

**CETACEAN SITE USE & BOAT TRAFFIC AT NEW QUAY
ON THE
CEREDIGION MARINE HERITAGE COAST
WEST WALES
2000**

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March 2001



Produced by the Department of Environmental Services & Housing,
Ceredigion County Council
with the financial support of the Countryside Council for Wales

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INTRODUCTION

1. Background

This study began in 1994, following the establishment of the Marine Heritage Coast (MHC) in the southern part of Ceredigion. The original aims and objectives of the study were to:

- Obtain further information on cetacean site use and boating traffic that would help guide future management
- Build on local community interest and support for the MHC by actively involving them in producing their own science
- Raise public awareness of the issue of potential boat disturbance and to influence local behaviour whilst at sea.

Since 1994, local volunteers have undertaken shore-based observations during the summer months from a number of sites along the 16km stretch of Heritage Coastline. An analysis of this six-year data set was given in *Cetacean Site Use & Boat Traffic on the Ceredigion Marine Heritage Coast, West Wales 1994 – 99*, Pierpoint & Allan (2000). Baseline monitoring data on habitat use and behaviour of bottlenose dolphins, on levels of boat traffic, and concerning interactions between boat users and dolphins were provided. The results indicated the need to continue the study, and to concentrate further effort at New Quay, the site of greatest boating activity. The aims of the 2000 study at New Quay were, therefore, to:

- Compare site use by bottlenose dolphins in the year 2000, with previous years
- Determine whether changes have occurred in the observed behaviour of boat users during encounters with dolphins.

2. Code of Conduct

In 2000, the Coast & Countryside Project Officer accompanied each of the volunteers during watches from the Coastguard Lookout at New Quay. This enabled additional help to be given on aspects of observing dolphin behaviour, and recording breaches of the voluntary Code of Conduct for boat users. Pierpoint & Allan (2000) had observed no increase in the average separation distance between speedboat / motorboat users and dolphins since the introduction of the Code of Conduct and no increase in the stopping rates. However, amongst visitor passenger boats (VPB) average separation distances and stopping rates had increased since the introduction of the commercial operators' Code of Conduct. This indicated that the recreational boat users' Code of Conduct was limited in its effectiveness as a management measure aiming to reduce the risk of disturbance to bottlenose dolphins.

In order to establish why the Code of Conduct was having little impact amongst speedboat users, incidents of breaches in the voluntary Code of Conduct were passed to the Assistant Harbourmasters at New Quay and Aberaeron for further action. Harbourmasters are authorised to ultimately withdraw launching permits from offenders, having first reminded people of the Code and seeking their voluntary compliance. A total

of 23 incidents were recorded from early June to mid-September, 99% involving speeding. Meetings were held in the autumn with the powerboat users to discuss the Code of Conduct, and proposals for amendments are currently being drawn up.

METHODS

Observations of bottlenose dolphins were carried out at New Quay, Ceredigion, from June to September 2000. Data were collected by a team of volunteers, most of who had previously taken part in the project in previous years. Field methodology is detailed in Pierpoint & Allan (2000), which presents data from the first six years of this survey. In 2000, 2h watches were scheduled daily beginning at 11:00, 13:00 and 15:00. The number of dolphins present, the number of calves, observed behaviour, and environmental factors including sea state (HMSO, 1983) were recorded to summarise successive 15min periods. The times at which sightings began and ended was also noted with the direction in which the dolphins came and left the site. A count of all boats present or transiting through the site in 2h was made. When boats and dolphins were both present, the type of boat that is closest to dolphins was recorded, also the minimum distance between dolphins and this boat, and a code depicting whether this boat was moving or remained stationary during the encounter.

From these data we derived two sighting rates for dolphins: the proportion of 2h watches in which dolphins were recorded, and the average number of dolphins present per 15min in each watch. As sea state affects the probability of making sightings and accurately assessing the number of animals present, data collected in relatively poor conditions were excluded before sighting rates were calculated. Sighting rates for observation periods with an average sea state of 4 or less allowed comparisons with rates reported for 1994-99 (Pierpoint & Allan, 2000), but for most analyses data collected in sea states 0-3 only were used.

