CETACEANS AND PELAGIC TRAWL FISHERIES IN THE WESTERN APPROACHES OF THE ENGLISH CHANNEL

SUMMARY REPORT OF THE 2004 WDCS/GREENPEACE WINTER SURVEY: A WDCS SCIENCE REPORT

SUMMARY

A joint WDCS/Greenpeace cetacean survey using conventional line-transect techniques and trialling other survey methodologies, including acoustic detection, was carried out between 21^{st} of January and 8^{th} of March 2004 in the Western Approaches of the English Channel. The main aims of this survey were to study the local dolphin, porpoise and whale populations, to monitor the winter pelagic trawl fisheries there, and also to monitor interactions between these fisheries and the cetaceans. The results of this survey reveal a high relative abundance in the survey area, particularly of common dolphins, at this time of year. The species identified during the survey were: harbour porpoises, short-beaked common dolphins, bottlenose dolphins, Risso's dolphins, striped dolphins, fin whales and minke whales.

The provisional abundance estimate for common dolphins in the entire area surveyed in the Western Channel (8,872 km^2) resulting from this survey was 9,708 animals (95% CI = 4,799-19,639). However, the full designed transect coverage was only achieved in sub-area 'Stratum E' (which covers 4,129km^2) and this provides the best estimate achieved for common dolphins during this survey using standard line-transect methods: 2,841 (95% CI=169-5,512), although this is subject to potentially large bias related to responsive movement by the dolphins. Other surveys providing population estimates for common dolphins are likely to have similar problems of bias. Inevitably, attention will be drawn to the various population estimates that now exist for the common dolphins in the North Atlantic and the relationship between these and bycatch removals and this matter is discussed here.

The data from this survey show that the common dolphins in the Channel area (which may or may not be part of a discrete population) could well become depleted as a result of bycatch. We therefore have significant cause, from conservation and animal welfare perspectives, to be concerned about what is happening to this species in this region. Trawl fisheries and gill nets are implicated in the problem for this species.

INTRODUCTION

The Western Approaches of the English Channel are of importance for whales, dolphins and porpoises (known collectively as cetaceans). They also support feeding and spawning grounds for a diverse fish fauna including many commercially important species.

A total of 28 cetacean species have been recorded in the waters off northwest Europe in the last 25 years (Reid *et al.*, 2003). Of these, at least 19 species have been sighted or found stranded in the English Channel. The cetaceans most likely to be seen here are bottlenose dolphins (*Tursiops truncatus*), harbour porpoises (*Phocoena phocoena*), short-beaked common dolphins (*Delphinus delphis*), Risso's dolphins (*Grampus griseus*), striped dolphins (*Stenella coeruleoalba)*, minke whales (*Balaenoptera acutorostrata)*, long-finned pilot whales (*Globicephala melas)*, orcas (*Orcinus orca*) and fin whales (*Balaenoptera physalus)*. Other deep water cetaceans, cachalots (also known as sperm whales, *Physeter macrocephalus)* and various beaked whales, also visit this area, perhaps when migrating through, and are recorded less frequently.

These waters are intensively trawled by pelagic fisheries during the winter months from October to May and are also subject to significant gill and tanglenetting effort. These fishing activities coincide with relatively high levels of cetacean strandings.
In recent years, hundreds of corpses have washed ashore in south west England and on adjacent French coasts each winter. In the case of many of the common dolphin bodies, the external damage is consistent with death in the type of netting used in trawls.

Despite this, little bycatch monitoring has taken place in the pelagic trawl fisheries that operate in these waters, although, in recent years the UK has conducted extensive monitoring of the winter sea bass fishery, which has been found to be responsible for a high rate of cetacean bycatch. Indeed, the UK government recently called upon the European Commission to close the winter sea bass fishery in the western Channel (ICES area VIIe) because of the high level of common dolphin bycatch recorded in the UK fleet. This initiative was unsuccessful.

A joint WDCS/Greenpeace cetacean survey using conventional line-transect techniques and trialling other survey methodologies, was carried out between 21st of January and 8th of March 2004 in the Western Approaches of the English Channel, including a brief visit west to the Celtic Shelf. The main aims of this survey were to study the local cetacean populations, to monitor the winter pelagic trawl fisheries there, and also to monitor interactions between these fisheries and the cetaceans.

