INTRODUCTION

The common dolphin *Delphinus delphis* has a widespread global distribution, occurring in offshore waters of nearly all tropical, subtropical and warm temperate seas. This paper presents information on the distribution (spatial and temporal), and relative abundance of the common dolphin in the Bay of Biscay (the sea bordering western France and northern Spain), from an analysis of sightings collected under the Biscay Dolphin Research Programme, between 1995 and 1998.

The Biscay Dolphin Research Programme (BDRP) is a voluntary conservation body sponsored by the shipping company *P&O European Ferries (Portsmouth)* and affiliated to the cetacean monitoring unit *Sea Watch Foundation*. The mission statement of BDRP is to further the conservation of cetaceans and other marine life in the Bay of Biscay through scientific study and educational activities.

The BDRP database comprises sightings and effort data collected on monthly survey trips established in 1995. On each trip, effort-based cetacean surveillance work is carried out by a team of three experienced recorders, using standard methods developed for determining cetacean distribution and relative abundance by the Cetacean Group of the Mammal Society (latterly Sea Watch Foundation). Between August 1995 and December 1998 thirty-eight monthly trips were undertaken, with 19994 km of trackline searched in good-fair weather (sea state four or less and good visibility), and approximately 30000 km overall.

Survey effort has produced 220 common dolphin sightings of ca9000 animals, located in 16 ICES grid cells of the Bay of Biscay. These data confirm that common dolphins occur widely across the sampled areas of the Bay of Biscay, and in a few areas at very high density. There are marked seasonal patterns in common dolphin distribution. The core area of distribution appears to be a large, but mobile population present through much of the year along the northern edge of the continental shelf. The available data indicates that there is a marked seasonal movement along the continental shelf, north into the English Channel and Celtic Sea in the winter, and south into deeper waters of the central Bay of Biscay during the summer.

METHODS

Survey vessel and study area

The BDRP undertakes monthly surveillance surveys across the Bay of Biscay by travelling aboard the 37500 ton P & O ferry, the *Pride of Bilbao*. The ferry follows a (more or less) fixed route between Portsmouth, England and Santurtzi (Bilbao), Spain, and samples a representative range of topographical features and underwater habitats found in the Bay of Biscay. These include: the continental shelf west and south-west of Brittany, France (46-49°N by 4-6°W, depth <200m); the shelf edge (46-48°N by 3-5°W, depth 200-1000m); the abyssal plain (44-46°N by 3.5-4.5°W, mean depth 4000m) and the Cantabria coast, northern Spain (43°N by 3°W, depth <200 m).
Survey method
On each trip, common dolphins and other cetacean species are recorded on systematic cetacean watches, which adopt standard recording methodology developed by the Mammal Society /Sea Watch Foundation for effort-based recording (by volunteers) on platforms of opportunity (Evans, 1981, 1995). Watches are maintained continuously from dawn until dusk. On the Portsmouth to Bilbao ferry, the return journey extends over four days, and enables the whole of the route to be sampled at least once during daylight in the summer, and approximately 75% of the route in the winter.

On each trip a team of three experienced observers, scan ahead, 22.5 degrees on both the port and starboard sides. The methodology is essentially that of an unlimited distance single line transect, with every cetacean and other animal visible and identifiable being recorded once only. Recording is made from the bridge of the ship, at a height of 32m and at a ship speed of 15-22 knots.

For each common dolphin sighting, the number of animals is counted and where possible the age and behaviour of individuals is recorded. At time of sighting the following recordings are also made: time, position of the ship (using the ship’s global positioning system), position and orientation of the animal/s relative to the ship, and environmental conditions such as sea state, swell height, wind speed and direction, and visibility. These details are entered onto a standardised Sea watch Foundation sighting proforma (Evans, 1995).

At half hourly intervals, ship position, ship speed and environmental recordings are repeated and entered onto a standardised Sea watch Foundation vessel based effort proforma (Evans, 1995). Effort data enables the number of sightings to be scaled recording effort, and the calculation of relative abundance. To standardise data collection, trips are made at the same time each month (in the third week) and are carried out by a select number of experienced observers (97% of trips have been lead by the authors).

