A note on the release and tracking of a rehabilitated pygmy sperm whale (*Kogia breviceps*)

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ABSTRACT

A stranded, rehabilitated 220cm female pygmy sperm whale was radiotracked from 31 May-4 June 1994 after its release in the Gulf Stream off Cape Canaveral, Florida. The whale moved directly off the continental shelf and headed northward within a corridor bounded by the shelf break and the eastern edge of the Gulf Stream. It moved offshore up to 32 n.miles from the shelf break during the late afternoons and nights and headed back toward the shelf break during the day. The average travelling speed was 3.0kts, and ranged from 0-6kts. Speeds were greatest offshore of the shelf break (4.7kts), where the speed of the Gulf Stream was the greatest, and both travelling speeds and Gulf Stream speeds decreased with distance offshore. The whale did not appear, however, to be drifting passively with the current. Diving duration varied significantly with light levels. The whale made long dives (> 8min) at night and on overcast days when squid are known to be closer to the surface. During clear days, the whale's dives were significantly shorter, typically less than five minutes ($n = 841$). Although these results come from only a single, rehabilitated animal, the four days of data provided the first information on pygmy sperm whale movements and diving behaviour at sea: how its behaviour was influenced by time of day, oceanographic features, and environmental conditions, and how the whale's surfacing behaviour could allow survey estimates to be adjusted for diving whales missed along the trackline.

KEYWORDS: PYGMY SPERM WHALE; DIVING; RADIO-TAGGING; TELEMETRY; DIURNAL; STRANDINGS; OCEANOGRAPHY

INTRODUCTION

Little is known about pygmy sperm whales (*Kogia breviceps*) and their life in the wild. Until recently, this species had only rarely been sighted at sea (Caldwell and Caldwell, 1989), but aerial and ship surveys in the Gulf of Mexico have demonstrated that *Kogia* (including *K. breviceps* and its difficult-to-distinguish congener, the dwarf sperm whale, *K. sima*) are among the more commonly sighted cetaceans (Mullin *et al.*, 1994; Mullin and Hansen, 1999). These surveys confirmed that these species are clearly oceanic as they were usually seen at depths greater than 200m. Off the eastern USA coast, *Kogia* are most often sighted from shipboard surveys along the western edge of the Gulf Stream and in waters deeper than 200m (Mullin and Ford, 1992; Northeast Fisheries Science Center, unpublished data).

The pygmy sperm whale is also one of the most commonly stranded species reported along the southeastern coasts of the USA. From January 1978 to September 1997, 446 were reported along the Atlantic and Gulf of Mexico coasts (Odell, 1991; National Marine Fisheries Service, Southeast US Stranding Network, unpublished data). These strandings are particularly common along the coasts of Florida, where the Gulf Stream is close to the Atlantic coastline.

On 24 November 1993, a female pygmy sperm whale ('Inky') stranded alive on the New Jersey coast and was taken to the National Aquarium in Baltimore (NAIB) for rehabilitation. The animal was in poor health due to the ingestion of several large pieces of plastic which had lodged in the stomach and blocked the passage of food into the intestine (Whitaker *et al.*, 1994). The plastic was removed from the animal's stomach, after which the whale's health improved sufficiently for it to be released back into the wild. Live-stranded pygmy sperm whales have not survived long in captivity, so it was decided that releasing the whale into the wild would provide the best chance for survival.

As rehabilitation efforts have become more successful and releases have become more frequent, opportunities to track the movements or behaviours of some poorly known and difficult-to-study species have increased. Tracking released cetaceans also permits an assessment of the success of rehabilitation efforts. Rehabilitated pilot whales (*Globicephala macrorhynchus*) and a spotted dolphin (*Stenella frontalis*) have been released with satellite-linked time-depth recorders (TDRs) that provided movement and diving data and confirmed survival of the animals for the life of the transmitters (pilot whales: 97 days, Mate, 1989; Scott *et al.*, 1990; spotted dolphin: 24 days, Davis *et al.*, 1996). The release of this pygmy sperm whale provided a similar opportunity to study a little-known pelagic species. The initial goal was to attach a satellite-linked radio transmitter to monitor long-term movements and survivorship, but the dorsal fin was judged to be too small to accommodate such a device. However, a smaller package comprised of VHF transmitters and a recoverable TDR could provide more-detailed, but shorter-term data. Ship time was made

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available to accomplish the following objectives: (1) to safely transport, radiotag and release the whale back into the wild; (2) to monitor and evaluate the whale's reacclimation; and (3) to collect data on movements and diving patterns.

METHODS

Transport and release

The whale was released off Cape Canaveral, Florida. This area was selected because the Gulf Stream waters apparently preferred by this species were only 35 n.miles offshore and because transitional holding facilities were nearby. The whale was transported from Baltimore to the release site in two stages. On 5 May 1994, the whale was moved to an outdoor tank at Marineland of the Atlantic (St. Augustine, Florida) to allow time for recovery from the transport and acclimation to local climatic and photoperiod regimes. On 31 May, it was transported by truck to Port Canaveral to meet the 68m NOAA ship *R/V Relentless*, which served as the release and tracking platform. It took six hours to transport the whale to the release site: two hours by truck and four hours by ship. Throughout the transport and tagging procedure, the whale was kept wet and shaded and was monitored continuously by NAIB staff.