The main fishing ground used by pair trawlers during this survey period clearly overlaps with an area used by the common dolphins.

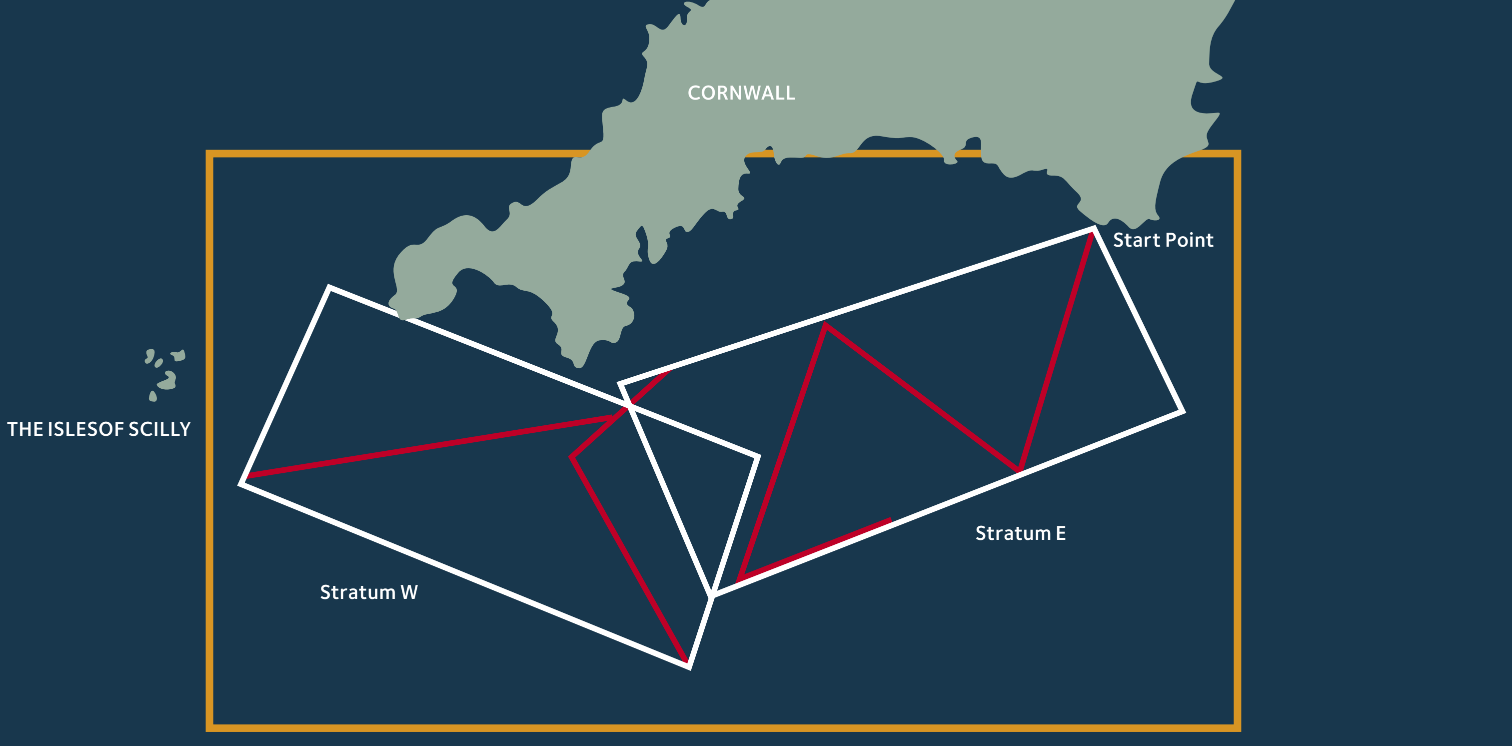


Fig.1.

- Main survey area
- Survey transects at fast speed
- Positions of the transect survey design

METHODOLOGY

One of the most commonly used methods for estimating density and abundance is line-transect sampling, in which the observer travels along a line (transect) recording detected cetaceans and their accurate distances and bearings to the line. The cetaceans may either be individual sightings or clusters of animals. With the collected data, together with covariates that could be affecting the detection of cetaceans, one can then estimate the cetacean density. The density estimate can then be converted to an estimate of abundance using design-based methods (Buckland *et al.*, 2001).

