
Dolphin Assisted Therapy

Can you put your faith in DAT?

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for WDCS, the Whale and Dolphin Conservation Society

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Dolphin Assisted Therapy: can you put your faith in DAT?

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Introduction: can you put your faith in DAT?

Dolphin Assisted Therapy, often known simply as 'DAT', is an increasingly popular animal-assisted therapy made available through a growing number of programmes around the world and marketed as offering a cure or respite from human illness or disability.

DAT involves two highly vulnerable groups of individuals. Firstly, the people undergoing the therapy are often children or adults with psychological or physical disabilities and/or emotional problems. Secondly, the dolphins used in DAT are either held in captivity or are part of a wild population and may suffer from confinement and/or human disturbance. This gives rise to a number of concerns about the impacts of DAT on people and dolphins.

In this report, WDCS asks whether there are any measurable benefits from DAT and, if so, to which element of the DAT experience can these benefits be attributed? For example: do dolphins possess a unique ability to heal with their ultrasound or sonar¹; are there any differences between interacting with a dolphin and with any other animal; and do dolphins elicit some kind of spiritual reaction that promotes a sense of well-being in human participants?

Proponents have claimed that DAT can be used to treat a whole range of physical and psychological conditions, including, but not limited to:-

Clinical depression, developmental apraxia, language development, speech development, attention disorders including ADHD, hearing impairments, Downs Syndrome, autism, cerebral palsy, chronic pain, cancer, stress, muscular dystrophy, spinal chord injuries, AIDS, brain injuries, post-traumatic stress disorder, anorexia, victims of sexual abuse, blindness, and disorders of the immune system.

Since there is no 'industry standard' to regulate or set criteria for what constitutes DAT, available treatments are extremely variable. DAT activities with captive dolphins include: interactions at the poolside, where a swim is offered as a reward for the completion of a set task; simply swimming with the dolphins either in their tanks or in a sea pen; dorsal fin rides; more structured interactions with dolphins whilst in the water; or even activities where the participant is made to feel that they are 'looking after' the captive dolphin, through feeding or other activities. Wild DAT interactions tend to be less structured and consist largely of swimming with dolphins in their natural environment. One of the consequences of this loose definition of DAT, and the lack of any official regulation of the practice, is that it has opened up the market for DAT programmes and facilities to proliferate across the globe with relative ease. Originating in the United States in the 1970s, DAT programmes are now available in a variety of different locations around the world; from Europe, to the Middle East, Asia, Latin America and the Caribbean.

¹ Dolphins emit echolocation sound waves by producing intense bursts of high frequency sound which function like the sonar of bats, bouncing back to them with detailed information about their environment.

How safe is DAT for people?

It is apparent from the evidence presented in this report that, before agreeing to participate in DAT, it is important that participants and their families evaluate the evidence for any potentially positive benefits to be gained from DAT and consider any potentially adverse implications, or risks, that there may be for the people participating in this type of therapy.

Risks associated with DAT

Aggressive behaviour by dolphins in captivity

The American Veterinary Medical Association recommends that for animal assisted therapies: *"animals should be selected on the basis of type, breed, size, age, sex, and, particularly, natural behavior appropriate for the intended use. Only animals with known medical and behavioral histories should be used, and medical and behavioral assessments should be performed prior to placing animals in a program"* (AVMA 2007).

In contrast to other animal-assisted therapies, captive dolphins are not domesticated animals and many have been captured from the wild. Swimming with dolphins in captivity is unusual in that it is one of the few commercial interactions between humans and potentially dangerous captive animals; where humans enter the animal's enclosure and where close body contact is encouraged. Interactions in captivity take place in a confined, artificial environment where dolphins are rewarded, usually with food, for their actions.

Contrary to the fact that dolphins can appear to display very friendly behaviour towards humans, a perception influenced by the apparent permanent 'smile' on their faces, Frohoff and Packard (1995) note that, in captivity, aggressive behaviour towards humans is not uncommon: *"During swim-with programs, human participants have been seriously injured as a result of aggressive and/or sexual dolphin behaviour directed towards swimmers... Aggressive behaviour has included, but is not limited to, biting, ramming with the rostrum, and slapping with flukes"*. Samuels and Spradlin (1995) also note the following behaviour displayed by captive dolphins towards swimmers in their enclosure: open mouth threat, hit, flinch, flee, abrupt-turn, rapid approach, jaw-clap, body-slam, push, head-jerk, tail-slap, abrupt rub and sexual behaviour. All of these types of behaviour by dolphins in captivity can be unpredictable and have the potential to cause distress and/or injury to swimmers. Their potential impact on physically or mentally disabled individuals should be considered particularly carefully.

Frohoff points out that unpredictable behaviour such as this is reportedly directed even at trainers, with whom the dolphins are usually familiar and have regular contact. Examples include charging, butting, biting, grabbing, dunking and holding the trainer on the bottom of the tank (Frohoff 2004, Defran and Pryor 1980, Sweeney 1990). Dr. Naomi Rose recalls her own negative experience during an in-water interaction with captive research dolphins (not trained to be submissive to humans) in which: *"They decided to take turns bullying me; one knocked my mask askew with her powerful tail while the other butted me in the ribs with her jaws, leaving me gasping for air"* (Rose 2003). Furthermore, pioneering dolphin trainer and researcher Karen Pryor (1990) noted in discussing *"Aggression-related behaviors"* that, in her view, *"any strike or blow – these are never accidental even in very small or crowded quarters"*.

The danger behind the 'smile'

In November 1999, the Bermudan Ministry of Environment reported that at least two people had been bitten during scheduled encounters swimming with dolphins in a facility in Bermuda. The bites were serious enough to require emergency hospital attention (Ministry of the Environment, Bermuda 1999). In August 2000, an 11-year-old child was bitten by a beluga she was interacting with at a marine park in Canada. The injury to her hand required stitches (Ananova 2000). In June 2003, a Japanese newspaper reported that a woman had sued a hotel in Taiji, Japan for injuries she sustained, including several broken bones in her ribcage and back, after a dolphin smashed into her during a swimming-with-dolphins encounter at the hotel (Mainichi Shimbun 2003). In 2006, a woman swimming with dolphins in a sea pen facility in Cuba was struck in the ribs by a captive dolphin and suffered a broken rib and a punctured lung (Stallard 2006).

The risk associated with interacting with these wild animals in captivity is often acknowledged either through disclaimers from the companies providing DAT, or through the terms and conditions of the agreement between the facility and the DAT participant or participant's family. For example, one centre in Turkey states under its

terms and conditions that: "... neither Mega Sport nor another sub-contractor or person has control over the dolphins or other similar animals. He alone [the customer/participant] is liable for risks and injuries or damage and any following risks or damage that may result".²

Potential for direct injury

Naturally aggressive behaviour between dolphins can take a variety of forms and may involve: chasing, pinning, ramming, hitting or biting an opponent (Samuels and Gifford 1997). Samuels *et al.* (2003) note that "*dolphin to human aggression sometimes resulted in such serious human injury as unconsciousness, a ruptured spleen, and broken ribs... or even death*".

In a review of the occurrence of stress-related behaviour in wild dolphins, behaviour recorded included: "Slaps and Splashes" against the water, forcefully "Pushing" the swimmer and "Bite" (Frohoff 2000). It is also possible that non-aggressive behaviour may accidentally pose a threat to human swimmers; for example, by inadvertently pushing swimmers out to sea, or too far from their boat (Webb 1978). Dolphins are sociable animals and some dolphin species, particularly bottlenose dolphins, are very large. These animals may be unaware of their comparative strength and could, therefore, accidentally injure or frighten human swimmers.