We have investigated trends in a number of parameters describing encounters between boats and dolphins. From 1994-99, the average separation distance between visitor passenger boats (VPB) and dolphins during encounters increased. The average distance was greater after the introduction of the code of conduct than in previous years. There was no corresponding trend for speedboat and motorboat users however. Also, during close interaction with dolphins recreational powerboats stopped less frequently than VPB. In 1994-99 we looked at the relative frequency with which a range of behaviours were observed during encounters with different types of boat. For example, 'staying' was found to be more common during encounters with VPB than other types of boat; 'tail-slapping' was most common in the presence of canoes. We have again looked at behaviour observed during encounters in the 2000 season, and compare the rates of 'staying', 'heading away from boat' etc. recorded with different craft. In summary, we investigate the following factors for evidence that boat users are now more likely to adhere to publicised codes of conduct.

- The average separation distance during encounters between dolphins and boats
- Rates at which boats stop or drift during close encounters with dolphins
- Observed rates of dolphin behaviour in the presence of boats

RESULTS

a. Observer effort

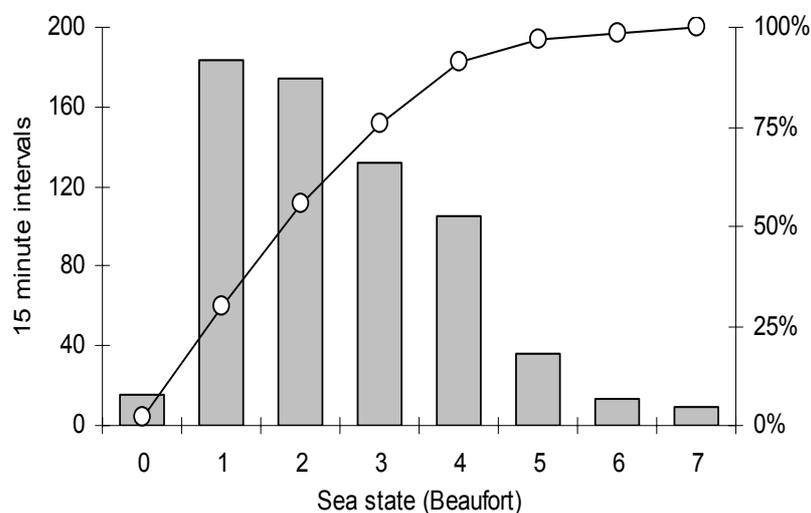
A total of 85 observation periods (watches) were completed at New Quay in the year 2000, spanning 39 days from June to September. Watches were 2h long with the exception of three watches that were abandoned after 1h because of bad weather. Observer effort therefore totalled 167h.

b. Sighting conditions

Observers recorded the sea state and other environmental parameters for each 15min interval. Sea state was recorded as Beaufort values (0-12), based on sea surface criteria (HMSO, 1983). Sea state was recorded for 668 intervals and values ranged from 0-7. Overall, the mean sea state was 2.5 (sd = 1.44; mode = 1). Ninety-one percent of data were collected in sea state 4 or less, 56% in sea state 2 or less (Fig. 1).

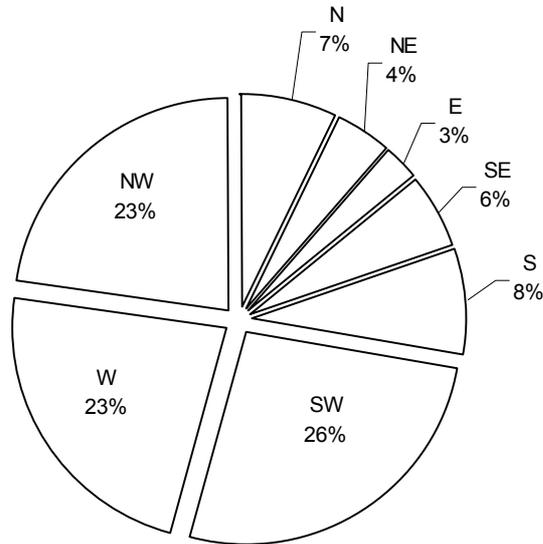
The median sea state value was calculated for each 2h watch: 77 watches were carried out in sea states 0-4 and 64 watches were carried out in sea states 0-3. These data were used to derive sighting rates for bottlenose dolphins and make comparisons with other years.