In line-transect sampling, the survey design comprises a set of straight lines, spanning the full study area for which an abundance estimate is required. The methodology requires that lines are randomly placed in the study area and that they are placed across known depth contours, in order to gain a clearer picture of density and minimise variance in encounter rate (Buckland *et al.*, 2001). For shipboard surveys in particular, the study area is often divided into geographic blocks (or strata) and systematic 'zig-zag' transect designs are used to ensure that there is no loss of expensive ship time in traversing from one line to the next. The ship can then continuously search for marine mammals during daylight hours and good weather conditions.

Transects were placed over two areas which were similar in size totalling an area of 8,872km2 (between the Scilly Isles and Start Point; see Fig. 1). These areas were established following transect design of a previous study conducted during the autumn of 2002 (De Boer and Simmonds, 2003; for more details see www.wdcs.org).

The survey was conducted from Greenpeace's MV Esperanza, a 72.3m Expedition/Research vessel, which traveled at either a 'fast' average speed of 8.6 knots or a 'slow' average speed of 5.3 knots. Data were collected mainly in the 'passing mode' (where the vessel did not deviate from the track-line). The survey took place between 21st of January and 8th of March in the Western Approaches of the English Channel, including a brief visit to the Celtic Shelf. The main Survey Area (our target area where we placed the survey transects), lay between 49°20'N-50°20'N and 3°26'W-6°10'W (see Fig. 1).

Two observers were located on the outer bridge deck (which served as the primary platform with an approximate eye-height of 11.3m), one on port and one on starboard. Observers scanned backwards and forwards whilst on watch in a 90 degrees sector (on port and starboard), forming an approximately 180 degrees combined survey area in front of the ship. Scanning was done with the naked eye with occasional scans along the horizon using 7X50 binoculars.

Effort during the survey was divided into several types (see Table 1). Survey effort continued throughout all daylight hours but was suspended when the Beaufort sea state exceeded 4.5 or visibility was considered poor. Sightings made during bad weather or when no systematic observations were being conducted (i.e. low and off effort), were regarded as incidental sightings.

From the 13th of February until the 4th of March, the ship towed a two-element hydrophone array. The hydrophone array consisted of two fixed elements 7.5m apart within a 13 metre oil-filled PVC pipe. It was towed on a 300m cable. A pressure sensor within the hydrophone allowed the depth to be recorded.

RESULTS AND DISCUSSION

A total of 469 sightings of approximately 3,707 animals were made during the expedition. The results of this survey reveal a high relative abundance of cetaceans (number of sightings per 100km) in the survey area, particularly common dolphins, at this time of year. The cetacean species identified during the survey were: harbour porpoises, short-beaked common dolphins, bottlenose dolphins, Risso's dolphins, striped dolphins, fin whales and minke whales. Table 2 shows an overview of visual effort during different survey effort modes for the main survey area and elsewhere.

Information on mean water temperature, depth, distance to shore of common dolphin sighting location and group size of definite and probable sightings encountered within the main survey area during different effort modes are shown in Table 3. Taking the whole survey into account, the proportion of common dolphins seen between the coastline and 12 nm was 36%. However, all the periods of fisheries observation where common dolphins were recorded were beyond 12 nm of the coast. This is significant given the recent closure of the UK's winter sea bass pair trawl fishery that applies only within this 12 nm coastal zone.

The group size of common dolphins was also higher during fisheries monitoring (11.5) than other survey modes where trawlers were not present (6.4). This difference is significant (Student's T-test, $p<0.05$). During fisheries monitoring, more common dolphins were also found to display behaviour indicative of feeding. These factors merit further investigation, as the group size and foraging strategies are also likely to affect the number of bycaught animals in nets.

The area where most pair-trawlers were encountered during this survey is boxed in blue in Figure 2. On the 5th of March a total of 7 different pairs of trawlers were operating between 49°45N - 50°01N and 3°46W - 3°18W, an area of approximately 13 by 20 nm. The average distance to shore of operating pair-trawlers was 20.94 nm (SD 8.71) and ranged between 3.1and 44.9 nm. Fig. 2 also depicts sightings of common dolphins made throughout the expedition (regardless of survey effort) and sightings of dead dolphins. From this chart it can be concluded that the main fishing ground used by pair trawlers during this survey period clearly overlaps with an area used by the common dolphins.