At the time of release, the whale was 220cm long, weighed 151kg and was estimated to be 12-18 months old from the length at stranding (180cm) and length-at-age data for *K. breviceps* (Ross, 1979). The whale readily ate squid after the plastic was removed from its stomach (Whitaker *et al.*, 1994), and squid has been found in the stomach of an even smaller (160cm) *Kogia* calf (Caldwell and Golley, 1965). Because *Kogia* are thought to be generally solitary animals, it was not thought to be necessary (or practical) to locate other *Kogia* in whose company the whale could be released. Another pygmy sperm whale was released at the same time and site in an independent effort by Marineland of Florida and the US Coast Guard vessel *Drummond*.

Tag design and attachment

The saddle-mounted transmitter/TDR data logger package was attached to the dorsal fin of the whale just prior to release to record the whale's movements and diving patterns. Attached to the saddle were two main components (Fig. 1): a long-range VHF transmitter (Model MOD-050 with a TA-6H semi-rigid, 43cm antenna, 148.210 MHz: *Telonics*, Mesa AZ), and a bouyant sub-package comprised of a TDR (Model Mk 5: *Wildlife Computers*, Redmond, WA) and a miniature VHF transmitter (Model 10-18 with a flexible, 42cm antenna, 149.390 MHz: *Advanced Telemetry Systems*, Isanti, MN). The TDR must be retrieved to recover the stored data, so the TDR sub-package was attached to the main saddle with a magnesium link that was designed to release in 2-4 days. The sub-package was made bouyant by embedding it in low-density syntactic foam (*Eccofloat* EF-38A, Emerson and Cuming, Canton, MA) and was balanced to float with the radio antenna upright after it released from the main saddle (the amount of foam necessary to float the entire package was judged to be too bulky for such a small dorsal fin). The transmitter would allow recovery of the TDR and its history of the whale's dives. The saddle, moulded from a cast of the dorsal fin, was padded with 6.4mm neoprene and attached to the dorsal fin with two 6.4mm Delrin pins. The placement of the pins were determined on the basis of a preliminary study of *Kogia* dorsal-fin vasculature (A. Pabst and W. McLellan, pers. comm.) and previous experience with attaching tags on small cetaceans by the authors (MS and AW). The Delrin pins were secured to the whale using 1.6gm magnesium nuts. These nuts reacted with the steel backing washers and slowly degraded allowing the package to be released from the whale after approximately two weeks. The actual release time was difficult to predict because the magnesium reaction is temperature-dependant and the precise water temperature that the whale travelled in (especially during deep dives) was not known. The entire package weighed about 225gm in air.

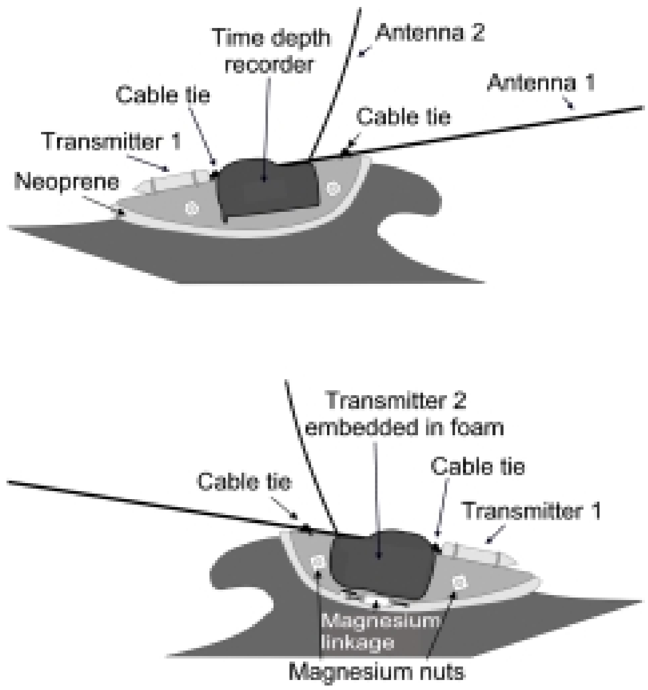

Fig. 1. Diagram of the radiotelemetry package. The *Telonics* transmitter (XTR1) was mounted along the leading edge with the antenna extending aft. A bouyant sub-package consisted of a time-depth recorder (TDR) on the left side of the package and a small ATS transmitter (XTR2) with a near-vertical antenna on the right side.

The tag was applied by Dr J. Geraci and NAIB veterinary staff. The dorsal fin was cleaned thoroughly with betadyne, and a local anaesthetic (Lidocaine HCl 2%) was injected prior to coring holes for the attachment pins. At the release site (28°21.5'N, 79°55.5'W), the whale was placed into a stretcher and lifted by crane into an inflatable boat tethered alongside the *R/V Relentless*. The whale was then removed from the stretcher and slid into the water.