Potential for disease transmission

The American Veterinary Medical Association notes, in relation to the general use of animals in therapy programmes, that: "*A wellness program should be instituted for animals participating in AAA, AAT, and RA programs to prevent or minimize human exposure to common zoonotic diseases such as rabies, psittacosis, salmonellosis, toxoplasmosis, campylobacteriosis, and giardiasis. Need for specific screening tests should be cooperatively determined by the program's attending veterinarian(s) and physician(s). Animals should also be appropriately immunized and licensed*"³ (AVMA 2007). Since there are no specific regulations for DAT in any country where this therapy is offered, there is no indication that such guidelines to protect the health of humans interacting with dolphins in captivity are being met. Furthermore, DAT participants are often physically vulnerable and may experience weakened immune systems as a result of their illness or disability.

In captivity, the potential for disease transmission between dolphins and humans may be even greater than in the wild⁴. There are a number of opportunistic bacteria found in dolphins that can cause disease in humans, through inhalation or wound contamination (Buck and Schroeder 1990 and Patterson 1999). Research conducted in the United States, on individuals who come into regular contact with different species of marine mammals, revealed that 50% had suffered an injury and 23% reported having a skin rash or reaction as a result of that contact (Mazet *et al.* 2004). Although captive dolphins may swim in a chemically-controlled environment, there may also be instances when the dolphin may breathe, defecate or urinate near the person participating in the therapy.

Brucellosis is a serious, debilitating disease in humans and an important cause of abortion and sterility in domestic animals (Tachibana *et al.* 2006). Evidence of infection from *Brucella* species has been found in wild marine mammals stranded on the shore (Foster *et al.* 1996, Maratea *et al.* 2003) and in captive dolphins (Tachibana *et al.* 2006). Tachibana *et al.* note that anti-*Brucella* antibodies have been detected in cetaceans and pinnipeds around Europe and North and South America, as well as the Arctic Sea. In addition, *Brucella* infections have now also been identified in dolphins in the South Pacific⁵.

Other potential threats to DAT participants

Other considerations for human safety in DAT carried out in the wild relate to the environment in which the encounter occurs and include wave conditions, undertow, rips, tidal considerations, sea temperature, boat traffic and dangers from other animals such as box-jelly fish, sea snakes and sharks. In addition, any potential distress caused by the experience should also be considered. Breusing (2004) notes, from observations of DAT with captive dolphins in Florida, that: "*many patients hesitated to interact with the dolphins in the first sessions because they were scared by these huge, unknown animals*".

2 <http://www.delphintherapie.net/index.asp?langid=10000&location=11> (Accessed 06.09.07)

3 Explanation of acronyms: Animal Assisted Activities (AAA), Animal Assisted Therapy (AAT), and Resident Animals (RA).

4 Contact between humans and dolphins is closer and more intense in the captive environment and captive dolphins may have more compromised immune systems than their wild counterparts.

5 Serum samples taken from 58 Pacific bottlenose dolphins (*Tursiops aduncus*) held captive in the Solomon Islands were tested for antibodies to *Brucella* species (Tachibana *et al.* 2006). Anti-*Brucella* spp. antibodies were detected in 53% of the samples taken from the Solomon Island dolphins. These results suggest that *Brucella* spp. or a *Brucella*-like organism are present in the Pacific bottlenose dolphin populations of the Solomon Islands (Tachibana *et al.* 2006).

What are the dangers for dolphins?

Many of the potential threats to dolphins involved in DAT are similar to those associated with swim-with-the-dolphins programmes in general. These include risk of injury to the dolphins, risk of disease transmission between swimmers and dolphins, disruption of natural behaviour and stress. For captive animals, these threats also include the negative impacts of confinement in captivity, which may have followed a stressful capture from the wild.

The lack of independent oversight of DAT can impact on the quality of life of the dolphin participants. For example, one centre in Turkey offering DAT housed both a bottlenose dolphin and a beluga in a very small enclosure which reached temperatures well beyond their natural range.

Stress in captive dolphins

The pressure on dolphins in captivity is likely to be further compounded by their use in DAT. This is due to the stress associated with people that the dolphins do not know entering their environment and the animals' inability to escape from human contact, be it visual or physical. This may increase the likelihood of aggressive behaviour. Acts of aggression displayed by captive dolphins towards people swimming with them may also have detrimental impacts on the dolphins themselves. As a precaution, these animals may be removed, either permanently or temporarily, from the DAT or swim-with programme. This may, however, be perceived as punishment by the dolphins, for an action which may have been inadvertent or even provoked.

In addition, it is also possible that captive dolphins (including those used in DAT), which are subjected to the constant psychological stress of submission⁶, either to other swimmers or to their trainers, are vulnerable to significant health problems as a result (Sweeney 1990). This may also have implications for the dominance hierarchy within the captive dolphins' social group, which could result in increased distress and injury for weaker or less aggressive dolphins as they battle to establish their place in the hierarchy (HSUS/WSPA 2006). Stress in dolphins can result in stomach ulcers, increased susceptibility to disease and even death (Curry 1999).

Potential for disease transmission and methods used to prevent infection

Just as dolphins are able to transmit disease to humans, the reverse is also true. Dolphins are particularly vulnerable to upper respiratory tract infections, which may be transmitted from humans (Kennedy-Stoskopf 2001 and Dunn *et al.* 2001). These problems may be more acute for captive dolphins, exposed to daily contact with humans, but may also apply to dolphins interacting with infected humans in the wild. As part of normal maintenance, dolphins in captivity are subjected to a wide range of medical procedures and chemical treatments, which they would not encounter in the wild. As William Johnson, a welfare consultant, puts in his seminal book on captive animals: *"From the moment of capture every single individual must be kept afloat by injections of synthetic vitamins, broad spectrum antibiotics, fungicides and hormones. Without them they would live no longer than a few days, succumbing to infections and malignant parasites as stress ravages their natural immunity"* (Johnson 1990).

Conservation implications and other threats

Pressure on wild dolphin populations

Dolphins are social animals and, in the wild, typically live in complex social groups. Regular interaction with humans may hinder the development of certain types of natural behaviour and the development of important social bonds between dolphins.

Disturbance to wild populations is a consideration associated with any dolphin watching or swim-with-the-dolphins activity. For example, research on bottlenose dolphins in New Zealand (Constantine 2001, Constantine *et al.* 2004 and Lusseau 2003) is starting to provide hard data that illustrate the cumulative impact of several tourist operations, vying for the attentions of wild dolphin populations.

It is also possible that swim-with-the-dolphins activities may influence feeding, breeding and other important behaviour and may even have an impact on the social structure of the pod. This may be of particular importance for bottlenose dolphins, where individual dolphins are believed to play a specific role within their social network (Lusseau and Newman 2004).

⁶ Taking up a submissive posture, or behaving in a submissive manner, to prevent any perceived confrontation.

Although regulations and guidelines for swimming with dolphins exist in some countries, research conducted in Australia strongly suggests widespread non-compliance with regulations by a significant number of tour operators (Scarpaci *et al.* 2003). There is also considerable concern that the promotion of DAT and swim-with-the-dolphins programmes in captivity may encourage the public to attempt to touch and feed wild dolphins. Such activities are potentially dangerous to both parties.

