

Shore-based monitoring of bottlenose dolphins (*Tursiops truncatus*) by trained volunteers in Cardigan Bay, Wales

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Abstract

Daily, year-round, records were made between January 1998 and December 2000, of the occurrence of bottlenose dolphins (*Tursiops truncatus*) in New Quay Bay, Cardigan Bay, Wales, by ten trained volunteers. This site previously was identified as a nursery area for the species, with a high proportion of mother and calf pairs. The frequency of dolphin sightings were recorded by the volunteers, in days per month, and the total annual sightings for 1998, 1999, and 2000, were comparable with a previous 1989–1996 study by a single observer. Changes were detected in the use of preferred foraging areas within the bay, and in the group size and structure. Recognised individuals showed long-term site fidelity, and 14 of 16 previously recognized individuals were noted by the observers. In the year 2000, a significant decline in group size and in the incidence of groups containing small calves was detected.

Key words: bottlenose dolphin, *Tursiops*, shore-based monitoring, Cardigan Bay.

Introduction

The southern part of Cardigan Bay, Wales, in particular the waters off the small fishing port of New Quay, is an area favoured by bottlenose dolphins (*Tursiops truncatus*, Montagu), (Morris, 1990; Bristow & Rees, 2001). The location is a candidate Special Area of Conservation for this species listed in Annex II of the EU Habitats Directive. Because these dolphins often come close to land, they readily can be seen by observers on shore, and they attract much public interest.

Between 1989 and 1996 a year-round, shore-based study was made of site-fidelity and behaviour of bottlenose dolphins in New Quay Bay (Bristow & Rees, 2001). That study ended in January 1997. In these open coastal waters, major logistic difficulties and substantial costs would be incurred if boat transect surveys were attempted on a year-round

basis. It was considered worthwhile therefore, to see whether the enthusiasm of local resident volunteers could be harnessed to continue the year-round surveillance begun in 1989. Using the same validated methods as the earlier study done by a single observer (Bristow & Rees, 2001), the main objectives were to test whether comparable data could be generated by a team of ten volunteers, to extend the data set into the longer term, and to note any changes in site usage or behaviour. This paper reports the findings from the 3 years observations, ending 31 December 2000.

Materials and Methods

The location for the study was New Quay Bay (Lat. 52°13'N, Long. 4°21'W). The small fishing port of New Quay faces NNW and many of the houses rise up the cliffs in steep terraces which overlook the harbour and New Quay Bay. The ten volunteers chosen for the study, four pairs and two single observers, all occupied properties along a 250-m stretch of Rock Street. The elevation was 25 m above sea level and the observers could cover the 90° arc of sea from New Quay Head to Ina Point (Figure 1). Additional observations were made from the quay, where dolphins often came within 10 m of the harbour wall, or from a rocky promontory at New Quay Head. The volunteers all had 10 × 50 or 8 × 50 binoculars.

Each observer was provided with proforma survey forms and a data entry dictionary to ensure data integrity and consistency. Information recorded included: date, time, duration of sighting, species, total number, adult, juvenile, large calf and small calf numbers, known individuals, activity, distance from shore, boat activity within 100 m of animals, and any associated sea birds. The study organizers recorded data on weather conditions, sea state, wind strength and direction, air and sea temperatures, and times of high water, throughout the study.

The volunteers were already familiar with dolphin activity in the bay, for between 3 and

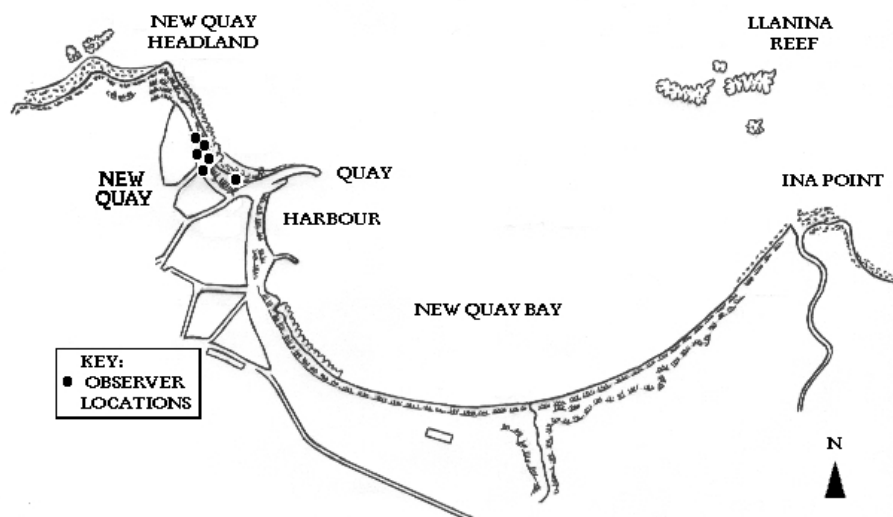


Figure 1. Study location.