Figure 1. Sea state recorded during observation periods.



The prevailing wind directions were southwest, west and northwest (Fig. 2). The most frequently recorded air temperature categories for the 668 15min intervals were 'warm' (39%), 'moderate' (30%) and 'cold' (26%) respectively. Most frequent general weather descriptions were 'sunny' (46%) and dull (32%).

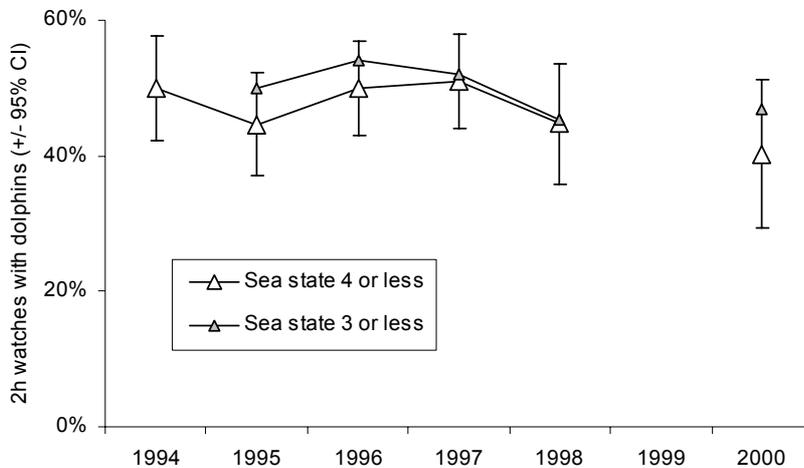
Figure 2. Wind direction recorded during observation periods.



c. Sighting rates of bottlenose dolphins

Overall in the year 2000, bottlenose dolphins were present in 31 of 77 watches (40%) carried out in sea states 0-4. From 1994 to 1999, the corresponding proportion of 2h watches in which bottlenose dolphins were recorded ranged from 45-51%. There were no observations in 1999. The proportion of watches in which dolphins were present at New Quay was therefore slightly lower, but similar to that recorded in previous years (Fig. 3). Sighting rates were higher in lower sea states. In sea state 3 or less, dolphins were recorded in 30 of 64 watches (47%), a similar value to that recorded in the last survey in 1998.

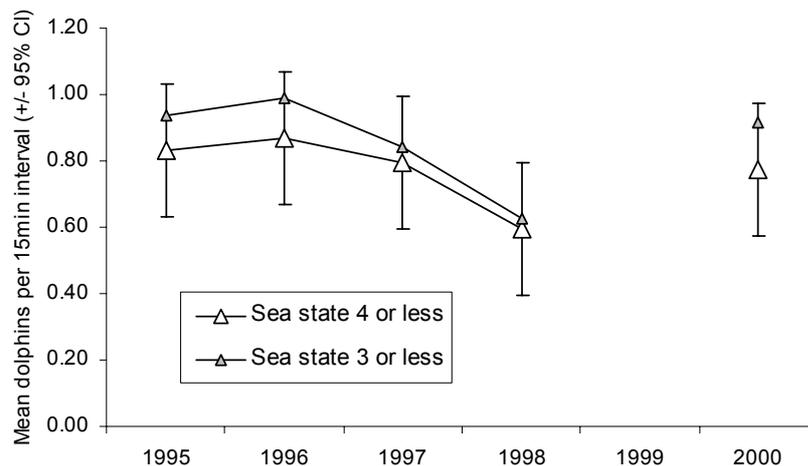
Figure 3. The proportion of 2h watches in which bottlenose dolphins were recorded: 1994-2000. 95%CI is shown for data collected in sea state 4 or less. Data collected in sea state 3 or less are shown for comparison.



