

Tour boats and dolphins: A note on quantifying the activities of whalewatching boats in the Shannon estuary, Ireland

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ABSTRACT

Commercial whalewatching of bottlenose dolphins, *Tursiops truncatus*, in the Shannon estuary, Ireland first began in 1993. This note attempts to quantify the development of this industry and operational procedures of commercial tour boats. Up to four vessels are involved, which carry out annually about 200 trips in total, involving ca 2,500 passengers, mainly (78%) in July and August. Thirty-six trips were accompanied, mainly in July 1997 and 1998, to record the search pattern and location at which tour boats observed dolphins and to identify the individual dolphins watched. The time to locate dolphins, total number observed and group size on each trip varied between years and between ports. There is some evidence that dolphins were less abundant and further upriver in 1998 compared to 1997. Operators from each port tended to search for dolphins in different areas and, over the short summer sampling period, largely watched different groups of dolphins to each other. The implications for management and the development of a sustainable whalewatching industry in the Shannon estuary are discussed.

KEYWORDS: BOTTLENOSE DOLPHINS; PHOTO-ID; SUSTAINABILITY; WHALEWATCHING; ATLANTIC OCEAN; NORTHERN HEMISPHERE

INTRODUCTION

Whalewatching has expanded rapidly around the world leading to increased concerns over possible adverse effects of this industry on cetacean populations and behaviour (e.g. IFAW, 1995). The International Whaling Commission (IWC) Working Group on Whalewatching recommended that member countries should 'identify and assess the possible effects of whalewatching operations on cetaceans' and encouraged the undertaking of 'scientific studies carried out in conjunction with whalewatching operations' (IWC, 1994; 1995). The IWC Scientific Committee now considers scientific aspects of whalewatching (e.g. see Donovan, 1999). There have been relatively few published studies of whalewatching operations and those available have mainly considered large whales (e.g. Corkeron, 1995; Gordon *et al.*, 1995; 1998; Findlay, 1997; Leaper *et al.*, 1997). In recent years the number and range of dolphin species subjected to whalewatching has increased worldwide. Hoyt (1995) listed seven dolphin species in 14 European countries currently subjected to whalewatching and in four of these (Croatia, Greece, Gibraltar and Portugal) dolphins are exclusively the target species.

The Shannon estuary, on the western seaboard of Ireland, is home to the only known resident group of bottlenose dolphins (*Tursiops truncatus*) in Ireland (Berrow *et al.*, 1996). Commercial trips to see dolphins in the estuary began in 1993 from Carrigaholt, Co. Clare and expanded to Kilrush in 1994. Hoyt (1995) considered whalewatching¹ in Ireland to be under-developed in 1994 - most whalewatchers visited Dingle, Co Kerry with its solitary, friendly dolphin (see

Lockyer, 1990) - but predicted that the Shannon estuary would become one of Ireland's premier whalewatching locations.

Bottlenose dolphins in Ireland are entitled to full protection under the 1999 Wildlife Bill. Following the development of whalewatching in the Shannon estuary, Dúchas, the government authority responsible for enforcing the Wildlife Act, have drafted legislation (Refuge for Fauna (Shannon Estuary) Designation Order, 1997) restricting boat numbers and activities in the vicinity of dolphins. The area has been nominated as a Special Area of Conservation (SAC) for dolphins under the EU Habitats Directive under which whalewatching is a notifiable activity. Present tour operators abide by a voluntary code of conduct but these proposed legal designations could greatly influence future whalewatching in the estuary.

Prior to this study there were no data available on the extent and operational procedures of whalewatching vessels in the Shannon estuary. A recent study, started prior to any whalewatching, suggested that some dolphins were resident throughout the year and that the estuary may be a calving ground (Berrow *et al.*, 1996). In order to develop a sustainable industry that does not degrade the habitat for dolphins, a thorough understanding of both the industry and the ecology of the dolphins is required. This initial study of tour boats in the estuary aimed to provide baseline information for future monitoring of whalewatching in the region and to use this information to determine further research and monitoring needs. It addressed a number of relevant questions including:

- (1) Where do operators search for, and locate, dolphins?
- (2) How many and which individual dolphins are watched by operators? and
- (3) Are these factors consistent within and between seasons?