Tracking

Onboard the *R/V Relentless*, a four-antenna array (four-element Yagi-Uda antennas oriented at 90° intervals) and another single antenna were mounted atop the aft mast 11m above the water. The receivers were mounted on the bridge to ensure reliable communication between the radiotracker and bridge watch officer. Two receiver systems were used (Model TR-2 receiver, Model TS-1 scanner-programmer, Model TDP-2 data processor: *Telonics*, Mesa, AZ; directional indicator, *Advanced Telemetry Systems*, Isanti, MN); one was connected to the four-antenna array to obtain directional bearings to the long-range transmitter (range approximately 13 n.miles), the other was connected to the single antenna to monitor the transmissions of the short-range transmitter attached to the TDR sub-package (range approximately 2 n.miles). This arrangement was to allow determination of whether the subpackage had been released from the saddle. The short-range transmitter produced intermittent signals simultaneously with those of the long-range transmitter when attached to the diving animal, and produced continuous signals when floating free at the surface.

During tracking, the vessel normally followed the whale at distances of 1 to 3 n.miles to avoid influencing the whale's behaviour. Once per day, the ship approached to within 3/4 n.mile of the whale to monitor its behaviour and the condition of the tag, using handheld mechanically stabilised binoculars (20 × 60 S, *Zeiss*, Wetzlar, Germany). A small inflatable boat was also launched once to get a closer view, approaching to within 15m of the whale.

VHF signals were received only when the transmitter antennas cleared the sea surface, thereby enabling surfacing times and dive durations to be determined. The surfacing times were recorded, on average, for 41 minutes every hour so that diving times and the times spent at the surface could be calculated. The position of the ship, bearing to the whale, signal strength and local time were recorded every 30 minutes. The whale's position relative to the ship was determined from the signal bearing and the signal strength, which was used to estimate distance by calibration with visually estimated distances by experienced observers.

Data analyses

The 30min interval positions of the whale were plotted, from which travelling distances were determined. These distances are minimum distances because the whale was assumed to travel in a straight line rather than meandering between estimated positions. Travelling speed was calculated from the distance travelled each hour, and thus should be considered as a minimum speed.

A Kolmogorov-Smirnov (K-S) test was conducted to compare the distributions of dive durations made during nights (from 20:30, about 15min after sunset, to 06:00, about 15min before sunrise), during clear days (06:00-20:30), and during overcast days. A 3 × 4 contingency table was used to test for more specific differences among the three environmental light levels above and four dive duration strata (>30sec-2min, >2min-5min, >5min-8min and >8min). Dives less than 30sec were excluded to focus on dives that were likely made to depth rather than near the surface.

The estimated mean proportion of time the whale spent at the surface was calculated, along with its standard deviation (SD) and coefficient of variation (CV). Data were stratified by two-hour intervals, each day was treated as a replicate, and the mean and standard error of the replicates were calculated by weighting the replicates by the amount of time that data were recorded during each daily time interval.

Environmental data

An expendable bathythermograph (XBT, 1 model T-4 and 27 model T-7) was deployed from the *R/V Relentless* every four hours to determine the vertical thermal structure of the water column during the track. Sea-surface temperatures were obtained from NOAA satellite data on 31 May, 2 June and 7 June to plot the location of the Gulf Stream. Gulf Stream current speeds were taken from Leaman *et al.* (1989). The bathymetry data were obtained from the General Bathymetric Chart of the Oceans Digital Atlas (British Oceanographic Data Centre, Birkenhead, England). Isobaths were plotted using *Arc/Info* GIS software (Environmental Systems Research Institute, Inc., Redlands, CA).

RESULTS

Reaction of the whale to release

When released at 10:40, the whale initially swam away from the ship at a speed of 2.1kts. By 11:30, 1-2min dives were interspersed with surfacings of 30sec or more. The whale travelled northeasterly, heading directly off the continental shelf and toward the axis of the Gulf Stream. The second whale released at the same time was not tagged by Marineland and was not observed during our track.

Movements

The whale travelled a minimum of 255 n.miles (425km) in four days (31 May to 4 June 1994) before the signal was lost (Fig. 2). After release, the whale had headed northward within a corridor bounded by the continental shelf break (defined as the 200m depth contour) and the eastern edge of the Gulf Stream (Fig. 2). During this track, the western edge of the Gulf Stream was over the continental shelf (Fig. 2). Daytime movements of the whale were inshore, toward the shelf break. Movements during the late afternoon and night were offshore, up to 32 n.miles from the shelf break. The whale spent most of the time over the steepest section of the continental slope, between the 500m and 800m depth contours. On the night of 3-4 June, movements shifted more easterly where the Gulf Stream also shifted easterly and the continental slope was less steep.