The number of dolphins present at the study site was recorded for consecutive 15min intervals in each watch. The average number of dolphins present in each interval per watch in 2000 was 0.77 (se = 0.16) in sea states 0-4, and 0.92 (se = 0.19) in sea states 0-3. This was equivalent to 3-4 animals per hour and similar to rates recorded in previous years (Fig. 4).

We carried out a statistical comparison to test whether a trend in the sighting rate was apparent at New Quay from 1995-2000. Using data collected in sea state 0-3, we looked at the average number of dolphins sighted in each 15min interval, in each observation period, and compared these data between years. We found that there was no significant trend for sighting rates to rise or fall over this period (Cruzick's Trend Test (two-sided), z (adj.) = -0.776, $P = 0.438$).

Figure 4. The average number of dolphins recorded per 15min: 1995-2000. 95%CI is shown for data collected in sea state 4 or less. Data collected in sea state 3 or less are shown for comparison.



d. Counts of the number of dolphins present

Previously we compared the average group size for sightings at four study sites (Pierpoint & Allan, 2000). For the present data, we were able to compare sightings at New Quay for surveys carried out in 1995, 1996, 1997, 1998 and 2000. For data collected in sea states 0-3, we found that the number of dolphins present in the year 2000 was similar to that recorded in 1995-97. However, the average (median) number of dolphins present in 1998 was found to be significantly lower than in other years (Kruskal-Wallis, T (adj.) = 46.8, $P < 0.0001$). The results of pairwise comparisons between years are shown below:

all pairwise comparisons (Dwass-Steel-Chritchlow-Fligner)

| | | |
|-------------|--------------|-------------|
| 2000 & 1998 | $P = 0.0007$ | Significant |
| 1997 & 1998 | $P < 0.0001$ | Significant |
| 1996 & 1998 | $P < 0.0001$ | Significant |
| 1995 & 1998 | $P < 0.0001$ | Significant |

| | | |
|-------------|-----------|-----------------|
| 1996 & 1997 | P = 0.033 | Significant |
| 2000 & 1995 | P = 0.952 | Not Significant |
| 2000 & 1996 | P = 0.893 | Not Significant |
| 2000 & 1997 | P = 0.870 | Not Significant |
| 1995 & 1996 | P = 0.118 | Not Significant |
| 1995 & 1997 | P = 0.996 | Not Significant |

These observations indicate that 1998 was a relatively poor year for dolphin sightings at New Quay as counts of the number of animals present during sightings tended to be lower than in 1995, 1996, 1997 and 2000. Highest counts recorded in each field season were: 10, 12, 10, 8, 12 for 1995-98 and 2000 respectively. The mean number of animals present was 3.1, 3.5, 3.0, 2.4 and 3.4 respectively.

e. Site occupancy

Occupancy, in this case, refers to the total amount of time that bottlenose dolphins spent at New Quay, during watches in which they were recorded at least once. Observers recorded the start and end times of each sighting and the total amount of time that dolphins were present were summed for each watch. We extracted data from 2h watches carried out in good sighting conditions (sea state 0-3; n = 331 watches) and compared the average occupancy values for each year. The aim of this analysis was to test whether dolphins were present at New Quay for similar amounts of time, on average, each year. Differences between years may indicate that dolphins were either more transient visitors to the site, or occupied and utilised resources at the site in some years for longer periods.