¹ Defined by the IWC as 'any commercial enterprise which provides for the public to see cetaceans in their natural habitat' (IWC, 1994).

METHODS

The authors accompanied 29 commercial whalewatching trips from two ports, Carrigaholt and Kilrush in County Clare (Fig. 1) from 5-11 July 1997 and 10-20 July 1998. An additional seven trips were monitored outside the peak season; two in 1997 (21 September and 27 October) and five in 1998 (1 June, 14/15/25 July) in order to begin to examine whether there is any significant temporal variation.

The position of the tour boats in the estuary was recorded from the vessels' Global Positioning System (GPS) every 10 minutes, together with prevailing weather (wind direction and strength, precipitation and cloud cover) and sea-state. The authors did not influence where the operators went in search of dolphins but, where possible, trips were chosen in order to carry out simultaneous observations on different vessels from the two ports. The two observers switched between ports whenever possible but with only one vessel operating from Carrigaholt and carrying out consecutive sailings, usually all trips each day from Carrigaholt were sampled. At Kilrush, where up to three vessels may be whalewatching at the same time, serial sampling was more difficult. Trips from the two ports were split evenly between the authors in both years. The data on the number of trips and passengers per annum was supplied by the tour operators.

The time taken to first observe dolphins on each trip and the total number of dolphins in each group was recorded. The definition of a group followed Shane (1990) who describes a group as 'one or more dolphins in apparent association'. Calves are defined as those dolphins still exhibiting neonatal folds (white vertical lines on body) and juveniles as those dolphins less than 75% the length of adults and usually more pale in colour. Group behaviour was categorised as either 'Travelling', 'Foraging' or 'Other' following Berrow *et al.* (1996).

Whenever possible, all dolphins in each group were photographed using a 70-300mm lenses and 100-400 ASA print film. Films were developed each night and prints

studied for identifiable individuals using standard photo-identification techniques (Würsig and Jefferson, 1990). Photography was opportunistic, with no control over which side of the dorsal fin was photographed, thus matching was not restricted to one side of the dorsal fin. Blemishes, blotches and tooth rakes as described by Thompson and Hammond (1992) were used to recognise individual animals over a week but only more permanent marks such as notches and nicks were used for monitoring dolphins over months and between the two years of the study.

RESULTS

Whalewatching industry

Between 1993 and 1995 the number of commercial trips increased to around 200 per annum and has remained relatively consistent at this level up to 1997 (Table 1). Most trips (59-84%) during 1995-1997 were carried out from Carrigaholt. During 1998, only 117 trips were carried out, an overall decline of 42% on 1997, with a greater decline from Carrigaholt (48%) compared to Kilrush (33%). Unfavourable weather (strong winds and high Beaufort sea state) from late July to September 1998 resulted in the cancellation of many trips (the exact number was not recorded by the operators). The data from 1997 have been used in subsequent analyses as they are thought to be more representative of the industry.

Although trips were run from May to September at both ports, the peak season is short with most trips (78%) carried out in July (37%) and August (41%). Only eight trips were carried out in May and 19 each in June and September 1997. A total of 2,431 passengers went whalewatching in 1997 at a mean rate of 6.3 passengers per trip. Although the number of trips has remained fairly constant since 1995, the mean number of passengers per trip from Carrigaholt has increased from 7.0 in 1995, 8.9 in 1996, 10.0 in 1997 and 10.7 in 1998