Such overlap of fishing effort and dolphin distribution is likely to increase the risk of bycatch. Indeed, it is this area where 11 of the 12 dead dolphins were found floating on the surface, although four of the dead dolphins have subsequently been shown to be the victims of gillnets. A higher relative abundance was also evident for both common dolphins and harbour porpoises in the presence of trawlers. Our findings indicate a rather low relative abundance of common dolphins in the French part of the Channel.

During fisheries observations, a total of 95 sightings of cetaceans (of which 50 sightings were common dolphins) were

Table 1. Information and abbreviations for different survey modes conducted at either fast (~8.6 knots) or slow (~ 5.3 knots) speed of the survey vessel.

Effort mode	Abbreviation	Speed Mode	Description
Transect	T TS	Fast Slow	Systematic surveys following pre-determined transects
High Effort	S SLOW	Fast Slow	Systematic surveys not following pre-determined transects whilst on transit
Fisheries Observations	FOF FOS	Fast Slow	Data collected during non-systematic surveys that were specifically aimed to monitor fisheries
Low effort	L	n/a	Dedicated observations made during bad weather (sea state>4.5) or when visibility was poor
Off effort	X	n/a	No dedicated observers on watch

The data from this survey show that the common dolphins in the Channel area (which may or may not be part of a discrete population) could well become depleted as a result of bycatch.

Table 2. Extent of visual effort and track lines for various survey modes within the Survey Area unless stated otherwise (e.g. the total expedition area (Total), the French part of the English Channel and an area off Portland).

Survey mode		Effort (nautical miles)	Effort (km)	Survey effort (hr:min)	Proportion of Effort (%)
Fast mode	T	226.1	418.7	26:02	3.39
	S	232.6	430.2	27:18	3.56
	S (French Channel)	137.6	254.8	15:26	2.01
	S (Portland)	15.9	29.4	1:53	0.25
	FOF	29.1	53.7	05:16	0.69
Slow mode	TS	25.2	47.1	4:40	0.61
	SLOW	164.2	303.7	25:52	3.37
	SLOW (French Channel)	30.8	57	6:13	0.81
	SLOW (Portland)	26.7	49.6	5:21	0.70
	FOS	68.5	127	16:38	2.17
n/a	Low Effort (Total)	608.9	1127.8	112:10	14.62
	Off Effort (Total)	2260.5	4186.4	369:29	48.16
	Monitoring dead dolphins	25.6	47.4	08:16	1.08
	Other	730.5	1353.4	153:00	19.94
	Total Track	4582.2	8486.2	767:14	100.00

Table 3. Water temperature, depth, distance to shore of common dolphin sighting location and group size of definite and probable sightings encountered within the main survey area during different effort modes, where 'ALL' represents pooled effort.

Effort mode		Temperature (°C)	Water depth (m)	Distance to shore (nmiles)	Group size
Fast (T+S)	n	68	85	100	100
	x	9.38	75.82	13.02	6.4
	SD	0.66	8.01	6.05	8.48
	Range	8-10.3	61-93.9	3.29-32.1	1-45
Slow (TS+SLOW)	n	19	16	25	26
	x	9.07	66.02	14.31	5.73
	SD	0.67	9.54	6.57	6.97
	Range	8.1-9.9	43.9-81.3	2.8-20.5	1-33
Fisheries Obs. (FOS)	n	30	12	30	30
	x	9.36	73.16	19.46	11.53
	SD	0.41	6.7	5.76	12.49
	Range	8-10	67.9-92	14-37.9	1-45
ALL	n	117	112	155	155
	x	9.32	73.62	14.51	7.32
	SD	0.61	10.5	6.54	8.27
	Range	8-10.3	43.9-93.9	2.8-37.9	1-45

