Chronic interaction between humans and free-ranging bottlenose dolphins near Panama City Beach, Florida, USA

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ABSTRACT

'Swim-with' activities, in which humans enter the water to interact with free-ranging cetaceans, are a popular form of nature tourism; however, there is considerable disagreement as to whether these encounters constitute a threat to the animals. At the request of the US Marine Mammal Commission, a systematic study was designed to quantify effects of swim-with activities on the behaviour of bottlenose dolphins in waters near Panama City Beach, Florida. Certain dolphin behaviours were identified as indicative of chronic interaction with humans, and based on presence of these behaviours, at least seven dolphins were identified that permitted people to swim nearby. Because these dolphins accepted food handouts from people, they were considered to be conditioned to human interaction through food reinforecement. Specific human-dolphin interactions that posed a risk for dolphins or humans were identified, and it was calculated that human interaction put a specific juvenile dolphin at risk once every 12 min, including being fed by humans once every 39-59 min. Humans interacting with that dolphin were estimated to be at risk once every 29 min. Although the study was of limited duration, the observations were so clear-cut and the nature of interactions so potentially hazardous it was concluded that food provisioning was the probable basis for swimming with free-ranging dolphins near Panama City Beach, Florida, and therefore, human interaction at this location was likely to be harmful to the dolphins and in clear violation of the US Marine Mammal Protection Act.

Of equal importance to the findings of this study is the methodology. A systematic behavioural methodology was designed that can be adapted to study potential impacts of nature tourism on coastal communities of cetaceans in which individuals are readily distinguished. The focus was on the behaviour of individual animals in order to describe and quantify in-water interactions between dolphins and humans, to make behavioural comparisons for the same individual dolphins in the presence and absence of swimmers, and to make behavioural comparisons for individual dolphins in the same region that do and do not interact with swimmers. Coupled with standard photo-identification techniques, these methods can be used to identify the class of animals, or proportion of a local community, that is more likely to interact with, be detrimentally affected by, and/or avoid human interaction. Sequential observations of the same individuals taken over time can be used to document habituation or sensitisation to human interaction.

KEYWORDS: BEHAVIOUR; BOTTLENOSE DOLPHIN; CONSERVATION; WHALEWATCHING; HUMAN INTERACTION

INTRODUCTION

Over the past several decades, there has been a significant shift in public attitudes towards cetaceans in many countries. For centuries, these animals were considered a resource to be exploited by humans, but in the 1970-80s, strong anti-whaling and pro-conservation sentiments became prevalent particularly in parts of North America, Europe and Australasia (e.g. Duffus and Dearden, 1993; Samuels and Tyack, 2000). In the USA, this viewpoint was manifested in the Marine Mammal Protection Act of 1972 (MMPA, 16 U.S.C. §1361 *et seq.*), which made the federal government responsible for conserving and protecting marine mammal species. With this shift in public sensibility came increasing emphasis on 'non-consumptive' uses of marine mammals. For example, cetaceans have become popular tourist attractions, and commercial operators now provide many ways for members of the public to view and interact with whales and dolphins at sea. Hoyt (2001) reported that cetacean-focused tourism is a $US1 billion industry attracting more than nine million people per year in 87 countries and territories.

Tourism focusing on free-ranging cetaceans is a type of 'nature tourism', which encompasses a variety of ways people can enjoy wild animals in natural areas (e.g. Newsome *et al.*, 2002). By implication, tourism focusing on nature is often presumed to be 'ecotourism'; however, in the strictest sense, ecotourism is a specialised subset of nature tourism, and the label is reserved only for those activities that are ecologically sustainable, environmentally educative and contributing to the conservation of biodiversity (e.g. Goodwin, 1996; Newsome *et al.*, 2002). There is a trend towards another form of nature tourism, 'adventure tourism', that is, 'instead of being satisfied with looking at nature, people want to interact with nature' (Simmonds, 1991, p.664). The proliferation of hands-on adventures targeting cetaceans in the wild has prompted expressions of concern from such organisations as the International Whaling Commission (IWC, 1995). With respect to nature tourism focusing on cetaceans in US waters, the National Marine Fisheries Service (NMFS) and the Marine Mammal Commission (MMC) find themselves having to apply general statutory provisions under the MMPA to address these new potential threats to marine mammals in the wild (NMFS, 2002).