Pressure on captive dolphins

When members of the public are allowed to swim with or touch captive dolphins, there is considerable concern that humans can inadvertently damage dolphins' delicate skin with their nails or jewellery. For this reason, some of the more 'responsible' swim-with-the-dolphins programmes in the wild advocate a "look but don't touch" policy. In addition, very little is known about the psychological impacts of DAT on the dolphins themselves. The effect of repeating the same basic actions, day after day, on the social development of these complex animals is still unknown.

Brening (2004) notes that although there has been some research on the impact of DAT on human participants, prior to his research (Brening 2004, Brening and Linke 2004, Brening *et al.* 2003 and Brening *et al.* 2005), there were no specific studies undertaken on the impacts of DAT on dolphins. Brening's research indicates that the type of environment in which DAT is conducted may have a significant impact on both the effectiveness of the therapy and the stress incurred by the dolphins. This research also suggests that limited space results in a reduction of self-motivated attraction of dolphins toward humans (Brening *et al.* 2005) and that only one of five dolphins studied in a DAT centre in Florida demonstrated a preference towards "patients"⁷ (Brening and Linke 2004). Furthermore, the dolphins in this facility were found to avoid close interaction with human swimmers and tried to separate themselves as much as possible from the swimmers (Brening *et al.* 2005). Brening *et al.* further note that different types of enclosure may have a substantial impact on dolphin behaviour during DAT. For example, they note that a larger enclosure, which includes an area where the dolphins can retreat, appears to result in more positive interactions with swimmers.

The capture of live dolphins from the wild is undeniably stressful, often involving high-speed boat chases and very rough or violent handling of the animals prior to them being hauled onto a boat before confinement in shallow holding tanks. Captures can also be lethal and, in dolphins, result in a six-fold increase in mortality risk during and immediately after capture (Small and DeMaster 1995). Dolphins not selected but released from the seine nets commonly used for their capture may also suffer a similar increase in mortality risk. Furthermore, Small and DeMaster (1995) note that bottlenose dolphins incur a relatively high mortality rate for the first 60 days following capture. A major consideration associated with DAT is that its proliferation is leading to the further capture of wild dolphins, which also has significant conservation, as well as welfare, implications for individual dolphins and dolphin populations. As concluded in 2004 by the European Association of Zoos and Aquariums, "*Neonatal mortality is a major problem, rendering the total ex situ bottlenosed dolphin population so far not being self-sustaining*" (Van Lint *et al.* 2004).

Poor regulation of the swim-with industry and DAT

WDCS is not aware of any regulations governing DAT or swim-with-the-dolphins programmes in the countries where DAT is conducted. Swim-with regulations alone are also scarce, although the current marine mammal regulations in the Bahamas include specific requirements for interactive programmes and the Italian regulations on the maintenance of dolphins in captivity prohibit dolphins coming into physical contact with members of the public. Since the suspension of regulations governing dolphin interactive programmes in April 1999, there have been no specific operational requirements for swim-with-the-dolphins programmes in the United States, where some DAT facilities are located. Without such regulations, it is not possible for the authorities to enforce any operational standards on national swim-with and DAT facilities.

⁷ Dolphin trainers, therapists and participants have reported that dolphins interact differently with "patients" than they do with healthy individuals.

Scientific evidence that DAT works?

There are various theories as to how human/dolphin interactions affect humans psychologically and/or physiologically. These include: the effect of ultrasound on human tissue and cell-structure, alterations in brain wave patterns, psychosomatic effects, the effects of dolphin vocalisations working in the same way as music therapy, and so forth. However, in evaluating the possible effects of any therapy, it is imperative to also consider the myriad peripheral factors which may have an impact on the perceived benefits of the therapy. In the case of DAT, these include: the relaxing effects of water, positive social interaction with other humans, and the experience of a new environment.

Increased concentration = enhanced learning: a flawed hypothesis?

One of the key viewpoints promoted by many DAT practitioners is the theory that using dolphin interactions as a reward focuses the participant's attention, encourages concentration and provides exceptional motivation to stimulate learning (Nathanson 1989 and Nathanson *et al.* 1997). This rationale is based on the assumption that the desire to interact with dolphins is strong enough to encourage the participant to focus long enough on a task, set by the therapist, to give the required response and thus increase their attention span. Proponents of this theory suggest, therefore, that participants returning to regular therapy, following DAT, should exhibit enhanced concentration levels, which should allow more information to be processed and thus facilitate accelerated learning.

The main proponent of this theory, David Nathanson⁸, asserts that some children's learning difficulties are related to their inability to maintain attention, rather than their inability to process information. Thus, Nathanson advocates that enhanced concentration levels allow more information to be processed, resulting in accelerated learning (Nathanson 1989). He claims that his particular DAT programme, Dolphin Human Therapy (DHT), can significantly increase motivation, attention, gross and fine motor skills, speech and language. Nathanson suggests that two weeks of DHT can achieve the same - or better - results as six months of conventional physical or speech therapy. Consequently, he advocates DHT as a very cost effective method for treating people (Nathanson *et al.* 1997).

In contrast, however, an independent review of Nathanson's work (Marino and Lilienfeld 1998) concluded that his research is fundamentally flawed, both in the research technique used and the conclusions drawn. Marino and Lilienfeld's criticism begins with Nathanson's theoretical rationale, claiming that it is "*dubious at best*". Nathanson claims that attention deficit "*explains why disabled populations have such difficulty with learning and motivation*" (Nathanson *et al.* 1997). However, Marino and Lilienfeld note that this notion is inconsistent with current scientific understanding of almost all of the disorders that Nathanson claims to have treated successfully. Marino and Lilienfeld ask:

"Would Nathanson and his colleagues have us believe that children with Cri-du-chat syndrome, for example, would have essentially normal IQs if only they could learn to focus their attention? Moreover if the attention deficit hypothesis were correct, it would follow logically that individuals with attention deficit-hyperactivity disorder, (ADHD), for whom attention problems are a core deficit, should be severely intellectually disabled" (Marino and Lilienfeld 1998).

Marino and Lilienfeld claim that Nathanson's research is based on a 30-year-old hypothesis which is no longer consistent with modern thinking. Furthermore, they note that despite Nathanson *et al.* basing their findings on improving the attention deficit problems of the participants, no attempt is made to measure their attention either before, or after, treatment. Marino and Lilienfeld refer to the studies being based on an "*implausible hypothesis*" and "*seriously flawed on methodological grounds*". They explain in detail a number of fundamental design errors in Nathanson's experiments, which they claim "*render the findings of Nathanson and colleagues uninterpretable and their conclusions unwarranted and premature*".

They conclude:

"...the current evidence for the efficacy of DAT can at best be described as thoroughly unconvincing. Both practitioners of DAT and parents who are considering DAT for their children should be made aware that this treatment has yet to be subject to an adequate empirical test" (Marino and Lilienfeld 1998).

⁸ Founder of Dolphin Human Therapy, practiced at Dolphin Cove, Key Largo, Florida, USA.
<http://www.dolphinhumantherapy.com/AboutUS/History.htm> (Accessed 06.09.07)

Furthermore, as pointed out by a professional with 25 years experience in the world of disability, autistic people don't necessarily lack the ability to concentrate but simply don't concentrate on activities that are important, or of interest, to non-autistic people (Smith 2007).

More recently, David Nathanson has undertaken research using an animatronic dolphin as an alternative "reinforcer" in "rehabilitation for children with learning disabilities". His findings report that "no significant difference between dolphins and TAD (Test Animatronic Dolphin) was found in eliciting orienting responses of touching and/or saying words for all study participants" and that "[F]or children with profound disabilities, TAD was significantly more effective in eliciting an orienting response of looking". Furthermore, Nathanson concludes "[I]n addition to current limitations associated with dolphins, future legal and administrative restrictions could include reductions in time spent in water with dolphins, or eliminating in-water interaction completely. No such potential limitations are associated with TAD" and "the cost and other limitations associated with dolphins make their therapeutic use impractical on a global scale" (Nathanson 2007).