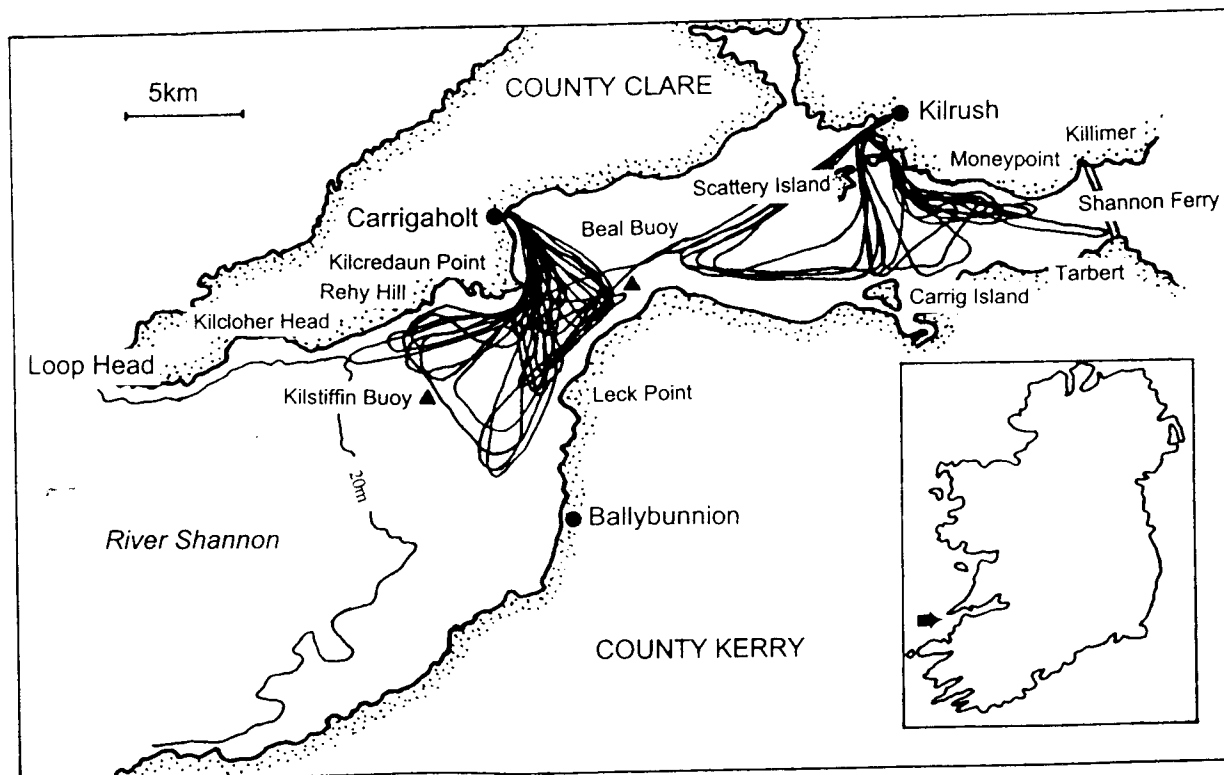


Table 1
Number of commercial whalewatching trips carried out in the Shannon estuary, Ireland, 1993 to 1998.

Vessel	Capacity	Port	1993	1994	1995	1996	1997	1998	% of total ¹
<i>Fiona David</i>	12	Carrigaholt	NA	NA	162	145	118	63	59
<i>Deva</i>	12	Kilrush	-	8	28	33	36	18	18
<i>St Senan II</i>	32	Kilrush	-	-	-	36	38	28	19
<i>Cariad</i>	12	Kilrush	-	-	-	5	8	8	4
<i>Karen Ann</i>	12	Kilrush	-	-	2	6	-	-	-
Others	NA	Kilrush	c10	-	-	-	-	-	-
Total			10+	8+	192	225	200	117	

¹ For 1997 figures.

which suggests that the carrying capacity (12) of the present operator, during the peak season, may soon be reached. The mean number of passengers per trip from Kilrush was 15.2 in 1997 and 15.0 in 1998. It is clear for both ports therefore, that although the total number of trips declined in 1998, the number of passengers per trip did not.