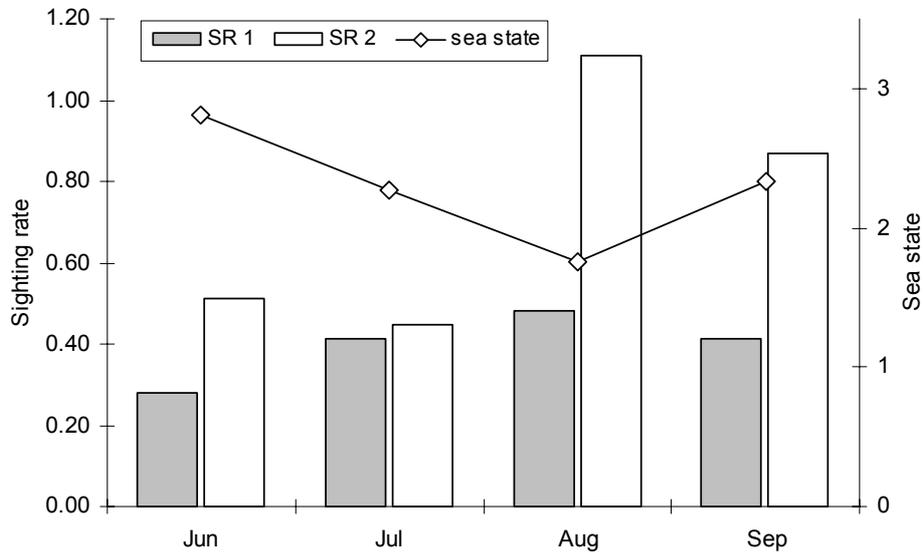
We found that there were in fact, no significant differences in site occupancy for the years 1995, 1996, 1997, 1998 and 2000 (One-way ANOVA, $F = 0.750$, $P = 0.559$). Dolphins therefore, spent a similar amount of time at the site each year. The mean number of minutes for which the site was occupied each year ranged from 47-56min, or 39-47% of 2h watches in which the species was recorded.

f. Monthly variation in sighting rates

Sighting rates of bottlenose dolphins peaked during August. The proportion of watches in which dolphins were recorded for example, rose to 48%. Sighting conditions were also at their best in August and, on average, the sea state during observation periods was lower than in other months. Fig. 5 shows the monthly sighting rates and mean sea state, for data collected in sea state 3 or less.

While increasing sea state certainly reduces the probability of sighting small cetaceans, the present data show a similar seasonal pattern to previous years, in which the number of dolphins recorded peaked in early to mid-August. For the present data, the number of watches in which dolphin calves were sighted also peaked in August: 24% (6 watches) compared to 11-12% (2 watches) in each other months.

Figure 5. Variation in monthly sighting rates and sea state. SR 1 is the proportion of watches in which dolphins were recorded; SR 2 is the mean number of dolphins per 15min interval. Mean sea state (Beaufort) values are shown. N = 77, 2h watches carried out in sea state 3 or less.



g. Levels of boat traffic

Observers at New Quay have recorded levels of boat activity in 1994, 1998 and 2000. In 1994 and 1998, New Quay was the 'busiest', in terms of boat counts, of all sites monitored by observers in the MHC. The most frequently recorded types of boat in all years were sailing boats, visitor passenger boats (VPB), commercial fishing boats, speedboats and motorboats. In 2000, VPB again accounted for approximately one quarter of all boat traffic. There was a reduction in sailing boat and speedboat activity relative to other boat types and an increase in commercial fishing boat activity. The relative frequency of different boat types is shown for all three years in Table 1.

Overall levels of boat activity can also be expressed in terms of the average number of boats counted. The data show that the level of activity lower in the year 2000 (on average 8.0 boats per 2h) than in 1998 (10.6) and 1994 (12.2).