The public is offered opportunities around the world for close encounters with cetaceans at sea. At some locations, tourism is based on feeding: for example, tourists at several sites in Australia offer fish to free-ranging dolphins (e.g. Connor and Smolker, 1985; Orams, 1994; Corkeron, 1998). This practice continues despite extensive documentation that feeding by humans is often harmful to the animals (reviewed in Orams, 2002). For example, detrimental effects on behavioural patterns are associated with food provisioning in several primate species (e.g. Wrangham, 1974; Southwick *et al.*, 1976; Brennan *et al.*, 1985; Altmann and Muruthi, 1988;

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Fa, 1988). Aggression and injury to humans and destruction of human property are associated with food provisioning in such terrestrial species as black and grizzly bears (*Ursus americanus, U. arctos*: Craighead and Craighead, 1971; Gunther, 1994); African elephants (*Loxodonta africanus*: Moss, 1988); coyotes (*Canis latrans*: Bounds and Shaw, 1994); vervet and Barbary monkeys (*Cercopithecus aethiops, Macaca sylvanus*: Brennan *et al.*, 1985; Fa, 1992); and cassowaries (*Casuarius casuarius*: Kofron, 1999).

Harmful effects of uncontrolled feeding by humans were recently demonstrated for free-ranging cetaceans as well. In Western Australia, low survivorship of calves was associated with tourist feeding of female bottlenose dolphins, *Tursiops* sp. (Wilson, 1994; Mann *et al.*, 2000). Such findings led wildlife managers to impose stringent regulations in order to minimise the impact of feeding on dolphins at existing sites (Wilson, 1994; 1996), and to prohibit all new feeding programmes in the state (Western Australian Wildlife Conservation Act No.1950, Closed Season Notice for Marine Mammals, 1998). In the USA, NMFS amended regulations under the MMPA in 1991 to specify that feeding, or attempting to feed, marine mammals in the wild constitutes a form of 'take' (50 C.F.R. §216.3). This decision was upheld in a 1993 court ruling, based on substantial evidence that feeding free-ranging cetaceans can alter their natural behaviour and increase their risk of injury or death (Bryant, 1994).

'Swim-with' activities, in which humans enter the water for the purpose of interacting with free-ranging whales and dolphins, are another popular form of cetacean-focused tourism. Swim-with activities target at least 20 cetacean species worldwide, and new programmes are initiated on a regular basis (e.g. Samuels *et al.*, 2000; 2003; Hoyt, 2001). The list includes such well-known situations and species as dusky (*Lagenorhynchus obscurus*), bottlenose (*T. truncatus*) and common (*Delphinus delphis*) dolphins in New Zealand (e.g. Barr and Slooten, 1998; Yin, 1999; Constantine, 2001), and Atlantic spotted (*Stenella frontalis*) and bottlenose dolphins in the Bahamas (e.g. Ransom, 1998). There are also a number of less familiar sites and species, including Hector's dolphins (*Cephalorhynchus hectori*) in New Zealand (e.g. Bejder *et al.*, 1999), dense beaked whales (*Mesoplodon densirostris*) near the Canary Islands (e.g. Ritter and Brederlau, 1999), dwarf minke whales *(Balaenoptera acutorostrata*) in Australia's Great Barrier Reef (e.g. Arnold and Birtles, 1999) and humpback whales (*Megaptera novaeangliae)* in the South Pacific (e.g. Constantine, 1998; Orams, 1999). In the USA, members of the public swim with wild bottlenose dolphins (*T. truncatus)* in Florida and wild spinner dolphins (*S. longirostris)* in Hawaii (e.g. Frohoff and Packard, 1995; Flanagan, 1996; Wursig, 1996; Ford, 1997; Samuels and Bejder, 1998; Colborn, 1999; Driscoll-Lind and Ostman-Lind, 1999; Forest, 2001).

There is considerable disagreement among wildlife managers, tour operators and scientists as to whether impacts of swim-with activities on targeted animals are harmful, beneficial or neutral. Opponents of swim-with activities suggest that the increased tolerance of humans and vessels that sometimes results from interaction may compromise free-ranging cetaceans by disrupting natural behaviour and/or increasing the animals' vulnerability to vessel strikes, entanglement and vandalism (e.g. Spradlin *et al.*, 1998). Moreover, interacting with free-ranging cetaceans is contrary to the 'respect the wild in wildlife' principles proposed by the National Watchable Wildlife Program (Duda, 1995, p.23) whose 'look but don't touch' guidelines have been adopted by many managers of terrestrial wildlife. There are also documented dangers for humans who enter the water to interact with cetaceans in the wild (e.g. Shane *et al.*, 1993; Santos, 1997). In contrast, some advocates of swim-with activities maintain that the animals have a choice as to whether or not they will interact with humans (e.g. Dudzinski, 1998), and others suggest that close encounters with free-ranging animals may enhance respect for wildlife, leading to environmental activism and benefits for nature areas (e.g. Orams, 1997). These points are countered by observations that the careful plans needed to safeguard the animals and to realise these potentials are not always in place (e.g. Duffus and Dearden, 1993; Amante-Helweg, 1996; Kinnaird and O'Brien, 1996), and that no tourism is ecologically neutral (e.g. Isaacs, 2000). The controversy is further confounded by the fact that not all swim-with situations are the same. Each of the four basic types of in-water encounters – involving free-ranging cetaceans that are 'lone sociable', food provisioned, habituated and unhabituated – is likely to result in different interactions, responses and impacts (e.g. Samuels *et al.*, 2000).