Changes in brain wave patterns

It has been suggested that interactions with dolphins can elicit certain brainwave patterns in humans (De Bergerac 1998) and that this may relate to any perceived ability for dolphins to treat conditions such as depression.

Researchers have used EEGs (electroencephalograms) to investigate how brain wave patterns in humans change before, during and after interactions with dolphins. During normal daily activities, human brain waves occur within the frequency range of 14 to 100 Hertz; this is known as "beta rhythm". These beta waves help us to concentrate and solve problems. However, too much beta can lead to stress and anxiety. "Alpha rhythm" occurs in the frequency band 8 to 13 Hertz and is associated with a relaxed, passive and calm state. The term "delta rhythm" was initially used to describe all the frequencies below the alpha range. However, a distinction was eventually made for waves in the range 4 to 8 Hertz, which became known as "theta rhythm". Waves below this were then classified as delta rhythm (Walter and Walter 1949).

Theta rhythm is associated with the 'twilight state' between waking and sleeping and brings vivid memories, access to unconscious material, dream-like mental images and creative ideas. It is difficult to maintain large amounts of theta without falling asleep.

The research of Olivia De Bergerac, of The Dolphin Society, Australia, indicated that dolphins can facilitate the initiation of what is known as the alpha-theta crossover (De Bergerac 1998). The alpha-theta crossover occurs where the amplitude of the alpha waves drops and the theta amplitude rises to the point where it crosses over the alpha waves. It is a very specific state that is believed by some neuropsychologists to be associated with the resolution of traumatic memories (Robbins 2000).

Rather than focusing on those with physical disabilities, De Bergerac's research was designed for individuals with psychological or emotional issues ranging from stress to chronic depression. Initially, individuals were encouraged to view the dolphins from the boat and eventually to enter the sea and swim or snorkel with them. De Bergerac collected data from the participants with the aid of questionnaires and an EEG.

However, research on invoking the alpha-theta crossover is not new or ground-breaking. Robbins (2000) describes the work of Dr Eugene Peniston of the University of Southern Colorado in the early 1990s. Peniston developed a protocol using "biofeedback" for the treatment of alcoholics.

If Peniston's research can be substantiated, then it would follow that it is possible to reach the alpha-theta crossover state, as described by De Bergerac (1998), without the use of dolphins. Indeed, this state can even be reached in a very clinical environment, given the correct guidance. Research is now ongoing into how this type of neurofeedback may also be useful in the treatment of autism, epilepsy, attention deficit disorder, grief, guilt, anxiety and post-traumatic stress disorder (Robbins 2000); in fact, a number of conditions for which DAT is claimed to be effective.

Contradictions from the proponents of DAT

The claims of the DAT-favouring fraternity appear fraught with contradiction. According to De Bergerac (1998), dolphins are able to facilitate the attainment of the alpha-theta crossover brain wave patterns in the human brain, a state which is associated with relaxation and creativity. Nathanson (1998), on the other hand, promotes the use of dolphins to facilitate learning and concentration, states that are associated with the higher *beta* frequencies. This suggests an important inconsistency in the views of DAT proponents. If credence is to be given to either theory then it is important to ascertain whether dolphin interactions induce alpha and theta brainwaves, or if, as Nathanson suggests, these interactions help humans to concentrate and produce more beta brainwaves.

Sound as a healing force

There has been some speculation that ultrasound from the echolocation clicks emitted by dolphins could have some healing affect (Cole 1996, Birch 1997). To investigate this hypothesis, Brensing *et al.* (2003) set out to determine if the intensity of ultrasound emitted by dolphins and the duration of contact with participants could have a significant impact on healing. Brensing also investigated whether, as has been suggested by some proponents of DAT, dolphins were able to distinguish between "patients", who might have particular therapy needs, and other swimmers (Brensing 2004). Observations by Brensing and his colleagues, at Dolphins Plus in Florida, demonstrate that only one out of five dolphins behaved significantly differently toward "patients" (compared to other swimmers). Most significantly, however, Brensing *et al.* observed that the close contact between human participants and dolphins in these encounters did not meet the duration requirements for common ultrasound therapies.

Brensing *et al.* note:

"Additionally we observed that the heads of the patients were mostly out of the water, so that it is quite unrealistic to think that a hypothetical piezoelectric effect on the skull could have had an influence on the success of the therapy. Nevertheless, while it can not be ruled out that dolphins use an unknown mechanism, the effects of ultrasound on biological tissue have been very well investigated over the last centuries, and it seems highly unlikely that there is such kind of an unknown mechanism".

Furthermore, one of the main proponents of DAT, David Nathanson, notes of his own DAT programme, Dolphin Human Therapy, that "[t]here is speculation that use of dolphin sonar may contribute to reducing stress and helping in the therapeutic process...No such effect has been observed with children with disabilities receiving therapy from Dolphin Human Therapy" (Nathanson 2007).

In contrast to the claims made by many DAT facilities that dolphins enjoy swimming with people, Brensing's research verified that the dolphins in his study were attempting to evade humans in the water (Brensing 2004). Indicators such as increases in speed, depth of diving and frequency of breaths, all also indicated that the dolphins may have been under some stress due to the presence of the humans in the water.

The Biophilia Hypothesis

Some DAT operators claim their use of dolphins enables participants to experience a powerful awakening of emotions associated with attachment to nature, or "Biophilia", and that this form of therapy generates intense emotions of "love and connection to nature" in the participants. Some operators believe, for example, that they can offer terminally ill children an experience of "beauty and quality" that will sustain them through the rest of their life. To evaluate this in scientific terms, it is important to consider how one might quantify this "reconnection with nature" and whether it is unique to DAT, or whether people can attain this reconnection via other means. There is no conclusive scientific evidence to suggest that an interaction with dolphins is any more effective in providing a reconnection with nature than other 'wilderness' experiences, or interactions with other animals. One might also question whether interaction with a dolphin in captivity represents a "return to nature" in the true sense.

Quality of DAT research

DAT has drawn the attention of researchers interested in assessing the experimental design of studies which attempt to validate dolphins' ability to heal. Humphries (2003) reviewed a number of studies which purported to have found positive benefits to people from DAT and found that all the research examined "failed to adequately control for a number of possible threats to validity or alternative explanations". Humphries notes:

"The studies included in this synthesis are so plagued with methodological flaws that claims that the reported outcomes are due to dolphin assisted therapy may be erroneous" and, further, that: "the results of the synthesis do not support the notion that using interactions with dolphins is any more effective than other reinforcers for improving child-learning or social-emotional development". The investigations conducted in all six of the studies reviewed lacked experimental controls. Therefore, the results of these studies could not be conclusively attributed to the intervention of DAT.

Humphries concludes that:

"Claims of the effectiveness of using dolphins as a procedure for improving the behaviours of young children with disabilities are therefore not supported by available research evidence".

Furthermore, Marino and Lilienfeld (2007), conducted a more recent critique of five peer reviewed DAT studies published between 1999 and 2005, and found that *"all five studies were methodologically flawed and plagued by several threats to both internal and construct validity"*. A consistent problem throughout the studies reviewed was a failure to control for other factors of the treatment which might influence results (for example: being in the water; swimming outdoors; interacting with therapists; experimental expectancy effects). Marino and Lilienfeld conclude that: ***"the abundance of serious threats to validity in the five studies we examined renders each of their conclusions questionable at best, and entirely unwarranted at worst"***.