Table 1. The percentage of total boat counts accounted for by different boat types, during 2h watches: 1994, 1998 & 2000.

| Boat type | 1994 | 1998 | 2000 |
|-------------------------|------|------|------|
| visitor passenger boat | 12% | 25% | 24% |
| sailing boat | 38% | 34% | 23% |
| commercial fishing boat | 10% | 6% | 17% |
| speedboat | 17% | 19% | 14% |
| motorboat | 17% | 12% | 12% |
| other | 1% | 0% | 6% |
| canoe | 3% | 2% | 3% |
| water-skier | 1% | 1% | < 1% |
| jet ski | < 1% | <1% | 0% |

h. Encounters between dolphins and boat users

Boats were recorded in the vicinity of dolphins on 75 occasions. A 15min period in which dolphins and boats were present concurrently has been termed an 'encounter'. Data on a total of 1514 encounters have been collected since 1995. The type of vessel closest to dolphins at the site was recorded in each case. In 2000, VPB were the most frequently recorded vessel when dolphins were present (59% of 75 encounters).

The relative frequency of VPB and other boat types is shown in Table 2. The proportion of encounters in which VPB were recorded as the closest boat to dolphins has increased from previous years. The percentage of speedboat encounters (17%) was similar to the average frequency 1994-98. The number of motorboat encounters (1%) was lower than previously. If motor and speedboats are combined, the proportion of encounters for which these account was similar to the last survey in 1998 ($\approx 20\%$), but lower than the years 1994-97 (27-31%).

Table 2. The relative frequency with which different types of boat were recorded as the closest vessel to dolphins during encounters: 1994-98 & 2000.

| Boat type | 1994-98 | 2000 |
|-------------------------|---------|------|
| visitor passenger boat | 40% | 59% |
| sailing boat | 22% | 17% |
| speedboat | 16% | 17% |
| commercial fishing boat | 8% | 3% |
| canoe | 2% | 3% |
| motorboat | 12% | 1% |

i) *Average separation distances between dolphins and boats*

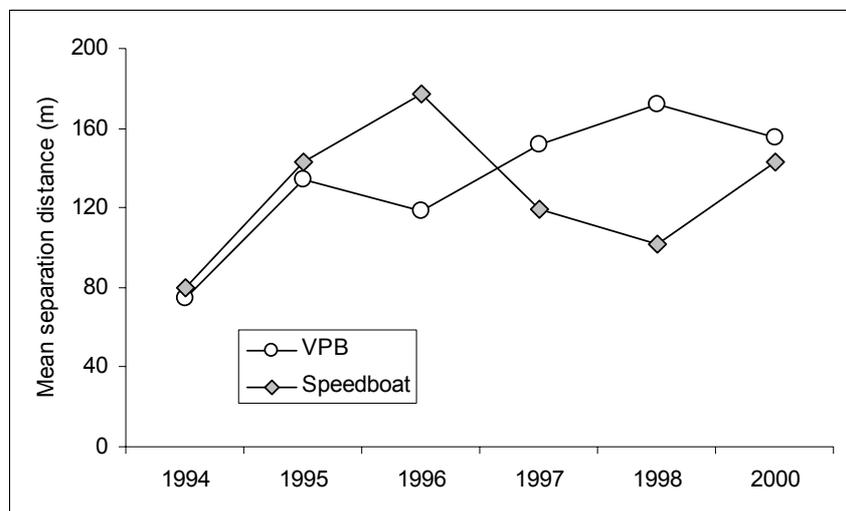
Separation distance refers to the minimum distance between dolphins and boats observed during encounters. It was recorded once each 15min, for the closest boat during this period. Distances were estimated by eye and recorded in metres.

Following analyses carried out in 1999, we again looked at the average distances between dolphins and VPB, motorboats and speedboats. The average separation distance for VPB is known to have risen after the introduction of codes of conduct for boat users. The objective was to determine whether a similar trend was now apparent for recreational users; this was not the case for 1994-99. The results provide an indication of whether management measures have encouraged recreational motor and speedboat users to keep their distance from groups of dolphins, allowing the dolphins to approach boats if they choose and to initiate any close interaction.

Separation distance was recorded for 72 encounters in this year of the survey. VPB and speedboats accounted for 41 and 13 encounters respectively. When motorboats and speedboats were combined they provided 14 or 19% of all data.