In the USA, swim-with activities remain a legislative 'grey area'. 'Harassment' was defined in the 1994 amendments to the MMPA to mean 'any act of pursuit, torment, or annoyance which …has the potential to injure… or …disturb a marine mammal …in the wild by causing disruption of behavioural patterns…'. NMFS interpreted this definition to include swim-with activities and issued guidelines accordingly. However, that interpretation has been challenged because swimming with free-ranging cetaceans was not specifically named (e.g. Baur *et al.*, 1999). NMFS (2002) published an Advance Notice of Proposed Rulemaking to address concerns about human interactions, requesting comments from the public regarding a need for specific regulations to protect free-ranging marine mammals. Comments received are currently under review.

As a step towards resolving the controversy over commercial swim-with activities in US waters, the MMC requested a study designed to evaluate systematically how chronic in-water interactions with humans affect the behaviour of free-ranging bottlenose dolphins. A pilot study was conducted near Panama City Beach, Florida, where free-ranging bottlenose dolphins have frequent encounters with clients of commercial tour operators and members of the public (Samuels and Bejder, 1998). The boat-based study was conducted from the perspective of individual dolphins in the region. A concurrent and complementary shore-based study was conducted from the perspective of tourists seeking interactions with dolphins in Panama City Beach waters (Colborn, 1999).

METHODS

Sighting records

A total of 29 hours was spent searching for and observing dolphins in waters near Panama City Beach, Florida, during five days from 4-9 August 1998. The study was focused on dolphins in the vicinity of the southwest shore of Shell Island in the St Andrews State Recreation Area (30°07'N, 85°43'W). This site, hereafter referred to as 'Interaction Beach', was where nearly all human-dolphin interactions reportedly occurred. Interaction Beach and environs comprised an area of less than 1 n.mile^2. The entire study area was approximately 24 n.mile^2 with Interaction Beach near the centre, and including St Andrews Bay, Panama City Harbor Channel and Gulf of Mexico waters up to 1.5 n.miles offshore of Shell Island and Biltmore Beach.

On 4-5 August, the research effort emphasised photo-identification surveys; thereafter (6-9 August) effort emphasised extended focal follows of selected dolphins. Time was divided between identifying and observing dolphins that had interactions with humans on a regular basis and dolphins that did not interact with humans.

Standard photo-identification techniques were used (Würsig and Jefferson, 1990) to photograph dolphin dorsal fins during brief, close approaches in a 21ft boat with an outboard engine. Each image was automatically stamped with the date and time so that the photographed dolphin could be associated with behavioural records. For each dolphin, or dolphin 'school' (defined as a short-term aggregation in Connor *et al.*, 1998) encountered, an estimate of school size and presence or absence of certain behaviours was recorded to gauge the animals' tolerance of close encounters with humans. Certain behaviours were considered to be indicative of chronic interaction with humans (Table 1).

A 200mm lens was used and a limited number of close approaches was made; therefore it was not possible to obtain adequate identification photos for each dolphin encountered. Only high-quality identification photos were analysed, which included nearly all photographs of dolphins that had interactions with humans on a regular basis but only a subset of photographs of dolphins that did not. As a result, the estimate of the number of dolphins that did not interact with humans was based on school-size records.

Table 1

Dolphin behaviours indicative of chronic human interaction

Behaviour	Description
Remain close	Remain within touching distance of one of more humans that are in the water or in a vessel.
Head up	Approach with head out of water to within 2m of vessel or human.
Beg	Approach with head out of water and open mouth to within 2m of vessel or human.
Lunge at vessel	Vertical lunge with open mouth and head and flippers out of water within 2m of a vessel.
Follow vessel	Rapid travel within 2m of the side or stern of a vessel that is moving at speed (but not riding the bow wave).
Accept food	Accept fish handouts or other food items from humans.

Focal follows

During 4-9 August, a protocol was developed for focal-animal sampling of dolphin behaviour (Altmann, 1974). Since the goal of this fieldwork was to design a systematic protocol for describing and quantifying in-water interactions between dolphins and humans, the protocol was revised and behavioural measures were added over the course of the week. As a result of changes in the protocol, specific findings reported below are sometimes based on different sample sizes.