20 years. They were given detailed talks on the previous 8-year study in New Quay (Bristow & Rees, 2001), to make them fully aware of the aims of the new study and the need to achieve consistency with the methods previously used. Five talks were given in the first six months, and in that period, the organizers often were present when observations were being made. Local meetings with the volunteers occurred on a weekly basis throughout the study, facilitating progress reports and retaining their interest.

The use of ten observers made it easier to maintain daily, year-round coverage of the area. The volunteers chose and recorded their own observation hours. The core observation hours and overall effort of between 4 and 7 hrs per day, depending on hours of daylight, were comparable with the earlier study by a single observer.

A sighting was defined as a single event, whether a dolphin or a group remained visible in the study area for only a few minutes or for several hours. If an additional group of dolphins was seen, with the original group still in sight, this was treated as a new sighting. When no dolphins were seen for 20 min a subsequent sighting was treated as a new one. In addition to close groupings, 2 or 3 large adults traveling parallel as much as 100 m apart were treated as a single group, as were split groups forming an arc for feeding, or when a single large adult seemed to flank or lead a group. Body size estimates, assisted by behaviour and colour were used to categorize animals as: small calves (<1.5 m),

large calves (1.5–2.0 m), juveniles (2.0–2.5 m), or adults (3–4 m). Definitions of behavioural categories were as used previously (Bristow & Rees, 2001).

Results

Sightings frequency and group sizes

The frequency of dolphin sightings in days per month for the 3 years (1998–2000) were comparable with the results for 1995 and 1996. There were 150, 180, and 142 days with dolphin sightings in 1998, 1999, and 2000 respectively, compared with 162 in 1995 and 175 in 1996.

The use of ten observers did not lead to an increase in effort compared to the earlier study. The sightings rate for the peak month in this study, 0.20 per observer-hour, was comparable with the figure of 0.18 in the previous study. There were relatively few duplicated sightings. For example, in August 2000 dolphins were sighted on 27 days, there were 60 observations, but only two pairs were duplicated. Two different observers recorded 2 dolphins in both instances. In August 1999, dolphins were seen on 17 days, there were 30 observations and two pairs were duplicated. In one instance in that month, one observer recorded 2 dolphins and another recorded 3 dolphins. In such cases, which occurred rarely, the lower figure was used for analysis.

There were on average 48 days per year when sightings were not possible due to heightened sea

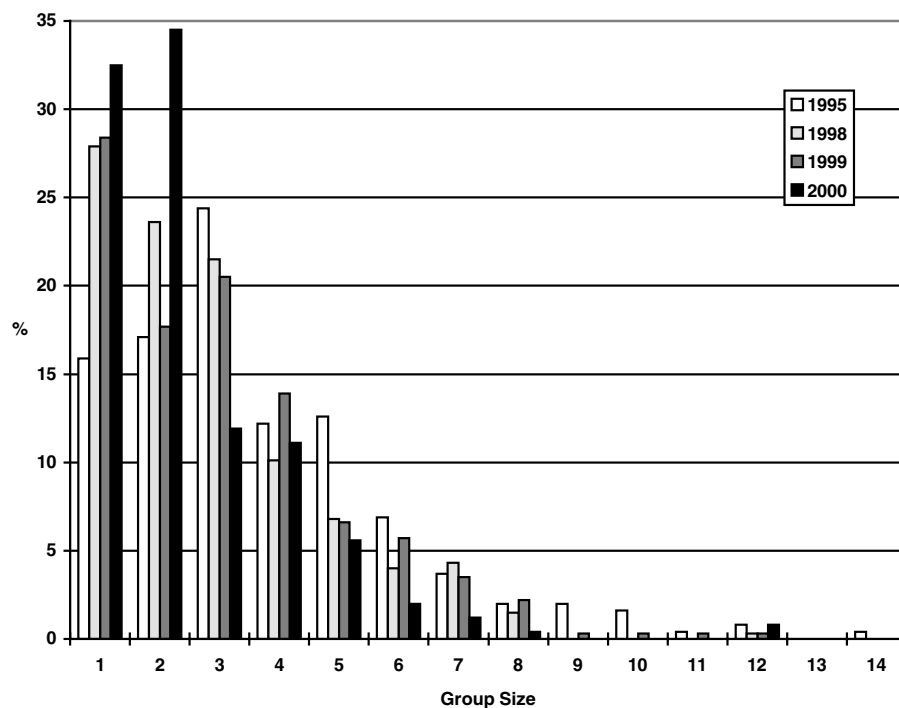


Figure 2. Bottlenose dolphin group size frequency by years.

state, and of these, short rough seas caused by NW winds force 5–9 accounted for 85%. In New Quay Bay, sightings were not possible with NW winds >4, NE >6, W >6 and SW-SE winds >force 8. Although it was tempting to correct the sightings data for those days, it could not be assumed that dolphins were present. The number of days with dolphin sightings in winter months is normally low, even in calm weather. Evidence from earlier acoustic records (Morris, 1990) also indicated that dolphins were not present in the bay at times of strong NW winds.