For VPB, the mean separation distance has now remained at a similar level since 1997 (Fig. 6). There was a significant trend for increasing distance over the six years of the survey (Cruzick's Trend Test (one-sided), z (adj.) = 4.1827, $P < 0.0001$). No corresponding trend was evident for speedboats ($P = 0.325$). However, the average separation distance recorded has increased since 1998 and the average distance is now similar for both speedboats and VPB (Fig. 6).

Figure 6. Trends in the average separation between boats and dolphins during encounters. Data for encounters within 800m only.



ii) *Moving and stationary boats*

There are relatively few data on whether boats remained stationary or drifting, or were moving during close encounters with dolphins. However, when within 50m of dolphins, VPB stopped on 8 of 13 occasions (61%) and speedboats stopped on 3 of 6 occasions

(50%). These data are higher for both types of boat than the average rate recorded at all sites, in any year from 1994-99. From 1994-99 the average rate at which VPB stopped was 40%; for motor and speedboats it was 35%.

When all encounters with 100m are considered, both VPB and speedboats were stationary in 50% of encounters (n = 28 encounters).

iii) Dolphin behaviour during boat encounters

There were a disproportionate number of dolphin encounters with VPB than other types of boat at New Quay. While behaviour was recorded for 44 15min intervals with VPB present, there were only 16 and 14 corresponding intervals with speedboats and sailing boats present respectively. Behaviour observed during these encounters is summarised in Table 3.

Table 3. The relative frequency with which different behaviours were recorded during encounters with visitor passenger boats (VPB), speedboats and sailing boats. The number of 15min intervals in which each behaviour was recorded is shown. The relative frequency of each behaviour is also given as a percentage. These data were extracted for encounters with a separation distance (closest point of approach) of 400m or less only.

| | VPB | | Speedboat | | Sailing boat | |
|---------------|-----|-------|-----------|-------|--------------|-------|
| Approaching | 2 | 4.5% | 0 | 0.0% | 0 | 0.0% |
| Bow-riding | 2 | 4.5% | 0 | 0.0% | 4 | 28.6% |
| Heading away | 3 | 6.8% | 5 | 31.3% | 1 | 7.1% |
| Staying | 23 | 52.3% | 6 | 43.8% | 5 | 35.7% |
| Leaping | 13 | 29.5% | 3 | 18.8% | 4 | 28.6% |
| Tail-slapping | 1 | 2.3% | 1 | 6.3% | 0 | 0.0% |

The majority of data with VPB present describe dolphins staying at approximately the same location as prior to the boat's arrival. There was also a relatively high incidence of leaping. These results are very similar to those for 1994-99. There were relatively few data for other boat types. However, there appear to be differences in dolphin behaviour with speedboats and sailing boats. Again, these data are similar to those collected in previous years and the most frequently recorded behaviour for these boat types was also 'staying'. The incidence with which dolphins headed away from speedboats however, was higher than for sailing boats or VPB; no bow-riding was recorded and relatively little leaping occurred. As in 1994-99, dolphins appeared to prefer to ride the bow of sailing boats than other types of vessel.

DISCUSSION

Summer 2000 saw the seventh year of an on-going project to record cetacean habitat use and interactions with boats on the Ceredigion Marine Heritage Coast. Observations were carried out at New Quay, an important site for bottlenose dolphins in Cardigan Bay. There are now six year's data available for this site. These data are held within an Access™ database that now includes 15,890 records. There was 167h of observer effort at New Quay in 2000; effort now exceeds 4,800h for the project as a whole.

The sighting rate for bottlenose dolphins appears similar at New Quay in 2000 to previous years. Dolphins were recorded in 40% of 2h watches carried out in sea state 4 or less. This a lower proportion of watches with dolphins present than in previous years: from 1994-98 this ranged from 45-51%. However, the sighting rate for data collected in sea states 0-3 was higher (47%) and this is similar to the last survey carried out at the site in 1998. The average number of dolphins recorded per 15min interval was also similar to previous years and no trend in the sighting rate was apparent over the seven-year period. As previously observed, sightings peaked in August. Calves were also seen most frequently in this month. The highest number of dolphins at the site was 12, in early September.