Standard behavioural sampling techniques (defined in Altmann, 1974) were used that have been adapted for studying dolphin behaviour and human-dolphin interactions (Samuels and Spradlin, 1995; Samuels and Gifford, 1997). Focal follows of individual dolphins, or temporarily cohesive dolphin schools, were conducted for periods ranging from 30 mins to 2 hrs 11 mins. Note that a group-level focus is typically not appropriate for behavioural sampling because an observer cannot continuously monitor all the behaviour of all individuals in an aggregation of animals (Altmann, 1974). However, this method was adequate for the present study because it was possible to continuously monitor whether any focal dolphins had interactions with humans. In this study, group-level behavioural sampling was used only for dolphins that did not exhibit any of the behaviours listed in Table 1. All focal follows were conducted in the vicinity of Interaction Beach where dolphins were so often surrounded by tourist vessels, even to the exclusion of the research vessel, that it is unlikely the presence of a research vessel had a significant effect on the behaviour of focal dolphins.

At regular intervals throughout each follow, the following specific information about focal dolphin(s) was recorded.

(1) Number of dolphins in the school: a 10m chain rule was used to define a temporarily cohesive group of dolphins (Smolker *et al.*, 1992).
(2) Activity: standard activity categories were used: rest, travel, forage, mill and socialise with other dolphins. A 'human interaction' activity state was added to encompass the behaviours indicative of chronic interaction with humans (Table 1). During follows of focal schools, 'predominant group activity' was recorded (Mann, 1999) and it was noted whether any individuals were engaged in a different activity.
(3) Location: the general location of the focal dolphin(s) was recorded using a 1 by 1 n.mile grid system superimposed on a chart of Panama City Beach waters.

The sampling interval at which these data were recorded varied according to dolphin activity. During rest, travel, forage and mill, information for the focal dolphin(s) was recorded at each surfacing (every 2-3 mins). However, discrete surfacing bouts were difficult to identify when dolphins were interacting with humans. Preliminary observations of human-dolphin encounters indicated that an interaction with a human occurred on average once per minute. Therefore, in close proximity to human activity, the above information was recorded for the focal dolphin as point samples at 1-min intervals.

In addition to these data taken at regular intervals, other behavioural information was recorded for the focal dolphin(s). Due to vessel crowding near Interaction Beach, it was not possible to record consistently all details of all interactions involving focal dolphin(s); therefore the following behavioural sampling rules were adopted (defined in Altmann, 1974):

(1) a record was made of whether focal dolphin(s) exhibited any of the human interaction behaviours (Table 1) at least once during each sampling interval (one-zero sampling);
(2) details of social interactions with humans or with other dolphins that involved focal dolphin(s) were recorded on an *ad libitum* basis, i.e. whenever possible;
(3) the number of fish (or other food items) offered to focal dolphin(s) was recorded;
(4) the numbers of vessels and human swimmers within 10m of focal dolphin(s) were recorded as scan samples at 5-min intervals;
(5) identification photos were taken periodically to confirm presence of focal dolphin(s). Identification photos were taken opportunistically when a close approach could be made without disturbing dolphin behaviour.

Analysis of risky behaviour

During focal follows, certain human-dolphin interactions were observed that may cause injury, illness or death to the dolphin or the human (Table 2). These risky behaviours were identified following the *Watching Wildlife* guide (Duda,

Table 2

Human-dolphin interactions that may result in injury, illness or death.

Code	Type of interaction	Sources of risk include:
Risk to dolphin		
D1	Human and dolphin make physical contact (or are within touching distance).	Human may inadvertently touch vulnerable body parts of dolphin; human may be aggressive and injure dolphin; human may cause dolphin to behave submissively; potential for disease transmission.
D2	Dolphin is in close proximity to vessels.	Dolphin may be injured by propeller, hit by moving vessel, or injured by an object that falls or is dropped from a vessel.
D3	Dolphin is in close proximity to deployed fishing gear.	Dolphin may be entangled or hooked; dolphin may learn to steal fish from fishers.
D4	Human feeds dolphin.	Dolphin may ingest tainted fish or inappropriate food; young dolphins may not learn appropriate foraging skills.
D5	Human offers object to dolphin.	Dolphin may ingest object and sustain internal injuries.
Risk to human		
H1	Human and dolphin make physical contact (or are within touching distance).	Dolphin may inadvertently touch vulnerable body parts of human; dolphin may be aggressive and injure human; potential for disease transmission.