The whale did not appear to be drifting passively with the current. Although it travelled at an average minimum speed of 3.0kts ($SD = 1.18$), speeds were variable, ranging from 0-6kts. The direction of travel also varied as the whale zigzagged back and forth across the Gulf Stream (Table 1, Fig. 3). Travelling speeds were the greatest (2.4m/s or 4.7kts) just offshore of the shelf break where the Gulf Stream current is greatest (about 1.9m/s or 3.7kts, Leaman *et al.*, 1989) and both travelling and current speeds decreased with distance offshore of the shelf break.

The whale remained east of the shelf edge where the sea-surface temperatures were 27.8-30.0°C. The XBT data revealed that, as would be expected in the Gulf Stream, the waters were well-mixed with a gradual thermocline. The 20°C isotherm occurred at depths ranging from 75-265m and the 10°C isotherm ranged from 370-575m.

Diving and surfacing patterns

The TDR sub-package did not release and the dive-depth data were not recovered. Diving patterns and behaviour could be inferred from surfacing times however (Fig. 4). The diving patterns appear to be influenced by light level (Fig. 5). The K-S test showed a significant difference between diving intervals during the daytime under clear skies and during night-time ($p < 0.01$). Daytime dives made under overcast skies were significantly different from daytime dives under clear skies ($p < 0.01$), but were not significantly different from night-time dives. The contingency table analysis also demonstrated a difference between clear daytime and night-time diving intervals ($p < 0.01$, 3 × 4 contingency table for dives >30sec). Two dive strata (the 2-5min and >8min dives) contributed most to these significant differences.

Typically, the diving intervals were less than five minutes during clear days, and longer than eight minutes at night (Figs 4-5). Longer dives generally occurred just after dawn, with the longest being almost 18mins long. When the sky was overcast, however, the long dives continued during the day (06:00-20:30 on 2 June and 06:00-12:00 on 3 June).

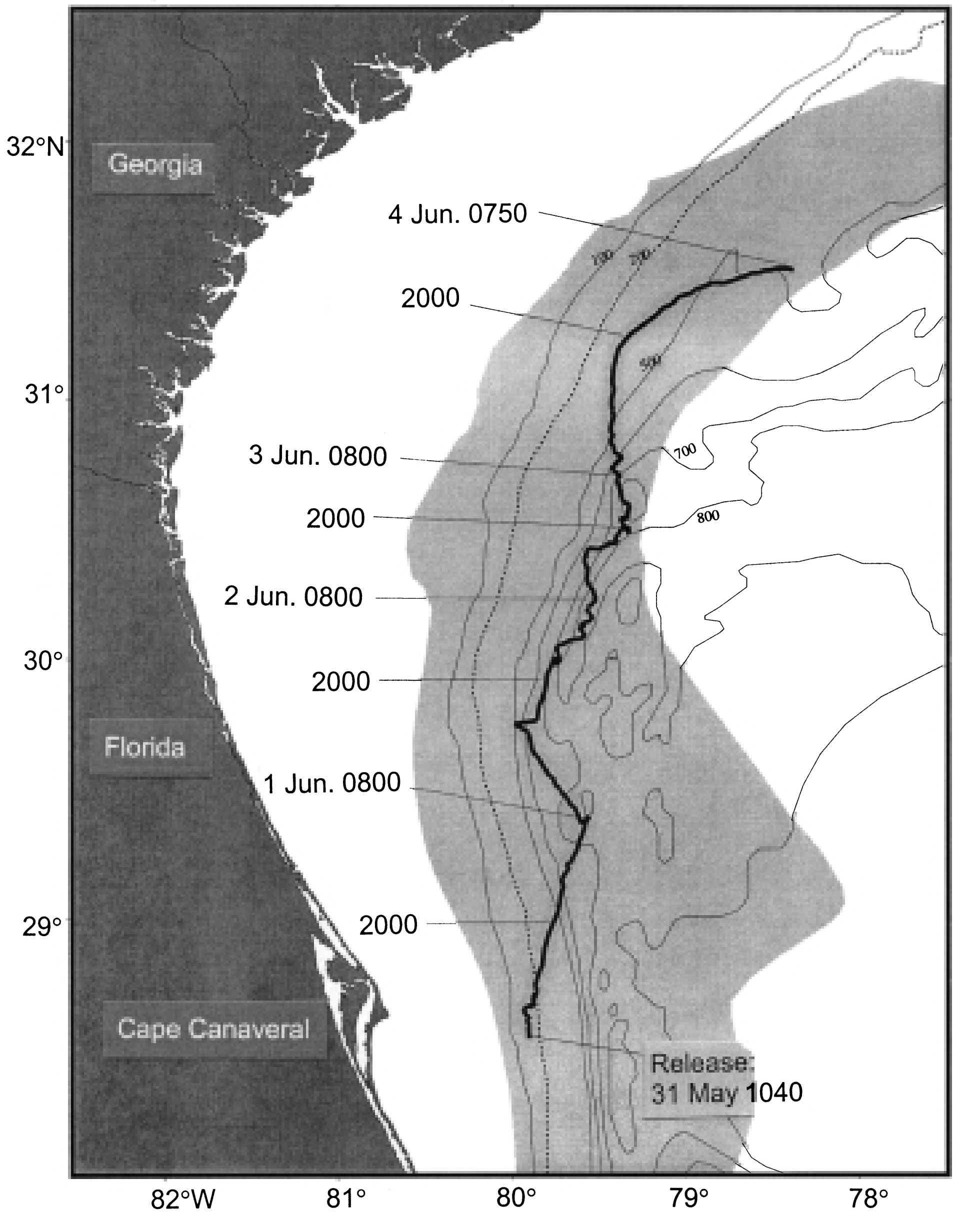

Fig. 2. Plot of the movements of the pygmy sperm whale, 31 May-4 June 1994. Also shown are the bottom depth contours, the continental shelf break (the 200m isobath), and the position of the Gulf Stream during the study.