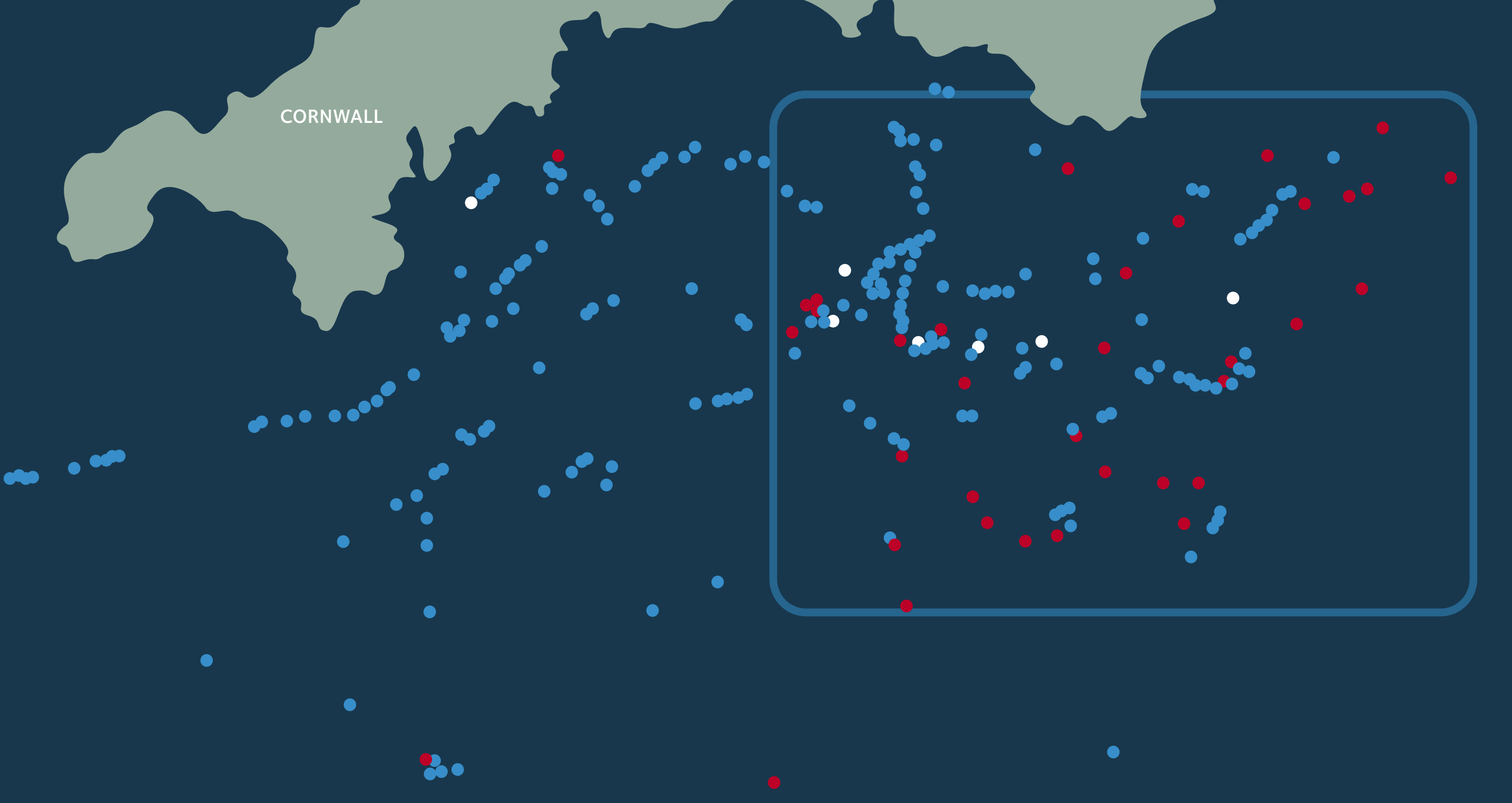


Fig.2.
Sightings of pair trawlers
Dead dolphins
All sightings of common dolphins regardless of the survey effort
Main fishing ground

reported. Interactions between fisheries and cetaceans were reported 7 times, including instances when common dolphins were seen around the trawlers during hauling and towing procedures. A fin/sei whale, a minke whale and also Risso's dolphins were seen in areas where pelagic trawling was taking place.

The post mortems of the dead common dolphins retrieved at sea revealed that four had injuries consistent with being killed in gillnet fisheries and the marked presence of injuries that may have been caused by nets recorded on live common dolphins suggests that some may be wounded during encounters with nets but nonetheless survive. (This apparent high rate of injury clearly deserves further investigation.)