1995), *Report to Congress on Results of Feeding Wild Dolphins: 1989-1994* (Bryant, 1994), a study of human-dolphin interactions in captive swim-with-dolphin programmes (Samuels and Spradlin, 1995), reports on the potential for interspecific disease transmission (e.g. Buck and Schroeder, 1990; Geraci and Ridgway, 1991) and common sense.

RESULTS

Number of dolphins that has chronic interaction with humans

Assessing each dolphin's tolerance of human interaction was unambiguous. Dolphins categorised as having chronic interactions with humans were repeatedly observed to make close approaches to vessels and to display the behaviours indicative of human interaction listed in Table 1. In contrast, dolphins that did not interact with humans showed no interest in swimmers or vessels (except to bow ride), and performed none of the human-interaction behaviours. Because of the prevalence of 'accept food' (Table 1) among dolphins that has interactions with humans on a regular basis, these dolphins were considered to be conditioned to human interaction by food reinforcement. [In Samuels and Bejder (1998), conditioned dolphins were mislabelled as 'habituated', following colloquial but inaccurate usage in the wildlife literature (Nisbet, 2000). Documenting the occurrence of 'habituation' required sequetial measures over time showing a waning in response as individuals learn that there are neither adverse nor beneficial consequences to occurrence of the stimulus (Thorpe, 1963). It was, therefore, incorrect to use the term in reference to dolphins attracted to human interaction by food reinforcement.]

Based on sighting records, a minimum of 89 dolphins was encountered during the five days. Behavioural assessment indicated that seven dolphins identified photographically, or 8% of all dolphins encountered, had interactions with humans on a regular basis. Six of the seven conditioned dolphins were identified during the first two days when the research effort emphasised photo-identification work. Since research emphasis was subsequently shifted to focal follows (a method that limits the number of dolphins encountered), there were likely to be a greater number of conditioned dolphins than the seven identified. Some conditioned dolphins were frequent visitors to Interaction Beach: six of the seven dolphins were sighted there on multiple days, and one dolphin was identified on four of the five days. During the study period, none of the conditioned dolphins was identified in schools with dolphins that did not interact with humans.

Differences in the behaviour of conditioned dolphins and dolphins that did not interact with humans

Nine focal follows were conducted for a total of 12 hours (Table 3). Conditioned dolphins were observed in four focal-individual follows (6h 32min); a single juvenile dolphin was the focus of three of those follows (5h 53min). Also conducted were one focal-individual and four focal-group follows (5h 28min) to monitor the behaviour of at least 27 dolphins that did not interact with humans.

Despite the brief observation period, the data indicated that the lives of conditioned dolphins were strikingly different from those of dolphins that did not interact with humans. It is estimated that conditioned dolphins were engaged in interactions with humans during approximately 77% of the time they were observed (i.e. one or more human-interaction behaviours occurred in 188 of 245 1-min point samples on 6-9 August). In contrast, dolphins that did not interact with humans never exhibited any of those behaviours (i.e. human-interaction behaviours occurred in none of a total of 85 surfacing intervals on 6-9 August).

Dramatic differences in ranging patterns were documented even though all focal follows were conducted within the same region. Conditioned dolphins remained at the same location, i.e. within the < 1 n.mile^2 area consisting of Interaction Beach and the adjacent Panama City Harbor Channel. All recorded 'travel' by conditioned dolphins was from vessel to vessel. Because conditioned dolphins typically approached any new vessel that arrived in the area, it was possible to keep the focal dolphin in view by looking for that dolphin alongside the most recently arrived vessel. In contrast, focal dolphins that did not interact with humans travelled distances of several nautical miles along the Gulf coast or into the bay; they moved through Interaction Beach, without stopping or showing any interest in human activities.

Profile of a juvenile dolphin conditioned to human interaction

The study focused on one conditioned dolphin, 'HiMidLo', so named for three distinctive nicks in the dorsal fin. HiMidLo was selected for intensive study because this juvenile was ever-present in the vicinity of Interaction

Table 3
Summary of focal follows of conditioned dolphins and dolphins that did not interact with humans.