Analysis
All field data collected is computerised and stored in spreadsheet and relational database formats. Between August 1995 and December 1998 thirty-eight monthly trips were made, with a total of 19994 km of recording effort being made in good-fair weather (sea state four or less, and visibility more than 5km).

Dolphin sightings along the ferry route have been grouped into 24 grid cells (measuring 1° longitude by 0.5° latitude), thus adopting the standard system developed by standard International Council for the Exploration of the Sea (ICES). The relative abundance of common dolphins (all years combined) for each grid cell has subsequently been expressed as the number of animals seen per 1000 km of search effort in good-fair weather. Common dolphin distribution maps have been generated by DMAP biological mapping software supplied by Dr Alan Morton. To describe seasonal patterns of distribution, sightings have been grouped into 3-monthly periods (first quarter of the year – January to March, second quarter - April to June etc.).

RESULTS
Overall distribution
Fig.1 shows that over the 3.5 year study period, the common dolphin has a cosmopolitan distribution in the sampled areas of the Bay of Biscay, occurring in both shallow and deep water areas. Common dolphins have been widely recorded in all months, and are the most frequently recorded cetacean species.
Relative abundance
Over the recording period (n=38 surveys), common dolphins have been sighted on 220 occasions in the Bay of Biscay, with over 9000 individuals recorded. Common dolphins have been most abundant in the northern part of the Bay, along the continental shelf edge (46-48ºN, Fig. 2). In this area, densities (per ICES grid cell) of up to 1,501-2,000 individuals per 1000km have been recorded. In contrast, common dolphins appear to be much less abundant in the southern half of the Bay, with densities (per ICES grid cell) mostly lower than 11-100 individuals per 1000km.

Seasonal patterns of distribution
In the first and final quarter periods (Jan-Mar and Oct-Dec) the majority of sightings have been from the northern part of the Bay, in the shallow waters off the Brittany peninsula (Fig. 3). In the second quarter (Apr-Jun) common dolphins are largely absent (suggesting dispersal) from this area, with the majority occurring much further south in the deeper waters of the middle of the Bay. In each quarter period, a large but mobile population has been located along the edge of the continental shelf in the north Bay.

DISCUSSION
Survey data indicates that common dolphins in the Bay of Biscay show marked seasonal patterns in their distribution. During the winter, the shallow Brittany coast supports large numbers of common dolphins. At this time Common dolphins are also at their most abundant in the adjacent English Channel (BDRP, unpublished data), and nearby Celtic Shelf (Tregenza, 1997) and it seems likely that this whole region is an important wintering ground for the species.

During the spring/early summer the deep waters of the middle of the Bay of Biscay support large numbers of common dolphins. These larger numbers further south could be explained by dispersal from wintering grounds further north or by immigration of oceanic common dolphins (as has been observed in other temperate regions, Forcada, 1990).

Forcada et. al., (1990) describe two possible populations of common dolphin in the eastern North Atlantic: one that inhabits the deeper oceanic waters, and one that inhabits neritic waters. Whilst common dolphins are distributed throughout the sampled areas of the Bay of Biscay, the effort adjusted data tend to indicate that the majority of animals occur in water depths of between 80-140 m, along the edge of the continental shelf. This in turn suggests that the majority of common dolphins sighted in the Bay of Biscay are of the neritic population.

REFERENCES
Figure 1 Common dolphin sightings in the Bay of Biscay, recorded from the Pride of Bilbao ferry 1995-98. Closed circles represent definite sightings, open circles unidentified Delphinidae.

Figure 2 Relative abundance of common dolphin in ICES grid cells of the Bay of Biscay sampled by the Pride of Bilbao ferry 1995-98.
Figure 3 Seasonal distribution of common dolphin in the Bay of Biscay 1995-98 from surveys on the P&O ferry, the Pride of Bilbao