Location and duration of whalewatching trips

A total of 36 trips were sampled during this study, 10% of the total carried out from both ports in 1997 and 14% of those in 1998. Eighteen trips were accompanied in July 1997 and 11 in July 1998. Most sampled trips (72%) during July 1997 were from Carrigaholt with only five (28%) from Kilrush. The weather during this period was generally favourable for whalewatching with light winds and Beaufort sea state < 2. A greater proportion of trips (64%) was sampled from Kilrush in July 1998 but unseasonably poor weather had resulted in many trips being cancelled.

Areas searched for dolphins from the two ports were similar in both years and individual tracks have been presented together (Fig. 1). Vessels from Kilrush tended to travel between Scattery and Hog Island and search for dolphins in mid-channel and around Moneypoint power station. Tour boats often contacted the Shannon ferry operating between Killimer and Tarbert (Fig. 1) via VHF radio and if dolphins had been seen there recently then vessels travelled up river towards Moneypoint (Fig. 1). If no dolphins had been reported, the tour boats tended to travel down river but only once beyond Beal Buoy. *MV Fiona David* from Carrigaholt had potentially more sites in which to locate dolphins but tended to cross the estuary after having cleared Kilcredaun Point towards Beal Buoy, travelling as far as Leck Point and occasionally Ballybunion (Fig. 1). If no dolphins were located, or if those found avoided close contact with the vessel, the cruise continued either west into the outer estuary, towards Kilstiffin Buoy and to Rehy Hill or Killeloher Head (Fig. 1), or east, up river, running down parallel to the series of navigation and cardinal buoys that mark the channel. Vessels operating out of each port rarely had visual contact with each other during any trips in this study and were never within 1km during trips.

Although the small sample sizes preclude any major statistical analyses of the data, some trends are evident and have management implications. The median length of each trip was longer from Kilrush in both 1997 (150 minutes) and 1998 (163 minutes) compared to Carrigaholt (123 minutes in 1997 and 120 minutes in 1998) but these differences were not significant (Mann Whitney *U*-test, $P > 0.05$). Time to locate dolphins (Table 2) was significantly longer from Kilrush compared with Carrigaholt in 1997 (Mann Whitney, $F_{1,26} = 26.0$, $P < 0.05$) but not in 1998 (Mann Whitney

Some operators tried to time the departure of their trips to coincide with certain states of the tide when they considered it easier to locate dolphins, but no significant relationship was found in 1997 between the time taken to locate dolphins and hours referenced to Highwater from either Carrigaholt (ANOVA, $F_{1,11} = 0.08$, $P = 0.79$) or Kilrush (ANOVA, $F_{1,3} = 0.44$, $P = 0.56$). Median trip length and time to locate dolphins was greater from Carrigaholt but shorter from Kilrush at other times of the year, but none of these differences were significant compared to July (Mann-Whitney *U*-test, $P > 0.05$).

Number of dolphins observed on whalewatching trips

The mean number of dolphin groups and total number of dolphins observed from Carrigaholt and Kilrush were similar in both years (Table 2). Single groups were observed on eight trips in 1997 (44%) and five (45%) in 1998; on only one trip during the study (from Kilrush in 1998) were no dolphins seen. Only one group, on average, was observed per trip in 1998 from Carrigaholt, half that recorded in 1997, but the number of groups observed from Kilrush vessels increased by 30% from 1.2 groups in 1997 to 1.7 in 1998. Where the exact number of dolphins in a group could not be determined, the lower estimate was used in calculations, therefore figures presented are a minimum. Juveniles and/or calves were recorded on 13 trips (72%) in 1997 and five (45%) in 1998, with up to four juveniles present in a large group in 1997. Most groups observed in both years were described as travelling (62% and 58%) or foraging (28% and 34%).