Counts of the number of dolphins present during sightings were similar in 2000 to those recorded in 1995, 1996 and 1997. The average count in 1998 however, was found to be significantly lower than in 2000 and all other survey years. In terms of the number of dolphins utilising habitat at New Quay, 1998 appears to have been a relatively poor year. This was reflected in relatively low sighting rates. In 1998, dolphins were also recorded in fewer observation periods than in other years.

We compared site occupancy between years for indications that site use by dolphins may have changed over the study period. Occupancy in this case, refers to the amount of time that bottlenose dolphins were present at New Quay during 2h watches in which they were recorded at least once. Differences between years may have indicated a tendency for dolphins to utilise habitat resources at the site for longer periods or alternatively, to have become more transient visitors. In fact, we found no differences between the average number of minutes that dolphins occupied this site in 1995-98 and 2000. Dolphins were present on average, for 47-56min in each 2h.

An index of boating activity suggested that New Quay was slightly less 'busy' in 2000 than in either 1998 or 1994, although up to 43 boats, mainly sailing boats in this case, were recorded occasionally. Visitor passenger boats (VPB), sailing boats and commercial fishing boats featured most frequently in 2h counts. Most encounters with dolphins occurred with VPB. These boats were recorded as the closest vessel to dolphins in approximately 60% of encounters, which was higher than the average for 1994-98. The frequency of motor and speedboat encounters with dolphins was similar to 1998.

We investigated aspects of each encounter between boats and dolphins for indications of changes in behaviour (of both dolphins and boat users) over the duration of the project. The closest distance between VPB and dolphins during encounters (mean separation distance) was found to have remained at the same level since 1997. This distance had risen following the introduction of the boat users' code of conduct. There

were few data for motor and speedboats in 2000, but these suggest an increase since 1998 and the separation distance is now on average, very similar to that of VPB.

The frequency with which VPB and speedboats stopped or drifted when close to dolphins was higher in 2000 than in any other year. When dolphins were within 50m, VPB stopped in 60% of encounters and speedboats in 50% of encounters.

The behaviour of dolphins when boats were present was similar to that reported for 1994-99. Observations of dolphins staying at the same location or leaping were most common overall. However, 'heading away' was recorded relatively frequently during encounters with speedboats.

In summary, sighting rates of bottlenose dolphins at New Quay were similar in 2000 to previous years. Sighting rates and sightings of young calves peaked in August. Most encounters between dolphins and boats involved VPB. The average distance to which these boats closed on groups of dolphins was similar to recent years and greater than that observed prior to the introduction of a code of conduct. VPB frequently stopped when dolphins are close and the dolphins themselves usually remained at the same location. Leaping is often observed also. The average distance between dolphins and speedboats during encounters has risen since the last survey in 1998 and is now similar to that of VPB. These vessels tended to stop during 50% of close encounters. However, the reported incidence of dolphins heading away was higher for speedboats than VPB, despite having been involved in far fewer encounters. The data suggest that speedboat users were more likely to adhere to the code of conduct in 2000 than in previous years. The data also indicate that public awareness measures should continue to be targeted at recreational powerboat users, to reduce the risk of displacing or otherwise disturbing the behaviour of bottlenose dolphins.

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ACKNOWLEDGMENTS

The data presented here were collected at New Quay by:

Jean Bryant, Geoff Browne, Jenni and Pete Hyatt, Vi and Doug Hewlett, Thelma and John Messenger, Jannine Stoodley, Gwyneth Phillips, Liz Davies, Dot Clancy, Sandy Kent, Marianne Reiter, Sandra Hopwood, Penny Sharp, Avril, Becky and Rosie Jones, Jan and Richard Robinson, Mike Irvine, Karen Nathe, Rosie Davies, Sue & Phil Simcox, R. Jones.

We extend our thanks to Geoffrey Moxon at Aberystwyth University, who 'computerised' this year's observations and to Gwyneth Phillips, the local co-ordinator.