"Despite DATs extensive promotion to the general public, the evidence that it produces enduring improvements in the core symptoms of any psychological disorder is nil" (Marino and Lilienfeld 2007).

Is DAT more effective than other Animal-Assisted Therapies?

Many advocates of swimming with dolphins refer to the “feelings of trust and innocence” or “non-judgmental unconditional love” engendered by the dolphins. Some advocates of DAT believe these emotions are somehow responsible for unlocking deep-rooted psychological problems within participants. If this is the case, arguably it should also be possible to achieve the same benefits with other Animal-Assisted Therapies (AATs), where other animals could be viewed as engendering the same non-judgmental positive emotions.

Many animals appear able to provide the type of sensory stimulation that is reportedly provided by dolphins in DAT. Other AATs can also offer new sensations in terms of fur, feathers and scales, unique sounds, new environments (such as a stable or farm yard) and different types of movement. The only unique element in DAT is the use of water. However, this can also be replicated by the use of hydrotherapy.

Health considerations

Companion animals that are introduced into hospitals and care homes by organizations such as PAT (Pets As Therapy) and CHATA (Children in Hospital and Animal Therapy Association) are vigorously checked for transmittable diseases and assessed for docile temperament. Such stringent checks might not be made of captive dolphins and one cannot guarantee the temperament of dolphins in wild interactions, or know enough about their medical status.

The American Veterinary Medical Association (AVMA) position statement asserts that:

“Animal assisted activities, animal-assisted therapy, and resident animal programs should be governed by basic standards, be regularly monitored, and be staffed by appropriately trained personnel. The health and well being of the humans and animals involved must be ensured. Veterinarians’ involvement in these programs from their inception is critical because they serve as advocates for the health and well being of animals participating in these programs, and as experts in zoonotic disease transmission” (AVMA 2007).

There is no professionally recognized body for regulating DAT to ensure that such standards are upheld. Governments have been slow to develop guidelines on DAT and the international organization under whose umbrella regulation of DAT should fall, the International Association of Human-Animal Interactions Organizations (IAHAIO), has absolved responsibility for DAT by producing guidelines on AATs which exclude it⁹. Therefore, DAT remains a wholly unaccredited and unregulated industry.

⁹ The International Association of Human-Animal Interaction Organizations (IAHAIO) adopted a series of guidelines at its conference in Prague, September 1998 (IAHAIO Prague Declaration 1998). The first automatically excludes dolphin assisted therapy, by stating that: “Only domesticated animals which have been trained using techniques of positive reinforcement (reward system) and which have been, and will continue to be, properly housed and cared for, should be involved”. DAT is thus excluded, seemingly on the basis that dolphins are not ‘domesticated’ animals or, arguably, in some cases and by implication, not properly housed or cared for.

Non-Animal Alternative Therapies

DAT without dolphins

Advocate of interactions with wild dolphins Horace Dobbs proposed several projects in which dolphin interactions could be synthesized using modern computer-based technology (Cochrane and Callen 1998, Dobbs 2000). One such project was entitled "Dolphin Dreamtime", in which an audio recording was produced which contained both music and autosuggestion. Dobbs has also been working on a Dolphin Therapy Pool, without dolphins. This combines hydrotherapy with dolphin images (possibly holograms) and recorded sounds emitted by dolphins.

Biofeedback¹⁰ may be used in conjunction with relaxation techniques to induce the alpha-theta brain state. Such techniques may be effective in clinical environments, but could also be used in synthesized dolphin encounters and may provide a practical alternative to DAT.

Hydrotherapy and the relaxing effects of water

It is argued that there are certain beneficial physiological effects that occur when humans are immersed in water. Firstly, there is greater freedom from gravitational forces. Water provides a much less restricting medium, particularly for those with physical disabilities. Research indicates that flotation also induces a theta state (Cochrane and Callen 1998).

It is proposed by hydrotherapy advocates that water therapy, without the use of dolphins, may provide stress relief, pain relief, reduction in anxiety and reduction in depression. One visitor to a hydrotherapy centre noted:

"Even children who have severe disabilities begin to unfold in the water. They slowly lose their fear and begin to move about as if they are in a familiar, soothing environment" (Cochrane and Callen 1998).

Virtual reality treatments

In this technological age, the benefits of virtual reality treatments - where particular environments, or situations, are artificially created - are being investigated to help a range of conditions, from stroke victims to people suffering from arachnophobia. Researchers have been successful in using virtual reality as a learning aid for children with a variety of disorders, including autism (Strickland 1997) and in investigating the attention span of children with ADHD (Cho *et al.* 2002). Stimulation from virtual reality is believed to provide environments which increase a person's ability to concentrate because the treatments are immersive, interactive and imaginary (Cho *et al.* 2002). Technology using an animatronic dolphin has also been tested as an alternative to the use of "real" dolphins (Nathanson 2007).

"...no scientific evidence exists that dolphin-assisted therapy is more effective than traditional or other adjunct therapies" (Smith 2003).

Comment by one of the pioneers of dolphin assisted therapy.

¹⁰ Biofeedback is a "method of treatment that uses monitors to feed back to patients physiological information of which they are normally unaware. By watching the monitor, participants can learn by trial and error to adjust their thinking and other mental processes in order to control "involuntary" bodily processes such as blood pressure, temperature, gastrointestinal functioning, and brain wave activity". (MedicineNet.com: <http://www.medterms.com/script/main/art.asp?articlekey=10810> Accessed 06.09.07)

How much does DAT cost?

There are various costs associated with any DAT activities that run beyond the monetary costs of the therapy itself. These include the cost to the participants and their families of travel, food and accommodation. However, there are also potential 'costs' to the welfare and conservation of dolphins that should be borne in mind.

Cost to participants and their families

When a family decides to embark upon a programme of DAT, in addition to the very high cost of the therapy programme itself, they must also consider the cost of travel, food and accommodation (which can often be for the whole family) and any loss of earnings associated with what can be a considerable commitment in time associated with participating in a DAT programme. There is also the often considerable effort involved in getting to the place where the programme is located. This may include overcoming a range of practical obstacles, with associated disruption and potential distress for the participant. Any potential injuries, infections or diseases that the participant could encounter should also be considered.

The cost for two weeks of DAT varies a great deal and a variety of packages are available. Figures given by Humphries (2003) quote a typical price of around \$2,600 (approximately £1,370) for five 40 minute sessions (Humphries 2003), but it can cost a participant and one parent more than £3,300 for two weeks, including flights and accommodation¹¹. At the more expensive end of the market is the 'Dolphin Human Therapy', which, during 2006, cost US\$7,850 for two weeks, or US\$ 11,800 for three weeks¹². These quoted prices are for the therapy only (five sessions per week) and do not include flights and accommodation.

Note: at the time of writing 'Dolphin Human Therapy' is no longer operating at Dolphin Cove in Key Largo.

There are other hidden costs such as surcharges for health care, which should be taken into consideration. Families are generally encouraged to bring children for a minimum of two weeks of DAT. When flights, accommodation and loss of earnings are taken into account, such excursions can cost up to £10,000.

Expectation

The individuals that DAT programmes aim to encourage into the process are often some of the most vulnerable within our society. Psychologist Bernie Graham has worked with a number of clinically depressed individuals and expresses concern that:

"To raise the expectations of depressed individuals with low self-esteem and self-worth by suggesting that they will receive unconditional love and affection and acceptance from a dolphin, and then expose them to what appears to be rejection..., is irresponsible to say the least and may result in tragic consequences" (Graham 1999).