There were no sightings of bottlenose dolphins in March 2000. In the earlier 8-year study there were also two winter months, February 1990 and March 1992, in which there were no sightings. In 1990 and 1992, stormy weather conditions and high seas almost certainly accounted for the lack of sightings; however, in March 2000, there were only four days when weather conditions made sightings impossible, making the lack of any sightings more unusual.

The frequency distribution of the sightings by group size is shown in Figure 2. The distribution, as in the previous study, is skewed towards small groups. The proportion of sightings of the smallest groups (1–2 dolphins) increased to 67% of total sightings in 2000, as compared to the 36% in the

previous study. The proportion of sightings of groups of 3–10 dolphins decreased to 32.2% of total sightings in 2000, compared to the 62.7% for 1989–1996. Although sightings frequency increased throughout the earlier study, group size distribution showed little variation over the 8 years. Comparisons for each year of groups from 1–14 were therefore made with one year (1995) of the previous study.

The deviations in group size frequency were tested for significance at $\alpha=0.05$ (critical value 22.36). For 1998 $\chi^2=21.08$, for 1999 $\chi^2=17.06$, and for 2000 $\chi^2=56.28$. Therefore, the changes in dolphin group size frequency, seen in 2000, are significantly different.

Related to the significant decrease in sightings of groups of 3–10 dolphins in 2000, the proportion of sightings of groups that contained small calves (<1.5 m) fell from 40% to 12%. Analysis of 758 groups of dolphins that contained a small calf, from 1989–2000 (Figure 3), showed that 88.6% of small calf sightings were in groups of 3–10 animals.

The persistent decline in monthly average group size, and the decline in sightings of groups with small calves, prompted the first author to join the observers, and undertake daily watches of 4 h in September 2000. September was chosen because in

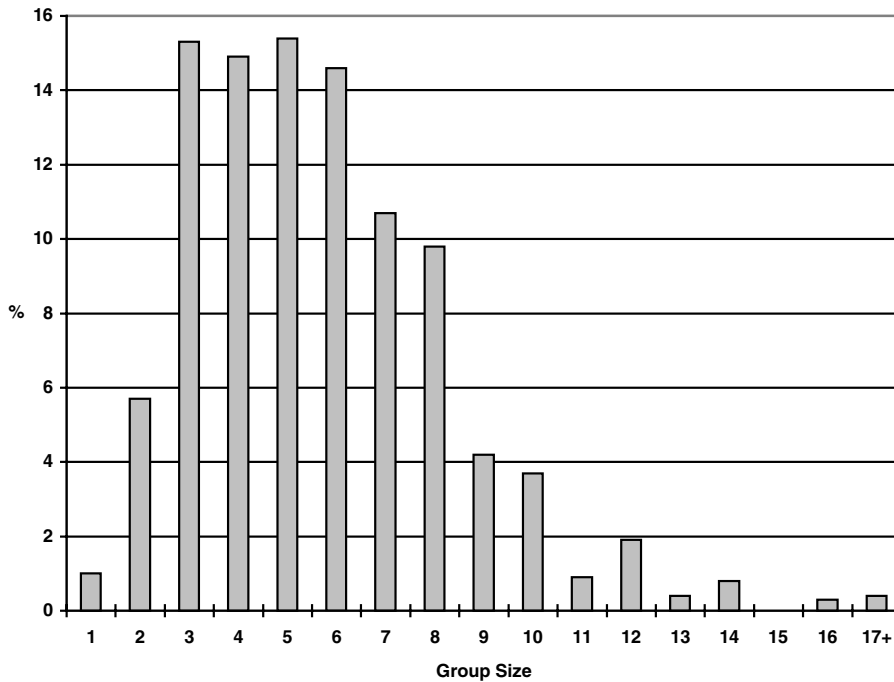


Figure 3. Percent of bottlenose dolphin sightings with small calves distributed by dolphin group size.

the previous study both average and maximum group size increased in that month. However, this exercise did not result in any additional sightings, and with the exception of one group of 12 dolphins, and two groups of 6, the group size in 32 sightings remained low.

The largest group of dolphins seen together in this study was a single sighting of 18 dolphins in May, 1999. This confirms the rarity of inshore sightings of large groups of dolphins in the New Quay Bay area. In the earlier eight-year study, there were only two sightings of groups of 16 or more dolphins.