Date	Name/ description	Duration (hr:min)	Summary
Conditioned dolphins			
5 Aug	HiMidLo	1:40	Remained at Interaction Beach; accepted fish handouts; suspected underwater feeding by tour operator.
6 Aug	HiMidLo	2:02	Remained in the channel adjacent to Interaction Beach; accepted fish handouts; rejected bologna.
7 Aug	HiMidLo	2:11	Remained at Interaction Beach from early morning until tour boats arrived; accepted fish handouts from vessel travelling at speed; suspected underwater feeding by tour operator.
9 Aug	HiNick	0:39	Remained at Interaction Beach; accepted fish handouts.
Total duration		6:32	
Dolphins that did not interact with humans			
5 Aug	Group of 5	1:45	Cohesive group travelling southeast in Gulf along Biltmore Beach and Interaction Beach; no interest in humans (except to bow ride).
6 Aug	Trio #1	0:55	Cohesive group travelling northeast into St Andrews Bay; no interest in humans.
7 Aug	Single dolphin	1:42	Distinctive dolphin with damaged dorsal fin, moved through several dolphin schools while travelling southeast in Gulf along Biltmore Beach and Interaction Beach; no interest in humans.
9 Aug	Group of 15	0:30	Cohesive group travelling southeast in Gulf along Shell Island; apparently disturbed by our approach (repeated tail slaps) but calmed within 15 mins; no interest in humans.
9 Aug	Trio #2	0:36	Cohesive group first sighted at Interaction Beach, travelling southeast in Gulf close to Shell Island; no interest in humans.
Total duration		5:28	

Beach, and it was suspected that the daily life of this dolphin was typical of that of many conditioned dolphins in the region. In addition, there were concerns regarding the effects of chronic human interaction on the behaviour and well being of an immature dolphin. Based on body size, HiMidLo was estimated to be a 4-5 yr old, an independent juvenile but not fully mature. The sex of this dolphin was not determined.

HiMidLo was encountered in the vicinity of Interaction Beach on four of five field days, including prior to the arrival of any tour boats on the morning of 7 August. Focal follows of this dolphin were conducted on three days (Table 3). HiMidLo was engaged in interactions with humans or vessels during approximately 75% of observation time (161 of 214 point samples on 6-7 August), and the dolphin was within 10m of humans in the water during 55% of observation time (125 of 228 intervals on 6-7 August). On average, there were 4 swimmers, 2.6 boats, and 1.3 jet skis within 10m of HiMidLo (73 5-min scans on 5-7 August). Maximums of 34 swimmers (5 August) and 14 vessels (6 August) were recorded within 10m of HiMidLo (Fig. 1). HiMidLo moved from boat to boat approximately once per 3 min (45 of 130 intervals on 7 August).

In contrast to the high proportion of time spent interacting with humans, HiMidLo was observed socialising with other dolphins only twice: an affiliative interaction involving 'gentle rubbing', and a presumably agonistic interaction involving a tail slap when another dolphin approached the boat where HiMidLo was begging. HiMidLo was observed to forage naturally only once ('pinwheel feeding'); whereas, this juvenile was fed by humans on average once per 39-59 min (6-9 times during the 5h 53mins of focal observations; Table 4; Fig. 2). The range in values was due to three instances of unconfirmed feeding in which people appeared to hide their interactions with dolphins in response to the presence of observers and/or the recent citation of a local commercial operator for feeding wild dolphins (NOAA, 1999). It was surmised from the dolphin's behaviour that these additional feeding events occurred.

HiMidLo had numerous risky encounters with humans in only three days of focal observations (Table 4). It was estimated that interactions with humans put HiMidLo at risk once per 11.8 min (30 interactions in 5h 53mins of focal observations), and that humans in the water with HiMidLo were at risk of injury by the dolphin once per 29.4 min (12 interactions in 5h 53min). Some interactions posed multiple risks to the dolphin, as when humans fed the dolphin from a vessel that was moving at speed with fishing gear deployed.

Focal observations of a second dolphin indicated that the behaviour of HiMidLo was likely to be typical of conditioned dolphins at Interaction Beach. The second conditioned dolphin, 'HiNick', was judged by size to be an adult. HiNick was identified at Interaction Beach on three days, and this dolphin's behaviour was observed for a total of 39 mins on 9 August. HiNick interacted with humans during 87% of focal observation time (27 of 31 point samples in which activity was known), was in close proximity to swimmers during 81% of the time (25 of 31 intervals), and was being fed by humans during 61% of the time (19 of 31 point samples) or once every 13 mins (3 separate feeding events in 39 min). *Ad libitum* observations of other conditioned dolphins were consistent with observations of HiMidLo and HiNick.

DISCUSSION

Food provisioning of free-ranging dolphins near Panama City Beach, Florida

Observations suggested that human interaction was likely to be harmful to dolphins in waters near Panama City Beach. Despite the brief observation period, a high rate of uncontrolled food provisioning by humans was documented, and numerous encounters with humans were recorded that put conditioned dolphins at risk of injury, illness or death. Dolphins like the juvenile, HiMidLo, may have been in additional danger if provisioning and human interaction

Fig. 1. A typical scene at Interaction Beach in which jet skis, boats and swimmers surround a dolphin. The woman on the stern of the boat to the left had been feeding fish to the dolphin. (Photo credit: L. Bejder).