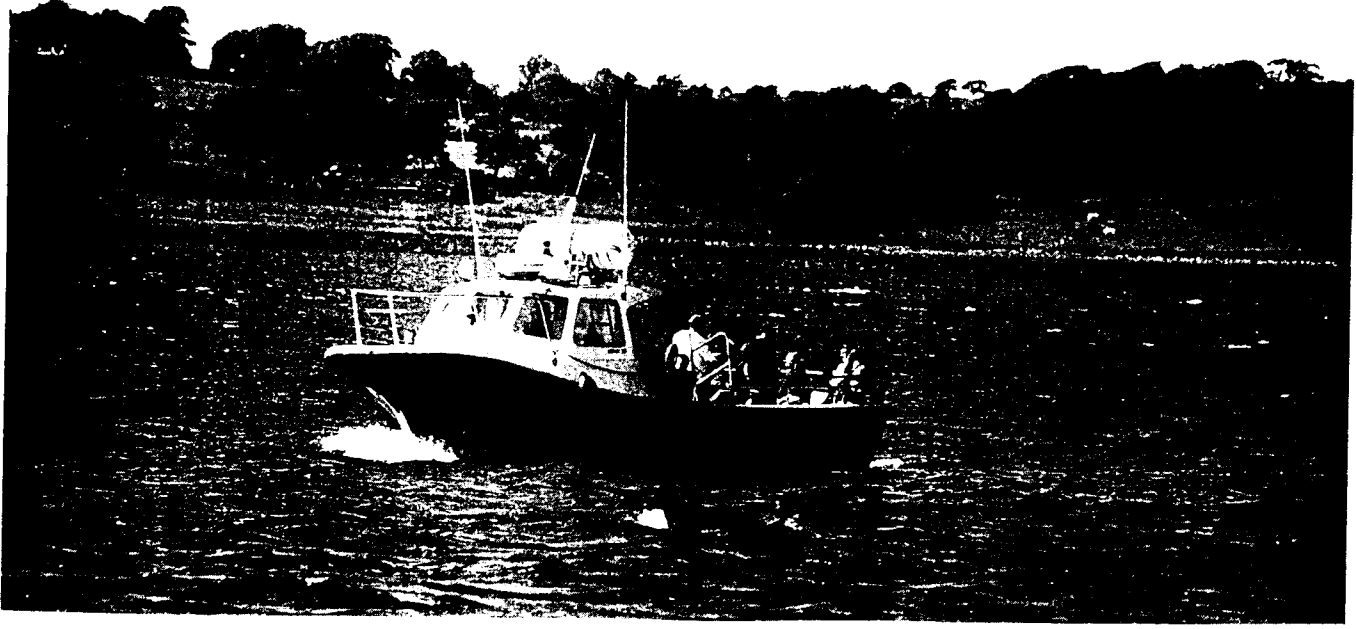
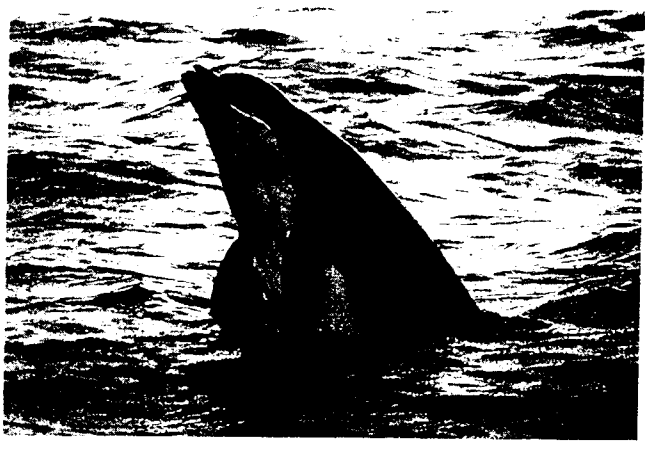
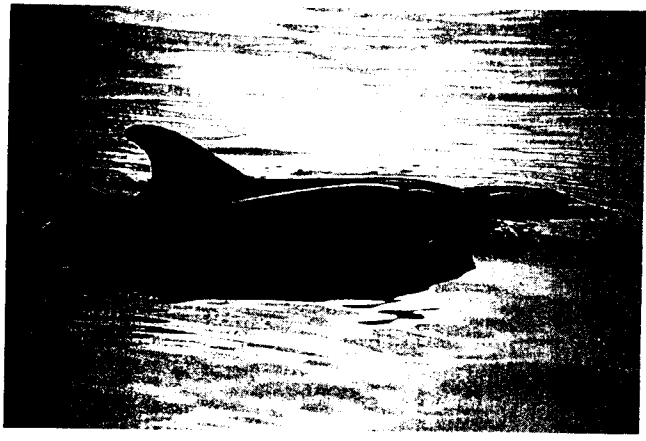
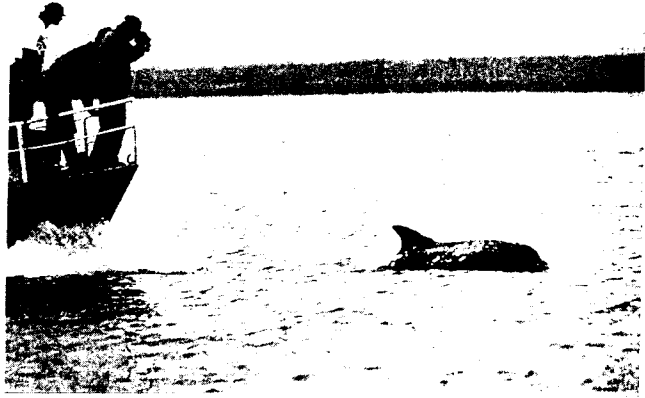
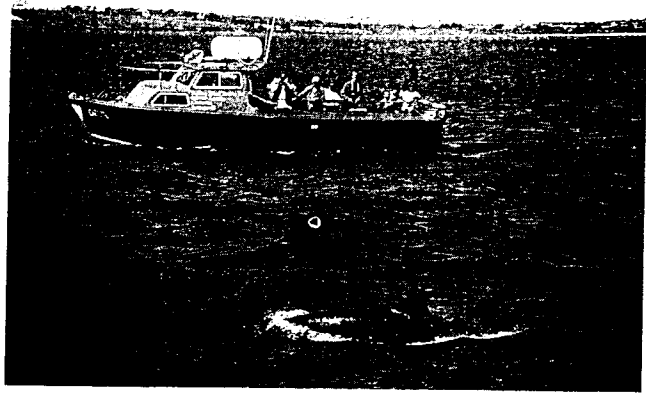
Monitoring of individual dolphins