Graham chastises the British media for sensationalizing DAT with headlines such as, *"Swimming with dolphins cured my anorexia"*. Such headlines raise the expectation of participants and their families and, as a consequence, painful disappointment may compound already existing problems.

Expertise

There are no prerequisites for the type or number of trained staff required in a DAT programme. Given the vulnerable nature of many DAT participants, and the range of disabilities and illnesses they may present, it is alarming that DAT practitioners require no specific training. There is also no overall regulatory body for DAT and, therefore, DAT participants and their families have little opportunity to evaluate the qualifications, or expertise, of the individuals in whose care they place themselves or their children.

"The surprising paucity of scientific evidence for the long-term effects of DAT raises profoundly troubling ethical questions regarding its widespread use and promotion" (Marino and Lilienfeld 2007).

¹¹ <http://www.dolphintherapie.net/index.asp?langid=10000&location=14> (Accessed 06.09.07)

¹² <http://www.dolphinhumantherapy.com/Welcome/WelcomePage1.htm> (Accessed 12.01.06)

Life in captivity and the cost to dolphins

Betsy Smith conducted pioneering research on dolphin interactions with autistic children in the semi-aquatic environment. However, after years of working with captive dolphins, Smith had a change of heart. In a recent publication, Smith states that the reasons she stopped working with dolphins in captivity are multiple (Smith 2003). She notes that she *“questioned the removal of sentient beings from their natural habitat for the sole purpose of financial gain”* and that *“Dolphin businesses will often justify their exploitation under the therapy pretext”*.

In addition, Smith declares that *“Every dolphinarium and swim-program extolled the ‘therapeutic value’ of dolphin contact, even though a child having fun is not equivalent to therapy. It is a rather cynical and deceptive practice by dolphinarium and swim-with programs owners. Some certified therapists with no dolphin knowledge will charge exorbitant fees for treatment that can be done without dolphins”*. Furthermore, she adds that *“At the heart of all these therapy programs is the exploitation of vulnerable people and vulnerable dolphins”*. Smith concludes: *“the question that became clear was whether what we did justified imprisoning dolphins. I had to consider ending my research after assuring myself that there were many fine therapies, including working with domesticated animals, providing the same success stories. After a bout of deep personal angst, I decided to stop all dolphin-assisted therapy research in 1992”* (Smith 2003).

Besides the obvious restrictions associated with keeping free ranging, social animals, with large territories, in small, barren enclosures, the sensory deprivation that the captive environment imposes on dolphins should also be considered. The pool is often featureless and does not provide the environmental diversity that wild dolphins are accustomed to, such as: different prey species to hunt and chase, planktonic blooms to swim through, interactions with other species, salinity gradients, underwater caves, or the choice of different temperatures, substrates, mates or sea states. Replicating the natural environment, with its many variables, for mammals in captivity is often challenging. It can be extremely difficult to provide adequate diversity of environment for captive terrestrial mammals, but to provide an adequate captive environment for mammals that live in a completely different medium presents a whole host of specific problems.

There are many accounts of our growing understanding of the intelligence of these highly social animals (for examples see: Connor *et al.* 2000; Janik *et al.* 2006; Reiss and Marino 2001; Ferrer i Cancho and Lusseau 2006 and Simmonds 2006). Researchers are now also developing an understanding of the concept of cultural transmission within cetacean societies and the specific role of individuals (see: Whitehead 2003, Whitehead *et al.* 2004, Lusseau and Newman 2004, Eriksen *et al.* 2005). Such insights could have important implications for the removal of individuals from wild populations for DAT programmes, especially considering the often-disproportionate removal of young females for their suitability in interactive programs, and for our understanding of the real impacts of a life spent in captivity. It is highly unlikely that we will ever be able to satisfactorily meet the sensory and social requirements of these intelligent animals in the captive environment.

Due to poor breeding success in captivity, dolphins continue to be captured from the wild to supply the demands of the aquarium industry. Thus there are ethical questions related to removing these animals from their natural habitat and forcing them into close contact with humans for DAT. Although a trained dolphin may be more accustomed to interactions with humans than a wild dolphin, these animals have not been domesticated, which requires deliberate selection for specific traits over dozens of generations and, therefore, may be more prone to stress from human contact than truly domesticated species (Iannuzzi and Rowan 1991). **Furthermore, there are significant ethical concerns relating to the conditions under which captive dolphins are kept and whether the detrimental impacts of keeping dolphins in captivity can be justified on the basis of unproven physical or psychological improvements for human DAT participants.**

Obligations of the providers of DAT

Generally, there are no acknowledged obligations on the providers of DAT to meet any set of consumer standards. Providers can assert, for example, that *“The success of a mediated dolphin therapy is not part of the contract”*¹³.

¹³ <http://www.delphintherapie.net/index.asp?langid=10000&location=11> (Accessed 06.09.07)

Beck (2000) notes that:

"The popular notion that animals are usually beneficial has permitted AFT [Animal-Facilitated Therapy] to flourish remarkably unencumbered by the bureaucracy and precautions usually associated with using humans for medical research. Nevertheless it must be recognised that, at least in the United States there are guidelines for human research subjects. These guidelines require (1) informed consent; (2) confidentiality; (3) right to withdraw at any time, for any reason; (4) assessment of risk; and (5) assessment that the benefits outweigh any risk. Because the long-term effects of most AFT programs have yet to be proven, society has been fairly lenient, permitting most AFT projects to continue...It is society's ethical responsibility not to take advantage of the freedom we have enjoyed and plan programs with appropriate safeguards for the animals, staff and patients associated with AFT programs".

Marino and Lilienfeld (2007) believe that:

"DAT practitioners should be required to inform parents and, where relevant, participants, of the absence of evidence for DAT's enduring effects on psychological symptoms. Only then can consumers of DAT make adequately informed decisions regarding the costs and benefits of this unsubstantiated intervention".

Conclusion

The increase in the popularity of dolphin assisted therapy, and the proliferation of DAT centres, is likely to be a result of both the growing interest in interaction with animals as a means of promoting well-being in humans and the related business potential of DAT. However, there is no proof that DAT is more successful than any other animal assisted therapy or that it is a successful long-term treatment at all.

DAT presents a number of ethical issues, and some physical threats, to both people and dolphins, which may be difficult to overcome. Of particular concern for participants and their families are the potential for aggressive behaviour by dolphins towards swimmers and the potential for disease transmission.

Fundamentally, there remains no conclusive scientific evidence that DAT is more effective than any other animal-assisted therapy or is a therapy with any long-term benefit. As Marino and Lilienfeld (2007) point out: *"Despite DAT's extensive promotion to the general public, the evidence that it produces enduring improvements in the core symptoms of any psychological disorder is nil... there is little reason to believe that DAT is a legitimate therapy or that it constitutes much more than entertainment"*. Moreover, the apparent short-term effects purported to be unique to DAT (which remain disputable – see Marino and Lilienfeld 1998, Humphries 2003 and Marino and Lilienfeld 2007) may also be achieved using other therapies. Alternatives to DAT are available, at a much lower financial cost and without the potential detrimental impacts for the dolphins and people involved.

Humphries (2003) concludes that the available research evidence does not conclusively support the claims that DAT is effective for improving the behaviours of young children with disability and recommends that:

"Parents of young children with disabilities and their practitioners should note that the cost of DAT is high (typically \$2600 for five 40-minute sessions) and that currently there is not enough research evidence available to support the use of the practice" (Humphries 2003).