Table 1

Mean travelling speed of the whale and current speed stratified by distance from the shelf break. Travelling speeds were calculated for each hour and the sample sizes represent the number of tracking hours in each strata. The Gulf Stream current speed is estimated from a plot published by Leaman *et al.* (1989, fig. 3) from stations along the 29°N latitude (off Cape Canaveral).

	On shelf	Distance from shelf (n.miles) 5-10	10.1-15	15.1-20	20.1-25	>25
Current speed (m/s)	1.5	1.9	1.7	1.3	1.0	0.9
Travelling speed (m/s)	2.0	2.4	1.9	1.6	1.4	1.1
Travelling speed (knots)	3.9	4.7	3.7	3.2	2.7	2.2
SD (knots)	1.41	0.66	0.95	0.98	0.89	0.94
CV	0.36	0.14	0.26	0.31	0.33	0.43
Sample size	7	5	13	21	20	27

When the whale was travelling in the morning or afternoon, the dives were typically 2-5mins long (Fig. 4). In the afternoon, the whale often appeared to be moving slowly or drifting at the surface ('logging') (Fig. 4). At dusk, the night-time long-dive pattern returned, presumably indicating deep foraging.

The proportion of the time spent at the surface also varied with time of day (Table 2). Because the transmitters broadcast only when the antennas had cleared the sea surface, signals were received from the long-range transmitter when the whale's dorsal surface was <25cm below the surface. Most surfacings (77%), as indicated by radio signals, lasted less than 4secs, but surfacing durations of up to 11mins were recorded. The longest surface times were observed when the whale was 'logging' during the afternoon, and after long dives.

During the morning (06:00-12:00), the average proportion of time spent at the surface was 0.094 (SD = 0.0613, CV = 0.65). The inverse of this proportion (10.64, CV = 0.65) is a correction factor (with the same CV) for this species to account for the number not observable at the surface during a survey. During the afternoon (12:00-18:00), the proportion of time at the surface was greater, 0.230