During 1997, 24 individuals were identified using photo-identification, and 18 during 1998. A plot of cumulative total number of identifiable dolphins per trip in

Table 2

Median time to locate dolphins and the mean (\pm SE) number of groups and individual dolphins located (range in parentheses) per trip from Carrigaholt and Kilrush during July. (One trip from Kilrush in 1998 failed to locate dolphins: these data were omitted from calculations on the time to locate dolphins.)

Season	Port	No. trips	Time to locate dolphins (min.)	No. dolphin groups	Total no. dolphins
1997	Carrigaholt	13	19 (10-30)	2.0 \pm 0.3 (1-4)	11.6 \pm 1.5 (5-22)
	Kilrush	5	40 (19-60)	1.2 \pm 0.2 (1-2)	12.0 \pm 3.2 (5-20)
1998	Carrigaholt	4	15 (10-60)	1.0 \pm 0.2 (1-1)	9.1 \pm 3.7 (3-20)
	Kilrush	7	50 (19-60)	1.7 \pm 0.4 (0-3)	9.6 \pm 4.4 (0-30)



We saw several bottlenose dolphins in the Sharmon - 9/11 - Feb 01

97 (Fig. 2) revealed an asymptote after 14 trips suggesting most identifiable dolphins in the study area and visited by tour boats had been encountered. No asymptote was reached in 1998 and a greater proportion of dolphins were only recognised on a single trip (67%) compared with 1997 (33%). This suggests that not all the identifiable dolphins in the study area being watched by tour boats were photographed in 1998. Some interesting and potentially important trends in the data are apparent but these cannot be analysed statistically.