Recommendation

It is essential that in any Animal-Assisted Therapy (AAT) programme, the health and welfare of both the humans and the animals involved should be the primary consideration. As an absolute minimum, AAT programmes should incorporate the involvement of medical, veterinary and psychology professionals. The evidence presented here demonstrates that, due to the unique circumstances under which DAT takes place, it is unlikely to adequately meet the psychological or physical welfare needs of either human participants or dolphins.

Due to:

- the considerable potential for detrimental impacts for both humans and dolphins in wild and captive DAT programmes;
- the high cost to participants, their families and dolphins involved in DAT;
- the fact that viable alternative therapy options exist;
- the fact that there are no official standards, or enforceable guidelines, relating to the provision of DAT and therefore that the proliferation of the industry around the globe continues unabated and totally unregulated;
- the fact that there remains no scientific evidence that DAT is any more effective than any other animal assisted therapy and it has not been demonstrated to have any long-term benefit;

it is highly recommended that the practice of dolphin assisted therapy be terminated.

References

- Ananova 2000. News report: 'Whale bites child': http://www.ananova.com/news/story/sm_28591.html (Accessed 06.09.07)
- AVMA 2007. Guidelines for Animal Assisted Activity, Animal-Assisted Therapy and Resident Animal Programs (Current as of January 2007): http://www.avma.org/issues/policy/animal_assistance_guidelines.asp (Accessed 06.09.07)
- Beck, A.M. 2000. The Use of Animals to Benefit Humans: Animal Assisted Therapy. In: Fine, A. (editor), *Handbook on Animal Assisted Therapy, Theoretical Foundations and Guidelines for Practice*. Academic Press.
- Birch, S. 1997. Dolphin-human interaction effects. Doctoral Thesis, Department of Electrical and Computer Systems Engineering, Monash University, Caulfield Campus.
- Brensing, K. 2004. Approaches to the behaviour of dolphins *Tursiops truncatus* during unstructured swim-with-dolphin programs. Inaugural-Dissertation eingereicht beim. Fachbereich Biologie, Chemie, Pharmazie der Freien Universität Berlin.
- Brensing, K., Linke, K., Busch, M., Matthes, I. and van der Woude, S.E. 2005. Impact of different kinds of humans in Swim-With-The-Dolphin-Programs in two settings. *Anthrozoos* 18 (4): 409-429.
- Brensing, K. and Linke, K. 2004. Behaviour of dolphins *Tursiops truncatus* towards adults and children during swim-with-dolphin programs and towards children with disabilities during therapy sessions. *Anthrozoos*. 16 (4): 315-330.
- Brensing, K., Linke, K. and Todt, D. 2003. Can dolphins heal by ultrasound? *Journal of Theoretical Biology* 225: 99-105.
- Buck, C.D. and Schroeder, J.P. 1990. Public Health Significance of Marine Mammal Disease. In: Dierauf, L.A. (editor), *CRC Handbook of Marine Mammal Medicine: Health, Disease and Rehabilitation*. CRC Press Inc., Boston.
- Cho, B.H., Lee, J.M., Ku, J.H., Jang, D.P., Kim, J.S., Kim, I.Y., Lee, J.H. and Kim, S.I. 2002. Attention Enhancement System using virtual reality and EEG biofeedback. *Virtual Reality 2002*. Proceedings. IEEE.
- Cochrane, A. and Callen, K. 1998. *Beyond the blue: dolphins and their healing powers*. Bloomsbury, London.
- Cole, D. M. 1996. Phenomenological effect of dolphin interaction on humans. International Symposium on Dolphin Healing, Co-hosted by the Aqua Thought Foundation.
- Connor, R.C., Wells, R.S., Mann, J. and Read, A.J. 2000. The Bottlenose Dolphin: Social Relationships in a Fission-Fusion society. In: Mann, J., Connor, R.C., Tyack, P.L. and Whitehead, H. (editors), *Cetacean Societies: Field Studies of Dolphins and Whales*. University of Chicago Press.
- Constantine, R. 2001. Increased avoidance of swimmers by wild bottlenose dolphins (*Tursiops truncatus*) due to long-term exposure to swim-with-dolphin tourism. *Mar. Mam. Sci.* 17 (4): 689-702.
- Constantine, R., Brunton, D.H. and Dennis, T. 2004. Dolphin-watching tour boats change bottlenose dolphin (*Tursiops truncatus*) behaviour. *Biological Conservation* 117: 299-307.
- Curry, B.E. 1999. Stress in mammals: the potential influence of fishery-induced stress on dolphins in the eastern tropical Pacific Ocean. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-260, US Department of Commerce.
- De Bergerac, O. 1998. *The dolphin within: awakening human potential*. Simon and Schuster, Australia.
- Defran, R. H. and Pryor, K. 1980. The behavior and training of cetaceans in captivity. In: Herman, L.M. (editor), *Cetacean Behavior: Mechanisms and Functions*. University of Hawaii, John Wiley and Sons, New York.
- Dobbs, H. 2000. *Dolphin Healing: The extraordinary power and magic of dolphins to heal and transform our lives*. Piatkus, London.
- Dunn, J.L., Buck, J.D. and Robeck, T.R. 2001. Bacterial Diseases of Cetaceans and Pinnipeds. In: Dierauf, L.A., and Guillard, F.M.D. (editors), *CRC Handbook of Marine Mammal Medicine* (Second edition). CRC Press, Boca Raton.
- Eriksen, N., Miller, L.A., Tougaard, J. and Helweg, D.A. 2005. Cultural change in the songs of humpback whales (*Megaptera novaeangliae*) from Tonga. *Behaviour* 142, 305-328.
- Ferrer i Cancho, R. and Lusseau, D. 2006. Long-term correlations in the surface behavior of dolphins. *Europhysics Letters*. 74 (6): 1095-1101.
- Foster, G., Jahans, K.L., Reid, R.J. and Ross, H.M. 1996. Isolation of *Brucella* species from cetaceans, seals and an otter. *The Veterinary Record* 138: 583-586.
- Frohoff, T.G. 2004. Stress in Dolphins. In: Bekoff, M. (editor), *Encyclopedia of Animal Behavior*. Greenwood Press, Westport, Connecticut.