Identifiable individuals

By the end of January 1997, when the earlier study finished, 16 adult dolphins had been recognized from the distinctive natural markings on their dorsal fins. In the present study, the observers provided drawings, photographs or video footage of dolphins with distinctive markings, and these were compared with the catalogue from the previous study. In the 3-year period, 14 of the previously recognized adults were seen, with between 7 and 12 seen each year. Dolphins A and C were not seen, but 4 further dolphins were identified. One of these, dolphin T, with a distinctive twisted back, had previously been noted in 4 years between 1987

and 1991. The site-fidelity of individual dolphins was confirmed by the fact that dolphins B, D, E, F, L, and P have been recorded in the New Quay Bay area as adults, since 1987 (this study; Morris, 1990; Bristow & Rees, 2001). Three of these dolphins were present in 13 years over that period.

Behaviour

The major dolphin activities recorded were 'traveling', 'feeding', and 'social/play'. Traveling was the predominant dolphin activity throughout the study, with feeding the second most frequently observed activity. The results from the 3 years were in accordance with the results of the previous study. The only major changes in behaviour related to changes in the foraging locations within New Quay Bay. In the last 3 years of the previous study (1994–1996), 44–56% of feeding observations occurred off New Quay Headland, and 12–13% were off Llanina Reef. Over the 3 years of this study, observations of feeding off New Quay Headland declined to 20–22%, while observations of feeding either side of Llanina Reef showed an increase to 36–65%. The area within 100–300 m of the end of the quay remained a secondary foraging area, favoured by adult dolphins with accompanying calves, and use of this area showed little change.

Discussion

The object of this study was to discover if suitably trained observers could monitor dolphin activity on a long-term, year-round basis and produce results comparable with those made by a single observer in the same location. The choice was made to limit the number of observers to ten, all of whom could view the study site from a similar elevated position. Training, support, and feedback from the organizers was extensive, throughout the 3 years of the study. By this means, we sought to minimize observer bias and variability.

Young & Peace (1999) showed that the use of inexperienced observers in shore-based surveys of bottlenose dolphins can produce significant errors in reported sightings. However, they also stated that for localized habitat utilization studies, discrepancies can be reduced by using smaller numbers of experienced observers, and by using elevated observation positions, like this study. Young and Peace noted that regular shore-based surveys can be used to track population trends over time, and potentially are more efficient than boat-based or aerial surveys for near-shore populations of whales or dolphins. The results from the present study go a long way towards realizing that potential.

The frequency of dolphin sightings, in days per year, found in the 3 years of this study were comparable with those found in the last 2 years of the earlier year-round study. Sightings had been increasing between 1989 and 1995, and the results from this study indicated that a plateau was reached between 1995 and 2000.

Some change in group size was noted in 1998 and 1999 although this was not statistically significant, but 2000 was significantly different. In 2000, the decrease in groups of dolphins with mother and calves using what has been established as a 'nursery' area was significant.

From February onward, group size deviated from the established pattern, with no sightings at all in March 2000. No groups of more than four dolphins were seen until June 2000, and unusually, no small calves were seen until the end of May. Normally, groups containing small calves are seen from March. We looked to weather and environmental factors for an explanation. Weather conditions and below average sea temperatures have in the past led to a decrease in dolphin sightings, but this did not apply to the winter of 1999/2000. Sea surface temperatures at the beginning of 2000 were a degree above average, and there were above average dolphin sightings in January 2000.

The incidence of boat disturbance in 2000 was less than in many previous years, and can therefore be discounted as a factor. The area of observation, New Quay Bay, is only a small part of Cardigan

Bay, and it could be that unknown factors within the larger bay or beyond are affecting the dolphin population. There was an increase in commercial fishing in an area southwest of New Quay during the period. Locally, the licensed discharge to the sea at New Quay Head of shell waste from a whelk (*Buccinum undatum*) processing plant has altered the seabed characteristics in a previously favoured dolphin feeding location. Beginning in 1997 and also in 1999 a thousand tonnes of shells were discharged by chute onto the adjoining rocky ledges. In 2000, over one thousand tonnes were discharged in the period between February and July. Divers reported the seabed to have become carpeted with shells. The observations in this study indicate that proportionately less use was made by dolphin groups of this previously favoured feeding location, and that more use was made of a more exposed location on the opposite side of the bay. There was also a negative relationship between decreasing average group size and increasing shell waste discharges over the study period.

Whatever the cause of the change to dolphin activity and behaviour seen in New Quay Bay, the results confirmed the value of long-term, year-round, monitoring of this designated conservation area. The results demonstrated that in a location where dolphins regularly come within 10 m of the shore, cost-effective surveillance can be provided by a small number of well-trained local community members. It has been shown that trained volunteers can identify known marked individual dolphins and detect changes in site usage that may have been missed by intermittent surveys.

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