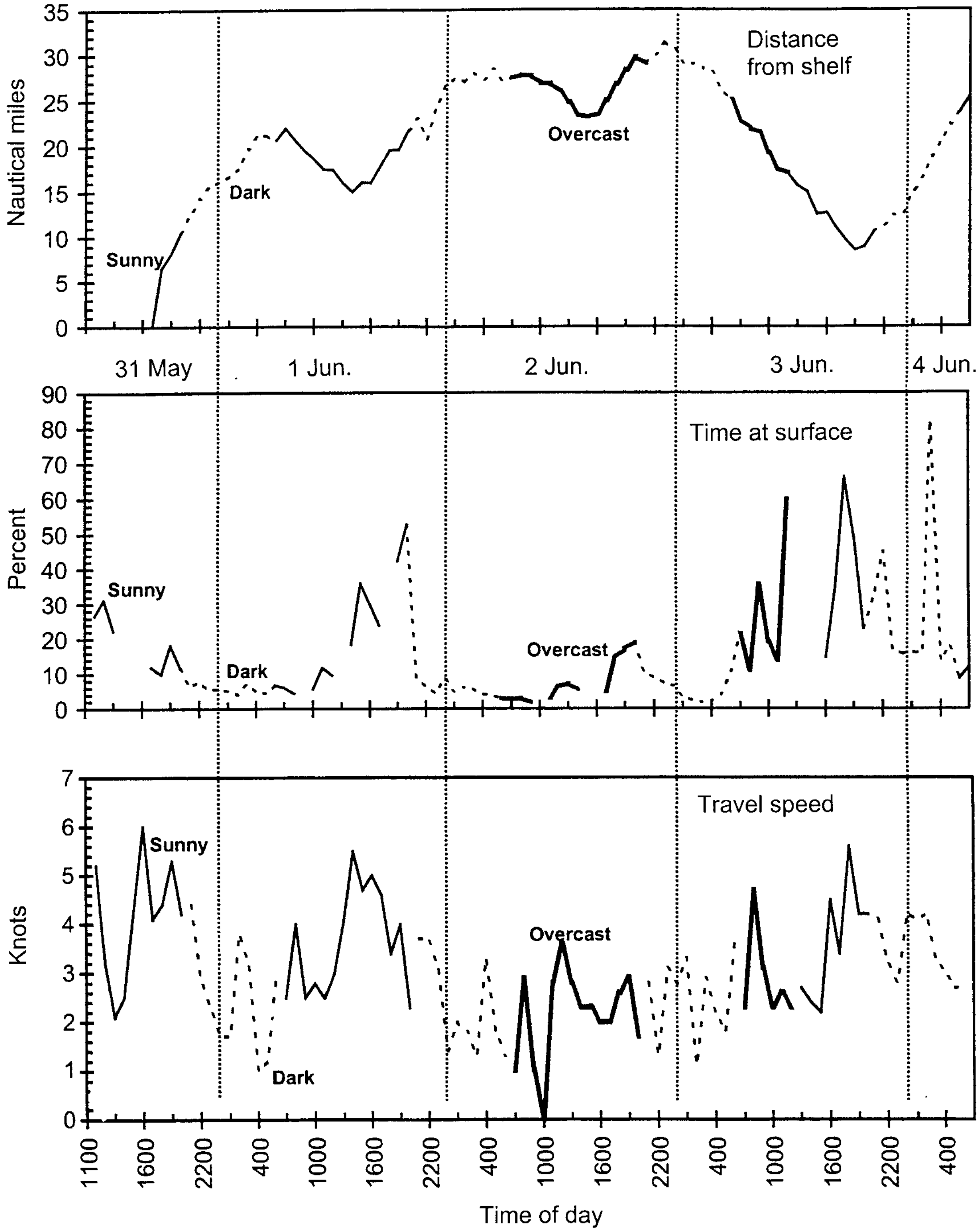

Fig. 3. Plot of distance from the continental shelf (measured from the 200m isobath), percentage of time at the surface, and travelling speed of the whale during the course of the tracking study.

(SD = 0.1068, CV = 0.46) and, therefore, the correction factor was less, 4.35 (CV = 0.46). These proportions were not significantly different ($p = 0.11$, t-test for proportions), probably because the sample size ($n = 4$ days) was small.

Behavioural observations

The whale was sighted eight times during the course of the four-day track. At 18:20 on 2 June, the whale crossed the bow of the ship, breached three times and porpoised once within 150m of the ship, and then continued on its course. At 16:05 on 3 June, the whale was observed 'logging' at the surface from a small inflatable boat at a distance of 15m. None of the observations suggested that the whale was behaving abnormally (Caldwell and Caldwell, 1989), nor did it appear that the tag was misaligned.

Termination of the track

Both VHF signals from the whale stopped abruptly at 07:52 on 4 June. Immediately prior to this time, the signals from both transmitters had been strong and the whale was estimated to have been within 1 n.mile of the ship. After loss of the signals, the area was searched thoroughly over the subsequent 12 hour period, but no further signals were heard from either transmitter and the whale was not sighted. The TDR sub-package did not release from the saddle prior to loss of the signals.

DISCUSSION

Movements and diving patterns

One obvious caveat is that the data are limited in duration and were collected from a single individual recently released from captive rehabilitation, and thus may not have been