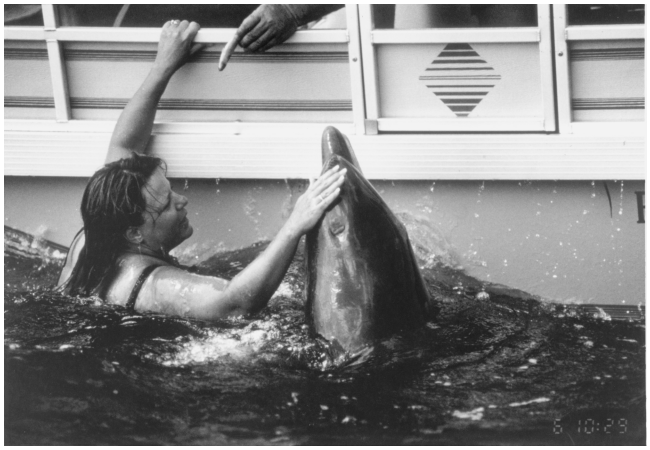

Fig. 2. A woman in the water alternately petted, embraced and fed fish to HiMidLo during the focal follow on 6 August in the Panama City Harbor Channel. Her actions put both the woman and the dolphin at risk of injury (Table 2). (Photo credit: L. Bejder).

have interfered with development of the foraging and social skills necessary for survival in the absence of provisioning.

Given that the methodology limited the number of dolphins encountered, there was likely to be a greater number of conditioned dolphins than those identified in this study. A longer-term study would be needed to ascertain the actual proportion of the local community that is affected by human activity.

Numerous encounters at Interaction Beach were observed in which humans in the water were at risk of injury by the dolphins. The death of a Brazilian swimmer from injuries inflicted by a bottlenose dolphin (Santos, 1997) showed that this is a risk to be taken seriously. Such encounters can also have detrimental consequences for the animals involved. In Brazil, dolphin aggression was provoked by human misbehaviour; nevertheless, an intensive effort was needed to protect the dolphin from further harassment or retribution (Santos, 1997). Other instances of human misbehaviour have had less fortunate consequences for the animals. For example, animals lured by food to approach human activities have sometimes been killed when they became aggressive or destructive (e.g. bears: Gildart, 1981; coyotes: Bounds and Shaw, 1994).

The frequent and uncontrolled feeding of dolphins, both by commercial operators and members of the public, indicated that food provisioning was the basis for in-water encounters between humans and dolphins in Panama City Beach waters. Since dolphins that receive food handouts will indiscriminately approach any vessel or swimmer, even people who did not feed dolphins were able gain close access. It should be noted that food provisioning does not occur at all locations where people swim with free-ranging dolphins. For example, feeding is clearly not a component of swimming with bottlenose, common, dusky and Hector's dolphins in New Zealand (e.g. Barr and Slooten, 1998; Bejder *et al.*, 1999; Constantine, 2001), spinner dolphins in Hawaii (e.g. Driscoll-Lind and Ostman-Lind, 1999; Forest, 2001; Wursig, 1996), spinner and bottlenose dolphins in Japan (e.g. Dudzinski, 1998), or spotted and bottlenose dolphins in the Bahamas (e.g. Ransom, 1998). However, the situation at Panama City Beach suggests that feeding by humans may be the basis for swimming with free-ranging dolphins at some other sites. At locations like Panama City Beach where food provisioning is used to sustain swim-with activities, human interaction is likely to be harmful to the dolphins.

Studying the effects of swim-with activities on the behaviour of coastal cetaceans

The stated goal of this fieldwork was to design a systematic study to investigate effects on free-ranging dolphins of chronic in-water encounters with humans. It was found that Panama City Beach, Florida, was not a suitable site for such a study because feeding was so prevalent. The effects of food provisioning are so pervasive that it would be difficult to tease apart which effects on dolphin behaviour were due to in-water interactions with humans and which were due to food provisioning. Nevertheless, on the basis of observations, it is concluded that the risks to conditioned dolphins in Panama City Beach waters were so clear that immediate enforcement action would be justified without further study. Should enforcement take effect, further study would be warranted to monitor the behaviour and welfare of potentially dependent dolphins after food handouts were stopped.

