, *Tursiops truncatus*. Pages 137-182 in Handbook of Marine Mammals, Vol. 6 of the Second Book of Dolphins and Porpoises. Academic Press, San Diego, CA.
- Wiepkema, P. R. 1987. Abnormal behaviours in farm animals: Ethological implications. Netherlands Journal of Zoology 35.1(2):279-299.