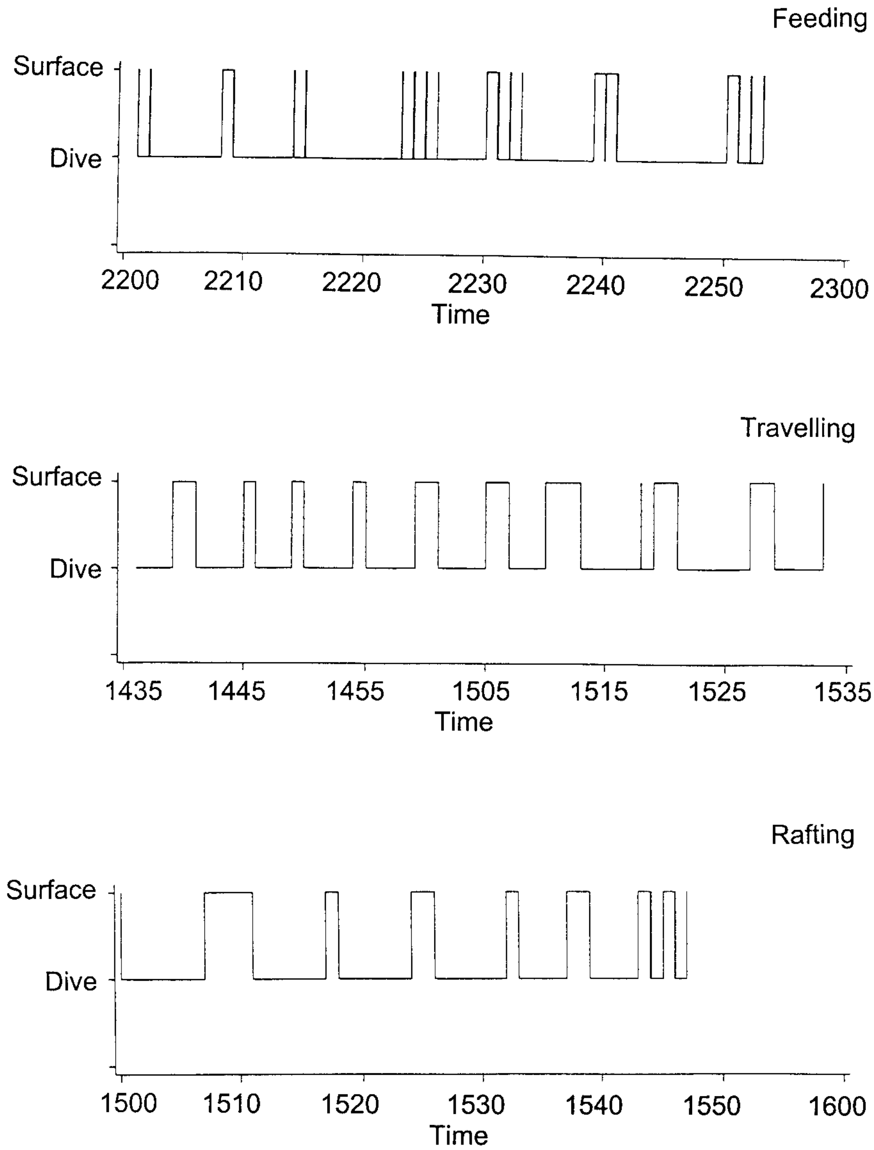

Fig. 4. Representative examples of diving patterns of a pygmy sperm whale. Top: long-dive pattern likely associated with feeding on vertically migrating prey associated with the deep scattering layer. Middle: medium-length diving pattern likely associated with travelling. Bottom: diving and surfacing pattern associated with rafting at or near the surface or 'logging' behaviour (see Leatherwood and Ljungblad, 1979; Scott and Wussow, 1983).

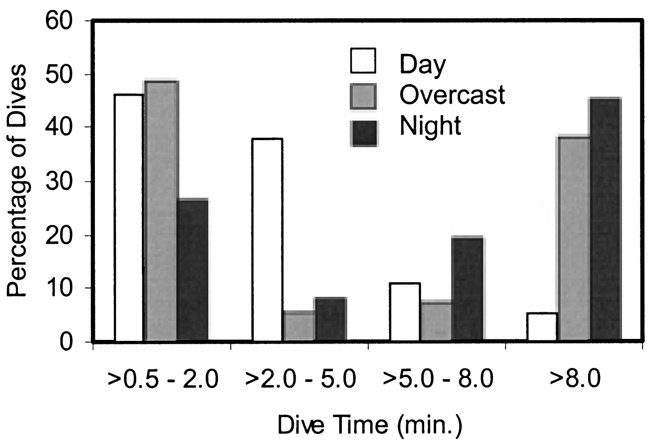

Fig. 5. Percentage of dives in different dive-time intervals for three different environmental light levels: clear day ($n = 213$), overcast day ($n = 105$) and night ($n = 205$). Short dives (< 30sec) were excluded from this analysis to emphasise deeper dives.

Table 2

Proportion of time spent transmitting at the surface, by two-hour intervals. The proportions calculated for each day were weighted by the amount of time data were recorded for each interval and averaged. Correction factors were calculated for daylight hours by taking the inverse of the weighted average proportion. The first two-hour interval after the release of the whale was not included in the analysis.

Time	Date recorded (hours)	Surface time proportion (CV)	Survey correction factor
0000-0200	6.1	0.073 (0.58)	
0200-0400	5.4	0.093 (1.29)	
0400-0600	5.6	0.065 (0.74)	
0600-0800	6.2	0.082 (0.56)	12.20
0800-1000	3.1	0.098 (0.89)	10.20
1000-1200	3.6	0.095 (0.61)	10.53
1200-1400	3.3	0.217 (0.83)	4.61
1400-1600	2.5	0.215 (0.43)	4.65
1600-1800	4.2	0.183 (0.50)	5.46
1800-2000	4.4	0.278 (0.60)	
2000-2200	5.2	0.204 (0.62)	
2200-2400	5.5	0.090 (0.89)	

representative of other whales. The movement data from this study are in accord with survey sightings that suggest that these whales inhabit the Gulf Stream off the US Atlantic coast (Northeast Fisheries Science Center, unpublished data). The movements also support the idea that young whales live along the edge of the continental shelf before moving offshore as adults (Ross, 1984). Examination of stomach contents from animals stranded in the southeastern USA has shown a predominance of histioteuthid and ommastrephid squid (Raun *et al.*, 1970; M. Vecchione, pers. comm.). These are vertically migrating epipelagic and mesopelagic squid found along the deep continental slope. The whale zigzagged across a depth band that was the steepest part of the continental slope (between 500 and 800m) and in which the prey species from the mesopelagic boundary community are more concentrated (M. Vecchione, pers. comm.).