A systematic behavioural methodology focusing on individual dolphins was designed that can be adapted to study potential impacts of nature tourism on coastal communities of cetaceans in which individuals are readily distinguished. Methods like these have long been standard for studying effects of human activities on terrestrial animals (e.g. Altmann and Muruthi, 1988), but have only recently been applied to impact assessment studies for cetaceans (e.g. Allen and Read, 2000; Mann and Kemps, 2003; Nowacek *et al.*, 2001). In contrast, most studies of swim-with activities have focused on responses by schools of cetaceans and/or responses to vessel approaches (reviewed in Samuels *et al.*, 2000). These emphases are necessary first steps, in part dictated by methodologies used (e.g. distant, shore-based observations; in-water or tour vessel-based observations). However, as several researchers have noted, findings from such studies are often limited, and more refined, longitudinal investigations are needed (e.g. Constantine, 2001; Ransom, 1998; Samuels and Bejder, 1998; Yin, 1999). Noteworthy attributes of well-designed studies for evaluating impacts of tourism on free-ranging cetaceans are reviewed in Bejder and Samuels (2003).

In this study, behavioural sampling methods were selected that provided a focus on individual animals. These methods were designed to: (1) describe and quantify in-water

Table 4
Risky encounters between humans and HiMidLo during focal follows.

Date	Time	Human-dolphin interaction (durations based on # point samples elapsed)	Risk to dolphin or human? (Codes from Table 2)
5 Aug	10:39	Suspected underwater feeding by diver from tour boat (6 min)	D4
	10:58	Face-to-face with swimmer	D1, H1
	11:15	Surrounded by 8 boats, 5 jet skis	D2
	11:27	Fed from boat (5 min)	D2, D4
	11:35	Surrounded by 8 boats, 2 jet skis	D2
	11:35	Fed from boat (2 min)	D2, D4
6 Aug	8:47	Petted by swimmer	D1, H1
	8:51	Suspected feeding from tour boat; dolphin tossed fish near boat (1 min)	D2, D4
	9:01	Surrounded by 5 boats, 5 jet skis	D2
	9:16	Chin slap near swimmer	H1
	9:19	Anchor dropped near (on?) head	D2
	9:25	Close follow and lunge at boat while underway (3 min)	D2
	9:26	Surrounded by 3 boats, 8 jet skis	D2
	9:41	Surrounded by 3 boats, 11 jet skis	D2
	9:51	Hit by man in face while begging at boat	D1, D2
	9:53	Petted by swimmer	D1, H1
	9:55	Petted by swimmer	D1, H1
	10:24	Submissive flinch in response to 'swimmer on top of' dolphin	D1, H1
	10:27	Swimmer alternated feeding and petting (4 min) (Fig. 2)	D1, D4, H1
	10:35	Offered bologna from boat; dolphin rejected bologna and left (1 min)	D2, D4
7 Aug	7:44	Close follow to boat underway with fishing lines out	D2, D3
	8:04	Close follow to boat underway with fishing lines out	D2, D3
	8:11	Close approach to propeller of boat underway	D2
	8:18	Close follow to boat underway with fishing lines out	D2, D3
	8:30	Close follow to boat underway	D2
	8:46	Close follow to boat underway	D2
	8:53	Begging while boaters dangled hat and sunglasses	D2, D5
	8:56	Fed from boat while underway; dolphin followed and lunged at boat (6 min, 5 fish seen)	D2, D4
	9:14	Suspected underwater feeding by tour operator (intermittent for >51 min)	D4
	9:16	Tail slap near swimmer	H1
	9:29	Leap near swimmer	H1
	9:43	Abrupt dive near swimmer	H1
	9:45	Face to face with swimmer	D1, H1
	10:01	Fed near swimmer (1 min)	D1, D4, H1

interactions between cetaceans and humans, including types and frequencies of interactions; (2) make comparisons of behaviour, ranging and association patterns for the same individuals in the presence and absence of swimmers; and (3) make similar comparisons for individuals in the same region that do and do not interact with swimmers. These methods were coupled with standard photo-identification techniques to (4) estimate the proportion of the local community, and identify particular classes of animals, that are tolerant of human interaction.

The focus on individual animals allowed rapid assessment of the detrimental effects of human interaction on local dolphins. In addition, this focus provided a tentative profile of the vulnerability of the juvenile age class to the detrimental effects of tourism. In a longer-term study, data obtained using methods like these can be used to determine which animals are more likely to interact with, be detrimentally affected by, or avoid swimmers. Such a study conducted over time would provide valuable information on the short-term, seasonal and long-term impacts of swim-with encounters on the daily lives of individual cetaceans, on animals of different gender, age class, activity state, or reproductive condition, and on cetacean communities. Sequential observations of the same individuals taken over time can be used to document habituation of sensitisation of cetaceans to human interaction.

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