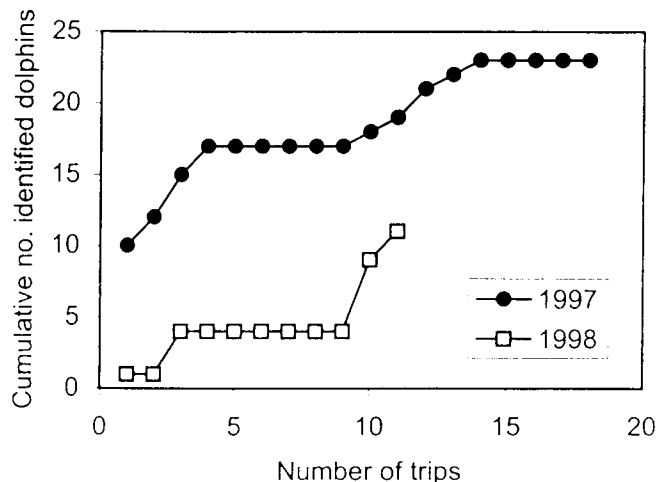


Fig. 2. Cumulative number of dolphins identified from tour boats in the Shannon estuary using photo-ID in 1997 and 1998.

In 1997, 21 of the 24 individually recognisable dolphins were recorded from Carrigaholt and eight from Kilrush, at mean rates of 3.2 and 2.8 identifiable dolphins per trip, but these were not significantly different ($\chi^2_1 = 1.08$, NS), thus photo-identification data are not biased towards either port.

Of the dolphins recorded from Carrigaholt in 1997, 4 (19%) were also recorded from Kilrush but only two dolphins (9%) were recorded from both ports in 1998. Of the five dolphins common to both ports in 1997, three were seen from Kilrush a day after they were seen from Carrigaholt, one was seen two days later and only one individual on the same day. There was 2.5 hours between these sightings from the two vessels and interestingly this animal was recorded on ten occasions during July 1997, more than any other individual dolphin, suggesting this animal has a large home range and exhibited little evidence of vessel avoidance. In 1998, the same dolphin was never seen at both sites during the intensive study period. On four occasions in 1997, the same dolphins were seen on consecutive trips on the same day from the same port showing that this was the same group located by the tour boat on each trip; no individuals were seen on consecutive trips from the same port on the same day in 1998. Of the 24 dolphins identified in 1997, six (25%) were also present in 1998. Two animals were only observed from Carrigaholt in 1997 and from Kilrush in 1998. One dolphin was only observed in both years from Kilrush and one observed from Carrigaholt in 1997 but from both ports in 1998.

Six of the dolphins identified in this study were also recorded in the Shannon estuary in 1993 by Berrow *et al.*

2000; it only those dolphins recorded from Carrigaholt are included, are considered to have been using the estuary, at least during the summer, since 1993.

DISCUSSION

Between 1993 and 1997 the whalewatching industry in the Shannon estuary grew to around 200 trips per annum. The present season is short and strongly influenced by the prevailing weather, especially in the outer estuary. Poor weather in July 1998 restricted the number of trips available to sample (only 28 from Carrigaholt and 18 from Kilrush). Despite the low sample sizes, this preliminary study provides information on the activities of tour boats with management implications and as such may aid the development of a sustainable whalewatching industry. It also provides a basis for the future evaluation of whalewatching and highlights the importance of establishing a scientific monitoring programme.