Dive duration has been shown to correlate with maximum dive depth for some cetaceans (Westgate *et al.*, 1995). Long-dive patterns have been observed in dolphins that feed nocturnally on vertically migrating prey that rise towards the surface at night (Evans, 1971; 1974; Leatherwood and Ljungblad, 1979; Scott and Wussow, 1983; MS, unpublished data). This would suggest that the whale's long night-time dives were deep-foraging excursions to prey on squid. The longest dives occurred near dawn when these squid would be descending to their daytime depths. The whale continued to make long dives on overcast days, during which vertically migrating organisms typically remain closer to the surface (e.g. Blaxter, 1975). During days with clearer skies, however, behavioural observations and diving patterns suggested that the whale typically was travelling or, in the afternoon, 'logging' at the surface.

Kogia along the USA Atlantic coast are typically found in association with the Gulf Stream. The Gulf Stream current varies in strength with distance offshore and depth, and likely influences the movements and foraging strategy of these whales. For example, as an animal travels 25 n.miles offshore from the shelf break along the 29°N latitude line, the current slows from 1.9m/s to 1.0m/s. As the animal dives offshore, the current further slows to 0.9m/s at 200m, 0.5m/s at 400m and 0.1m/s near the bottom at 800m (Leaman *et al.*, 1989). The data on movements, travelling speed and diving behaviour suggest that this whale fed offshore at depths where the current was relatively slow and travelled inshore, nearer the surface, where the currents were faster. During the day, the whale would thus make steady progress northward, even when rafting near the surface. By the time the whale headed back offshore the next evening, it would be foraging in a new area, particularly in relation to any prey patch encountered the previous night.

Correction factors for abundance surveys

The proportion of time spent at the surface can be used to calculate correction factors for abundance survey estimates to account for whales that were diving at the time the plane or ship passed through an area. Although the variations in surfacing proportion were not significantly different (likely due to low sample size), the data suggest that different correction factors are appropriate for different times of day. At least the following caveats should be considered before using correction factors estimated from data obtained during this study, however. First, as noted above, the daily behavioural patterns of a young, stranded, rehabilitated and released whale may not be representative of other whales. Second, the variances calculated are based on daily differences of a single individual rather than (as would be preferred) differences among many individuals. Third, the factors are based on the proportion of the time the transmitter was in air (i.e. the whale's back was no more than 25cm below the surface). If the water clarity of a survey area is such that whales can be sighted below this modest depth, then the correction factor and the abundance would be underestimated. Fourth, these correction factors are most readily useful for an 'instantaneous' survey; more parameters (e.g. observer search behaviour and vessel or aircraft speed) would be required to calculate an accurate correction factor, particularly for shipboard surveys.

Fate of the whale

The question of reintroducing rehabilitated cetaceans into the wild has been a topic of recent debate because of the mixed success of the few releases of captive cetaceans that have been monitored and published (Gales and Waples, 1993; Wells *et al.*, 1998). Given the sudden loss of signal after four days of tracking, the fate of this whale is not known. There are four possibilities for the loss of the signals.

(1) Both transmitters could have failed simultaneously. This explanation is considered unlikely because prior to signal loss both transmitters were functioning well. Further, the depth in that area was about 450m and a pressure test of another *Telonics* Model-050 transmitter revealed that it could survive pressures up to 1,000psi (equivalent to about 680m), so it is doubtful that pressure destroyed both transmitters.

(2) The whale could have swum rapidly out of reception range. This is highly improbable given the strong signals when last heard, the 13 n.mile range of the receiving system and the immediate box-pattern search of the area after loss of the signal.

(3) The whale could have died. If so, the death would likely have been sudden and traumatic because the dive patterns did not appear to change prior to loss of the signals, nor did the whale's behaviour appear to be abnormal when sighted the previous afternoon. No evidence of a shark attack (blood in the water or circling birds) or of potentially entangling fishing gear was seen in the immediate area.

(4) The saddle could have fallen off the whale and sunk because the bouyant sub-package was not designed to float the entire package. Observations of the tag the previous afternoon did not indicate that anything was amiss with the saddle or that migration of the bolts was occurring (generally indicated by a lifting of the saddle's leading edge). It is likely, however, that the saddle fell off due to shearing of the pins, migration of the pins through the fin, or premature corrosion of the magnesium nuts. All of these causes of saddle release have been observed on other tagged cetaceans (Scott *et al.*, 1990; MS and AW, pers. obs.).

The tracking data suggest that the whale appeared to be healthy and re-acclimating to life in the wild. It was capable of long dives and displayed diving patterns typical of other nocturnal feeders on squid (Evans, 1971; 1974; Mate, 1989; MS, unpublished data). Although movements generally followed the direction of the Gulf Stream, the tracking data indicated that the travelling speed and direction varied during the day, and that the whale was not simply drifting passively in the Gulf Stream. The whale remained in habitat types (along the continental slope and the western edge of the Gulf Stream) in which *Kogia* have been observed most often (Ross, 1984; Northeast Fisheries Science Center, unpublished data). The whale milled in areas during presumed feeding attempts as is often observed in other small cetaceans. The few, brief visual observations indicated that the whale's behaviour at the surface was similar to that of other pygmy sperm whales observed previously in the wild (Caldwell and Caldwell, 1989). The apparent normal behaviour of the whale is particularly interesting, given that the whale was thought to be no more than 18 months old at the time of release.

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