- Frohoff, T.G. 2000. 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. and Packard, J.M. 1995. Interactions between humans and free-ranging and captive bottlenose dolphins. *Anthrozoos* 8 (1):44-54.
- Graham, B. 1999. *Creature Comfort: Animals that heal*. Simon & Schuster, London.
- HSUS/WSPA 2006. *The Case Against Marine Mammals in Captivity*. The 2006 (3rd) edition. Edited for The Humane Society of the United States and the World Society for the Protection of Animals by Naomi Rose, Richard Farinato and Susan Sherwin.
- Humphries, T.L. 2003. Effectiveness of Dolphin-Assisted Therapy as a Behavioral Intervention for Young Children with Disabilities. *Bridges: Practical-based Research Syntheses, Research and Training Centre of Early Childhood Development*. Volume 1, Number 6.
- IAHAIO Prague Declaration 1998. Available at:<http://www.iahaio.org> (Accessed 06.09.07)
- Iannuzzi, D. and Rowan, A.N. 1991. Ethical issues in animal-assisted therapy programs. *Anthrozoos* 4 (3): 154-163.
- Janik, V.M., Sayigh, L.S. and Wells, R.S. 2006. Signature whistle shape conveys identity information to bottlenose dolphins. *Proceedings of the National Academy of Sciences of the United States of America*. Volume 103, No. 21: 8293-8297.
- Johnson, W. 1990. *The Rose-Tinted Menagerie*. Heretic Books.
- Kennedy-Stoskopf, S. 2001. Viral Diseases. In: Dierauf, L.A. and Guiland, F.M.D. (editors), *CRC Handbook of Marine Mammal Medicine* (Second edition). CRC Press, Boca Raton.
- Lusseau, D. 2003. Effects of Tour Boats on the Behaviour of Bottlenose Dolphins: Using Markov Chains to Model Anthropogenic Impacts. *Conservation Biology* 17(6): 1785–1793.
- Lusseau, D. and Newman, M.E.J. 2004. Identifying the role that animals play in their social networks. *Proceedings of the Royal Society of London B (Suppl.)* 271, S477-S481.
- Mainichi Shimbun 2003. News report: Woman sues hotel over dolphin blow. Mainichi Shimbun, Japan, June 7.
- Maratea, J., Ewalt, D.R., Frasca, S., Dunn, J.L., De Guise, S., Szkudlarek, L., St. Aubin, D.J. and French, R.A. 2003. Evidence of *Brucella* sp. infection in marine mammals stranded along the coast of southern New England. *Journal of Zoo and Wildlife Medicine* 34(3): 256–261.
- Marino, L. and Lilienfeld, S.O. 2007. Dolphin Assisted Therapy: More Flawed Data and More Flawed Conclusions. *Anthrozoos* 20(3): 239-249
- Marino, L. and Lilienfeld, S.O. 1998. Commentary: Dolphin Assisted Therapy: Flawed Data, Flawed Conclusions. *Anthrozoos* 11(4): 194-200.
- Mazet, J.A., Hunt, T.D. and 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.
- Ministry of the Environment, Bermuda 1999. Inquiry report on Dolphin Quest Bermuda during Hurricane Gert, September 1999.
- Nathanson, D.E. 2007. Reinforcement Effectiveness of Animatronic and Real Dolphins. *Anthrozoos* 20(2): 181-194.
- Nathanson, D.E. 1998. Long-term effectiveness of dolphin assisted therapy for children with severe disabilities. *Anthrozoos* 11(1): 22-32.
- Nathanson, D.E. 1989. Using Atlantic Bottlenose Dolphins to Increase Cognition of Mentally Retarded Children (Dolphin Research Centre, Grassy Key, Florida, USA). In: Lovibond, P. and Wilson, P. (editors), *Clinical and Abnormal Psychology*, Elsevier, North Holland: 223-242.
- Nathanson, D. E., De Castro, D., Friend, H. and McMahan, M. 1997. Effectiveness of short-term dolphin-assisted therapy for children with severe disabilities. *Anthrozoos* 10(2/3): 90-100.
- Patterson, I.A.P. 1999. Bacterial Infections in Marine Mammals. In: *Zoonotic Diseases of UK Wildlife*. BVA Congress, Bath.
- Pryor, K. 1990. Attachment C: Dolphin-swim behavioral observation program: Suggestions for a research protocol. In: Wells, R.S. and Montgomery, S. (editors), *Final Report on the Workshop to Develop a Recommended Study Design for Evaluating the Relative Risks and Benefits of Swim-with-the-Dolphin Programs*. Marine Mammal Commission, Washington D.C.
- Reiss, D. and Marino, L. 2001. Mirror self-recognition in the bottlenose dolphin: A case of cognitive convergence. *Proceedings of the National Academy of Science of the United States of America*. 98(10): 5937 – 5942.

- Robbins, J. 2000. *A Symphony in the Brain – The Evolution of the New Brain Wave Biofeedback*. Atlantic Monthly Press.
- Rose, N.A. 2003. Sea Change. In Frohoff, T. and Peterson, B. (editors), *Between Species: Celebrating the Dolphin-Human Bond*. Sierra Club Books, San Francisco.
- Samuels, A., Bejder, L., Constantine, R. and Heinrich, S. 2003. Swimming with wild cetaceans in the Southern Hemisphere. In: Gales, N., Hindell, M.A. and Kirkwood, R. (editors), *Marine Mammals: Fisheries, Tourism and Management Issues*. CSIRO Publishing, Collingwood.
- Samuels, A. and Gifford, T. 1997. A quantitative assessment of dominance relations among bottlenose dolphins. *Mar. Mam. Sci.* 13(1):70-99.
- Samuels, A. and Spradlin, T. 1995. Quantitative behavioral study of bottlenose dolphins in swim-with-dolphin programs in the United States. *Mar. Mam. Sci.* 11(4): 520-544.
- Scarpaci, C., Dayanthi, N. and Cockeron, P.J. 2003. Compliance with Regulations by “Swim-with-Dolphins” Operations in Port Phillip Bay, Victoria, Australia. *Environmental Management*. 31(3): 342-347.
- Simmonds M.P. 2006. Into the Brains of Whales. *Applied Animal Behaviour Science* 100: 103-116.
- Small, R.J. and DeMaster, D.P. 1995. Acclimation to captivity: A quantitative estimate based on survival of bottlenose dolphins and Californian Sea Lions. *Mar. Mam. Sci.* 11(4): 510-519.
- Smith, B. 2003. The Discovery and Development of Dolphin-assisted Therapy. In: Frohoff, T. and Peterson, B. (editors), *Between Species: Celebrating the Dolphin-Human Bond*. Sierra Club Books, San Francisco.
- Smith, P. 2007. Personal communication with WDCS. June.
- Stallard, J. 2006. A Fishy Tale, in Full House! Magazine, November 30.
- Strickland, D. 1997. Virtual reality for the treatment of autism. *Stud Health Technol Inform.*44:81-6.
- Sweeney, J.C. 1990. Marine mammal behavioral diagnostics. In: Dierauf, L.A. (editor), *CRC Handbook of Marine Mammal Medicine: Health, Disease and Rehabilitation*. CRC Press, Boston.
- Tachibana, M., Watanabe, K., Kim, S., Omata, Y., Murata, K., Hammond, T. and Watarai, M. 2006. Short Communications: Antibodies to *Brucella* spp. in Pacific Bottlenose Dolphins from the Solomon Islands. *Journal of Wildlife Diseases* 42(2): 412-414.
- Van Lint, W., de Man, D., Garn, K., Hiddinga, B. and Brouwer, K. 2006: EAZA Yearbook 2004. Published by the EAZA Executive Office, Amsterdam.
- Walter, V.J. and Walter, W.G. 1949. The central effects of rhythmic sensory stimulation. *Electroencephalography and Clinical Neurophysiology* 1: 57-86.
- Webb, N.G. 1978. Women and children abducted by a wild but sociable adult male bottlenose dolphin. *Carnivore* 1(2): 89-94.
- Whitehead, H. 2003. *Sperm Whales: Social Evolution in the Ocean*. University of Chicago Press, Chicago.
- Whitehead, H., Rendell, L., Osborne, R.W. and Wursig, B. 2004. Culture and conservation of non-humans with reference to whales and dolphins: review and new directions. *Biological Conservation* 120: 431-441.

WHAT IS MORE IMPORTANT THAN DAT?

- patient safety and well being
- ethical treatment of patients and their families
- protection and wellbeing of wild cetacean populations
- reducing the number of dolphins held in the confines of captivity

WDCS urges people considering DAT to review the information presented here and consider alternatives to DAT.

WDCS urges governments to take urgent steps to regulate DAT activities, to protect participants, their families and dolphins from exploitation.