Operators were very successful (97% success rate of trips sampled) in locating dolphins and the mean time to locate dolphins (20-30 minutes) confirms that the estuary provides excellent opportunities to observe and study wild bottlenose dolphins. In the present study there is a suggestion from group size and the number of groups observed that dolphins were less abundant in the estuary during 1997 compared with 1998 but a longer time-series is required to identify such trends. The time to locate dolphins from both ports was longer and the results from photo-identification suggest that the same dolphins were found further up river in 1998. This is not inconsistent with the findings of Wilson *et al.* (1997) who showed that bottlenose dolphins in the Moray Firth, Scotland move further up into the Firths during the summer as more dolphins move inshore, although the timing may vary each year.

Tour boats from both ports largely followed fixed routes when searching for dolphins and the areas searched by vessels from each were largely independent of each other. Operators attempted to observe the dolphins closest to the home port but such is the widespread distribution and abundance of dolphins around the river that at present operators have largely exclusive areas within which to whalewatch. At no time during the study were vessels from the two ports with the same dolphins at the same time. Visitors to either port at present can watch dolphins without the presence of other tour boats in the immediate vicinity. Berrow *et al.* (1996) had detected a relationship between the tide and the abundance of dolphins at some sites but no similar relationship was found from the tour boats although some operators believed that tide did affect their ability to detect dolphins. Other circumstances such as customer demand and access to home port (tidal restrictions, etc.) probably have a greater influence on the time each whalewatching trip operates.

Over the short sampling period in this study, the dolphin groups watched by each operator were largely independent of each other. However, although operators watched different dolphin groups between sites, in 1997 they often watched the same groups on consecutive days. These were also the same dolphins watched between years but by vessels from different ports. As the two whalewatching ports are up river from each other, a change in the distribution of individual dolphins through the season (May to September) and between years may mean that some groups will still be subjected to whalewatching activities throughout the season. Any adverse effects of tour boats on their behaviour could

The study has revealed that tour boats mainly locate travelling groups of dolphins. This may limit potential disturbance since travelling is probably less susceptible to the presence of tour boats than e.g. foraging or resting. However, tour boats also frequently watch juveniles and groups with calves, which may increase the impact of even small increases in disturbance caused by whalewatching vessels. The reaction of individual dolphins, groups and groups with calves warrants further study before the implications of this finding can be assessed. The areas in which tour boats search for and locate dolphins in relation to individual dolphins home ranges also needs to be quantified as do the areas where dolphins carry out maintenance and other activities.

There is evidence from the mean number of visitors per trip, that the carrying capacity of present operators at some locations may soon be reached with the attendant possibility of either the use of vessels with greater capacity or additional smaller vessels. As the number of visitors wishing to go whalewatching in the Shannon estuary increases, the number of boats or the number of trips carried out may need to be limited to minimise disturbance to the dolphins. Larger vessels, with greater carrying capacity, means fewer trips are required to accommodate larger numbers of visitors. However, financial considerations, such as the running costs of larger vessels and the quality of the product on offer (e.g. less intimacy on larger vessels) are also important in the development of whalewatching. The carrying capacity of dolphins to tour boats is not known. Following the principles for whalewatching developed by the IWC (IWC, 1997a; b), researchers and managers should attempt to quantify the disturbance caused by whalewatching vessels and regulate the number of vessels or trips to within agreed limits. In practice it is extremely difficult to determine the carrying capacity of dolphins to tour boats and a programme that monitors tour boats and dolphins and the interaction between them should be implemented at the beginning of any whalewatching developments.

These issues should be investigated and discussed with the industry as soon as possible in order to prevent possible conflict between operators and dolphins in the future. The present study has shown that it is practical to develop a scientific research programme for dolphins using the tour boats as 'platforms of opportunity'. The use of commercial whalewatching vessels to monitor whale populations has been successful in the inner Hebrides, Scotland (Leaper *et al.*, 1997) and in many other parts of the world (e.g. IWC, 1990). Monitoring from tour boats may be useful in determining long term changes in the distribution and relative abundance of dolphins in the Shannon estuary but for this to be the case, standardised methodology must be adopted and important indices identified.

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