Acoustic detections were not distributed evenly across the diurnal cycle (X^2 test for association with Yate's correction; $X^2 = 26.34$, 7 *df*, $p>0.001$). There were peaks in the percentage of acoustic detection in the morning, just after sunrise, and in the evening, just after sunset. A low in percentage detections occurred during the midday subdivision. High levels of dolphin detections have been associated with both feeding and social behaviour. Visual surveys are limited to day time and, therefore, acoustic techniques may be able to provide a better understanding of the interactions between dolphins and nets.

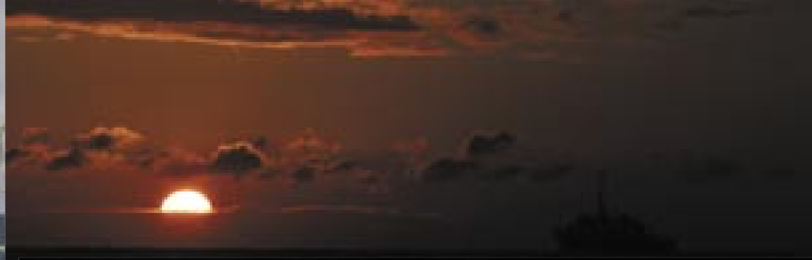
Only very few studies to date have reported the relative abundance of common dolphins in the NE Atlantic or supplied an estimate of density and abundance for them. It is necessary to be very cautious when comparing such estimates, as surveys differ in their distribution of effort, the vessel used, survey methodology and the season in which they are carried out.

The provisional abundance estimate for common dolphins in the entire area surveyed in the Western Channel (8,872 km^2) resulting from this survey was 9,708 animals (95% CI = 4,799-19,639). However, the full designed transect coverage was only achieved in sub-area 'Stratum E' (which covers 4,129km^2) and this provides the best estimate achieved for common dolphins during this survey using standard line-transect methods: 2,841 (95% CI=169-5,512), although this is subject to potentially large bias related to responsive movement by the dolphins.

The provisional abundance estimates were based on a number of assumptions including that the probability of detecting dolphins on the trackline, *g(0),* is assumed to be one, *i.e.* every animal that surfaces on the trackline is detected. However, this assumption could lead to a slight downward bias in the abundance estimation because, in practice, some animals may have been undetected.

Another assumption of the line-transect methodology is that the animals do not respond to approaching survey vessels before they are detected. Indeed, the results of the current study highlight the problem of responsive movement for surveys of common dolphins. The use of two different survey speeds enabled comparisons to be made of the way in which responsive movement affects the detection process. The results show that the effects are complex involving changes in both the location of the animal relative to the vessel and the detection probability. For this survey, the assumption that animals were detected before they responded to the vessel was clearly not valid (as there was clear evidence of responsive movement towards the vessel by the dolphins) and this will cause upward bias in the provisional estimates, a factor likely to affect other estimates made for this species.

For example, during the SCANS survey in Block A, which corresponds to the Celtic Shelf area, a common dolphin abundance estimate of 75,450 (95%CI=23,000-149,000)



CONCLUSION

The high levels of bycatch reported in the Channel area clearly raise both conservation and animal welfare concerns and, in conservation terms, there is one particularly important question: what is the effect of these removals on the populations of cetaceans in this region. There is clear evidence that many common dolphins and many harbour porpoises are being killed and other species are also being washed ashore dead. We should not forget that these other species may also be significantly impacted. For example, any removals from the small coastal bottlenose dolphin population in the south-west of England, which probably only numbers a few tens of individuals, could be highly significant.

Here, however, we focus on the situation of the common dolphins because our observations and results mainly feature this species. The area where bycatch is occurring is on the edge of the usual distribution of this species and bounded by the coastlines to the north and south, with very few observations of common dolphins further east in the Channel (Reid *et al.*, 2003). If this area is only used by a subset of the total Northeast Atlantic 'stock' of this species, which may be a distinct population which returns each year, then there is at least a risk of localised depletion within the Channel area. If local depletion occurs, it is not clear whether common dolphins from further afield would then start to exploit and re-populate the area. Furthermore, the relatively high encounter rate in this study (the highest of all the surveys in the North Atlantic) shows that the Channel is a very important winter habitat for common dolphins.

and a relative abundance (sightings per 100km) index for Block A of 0.94 (Hammond *et al.*, 2002) were calculated. The SCANS data were collected from a similar-sized vessel to that used in our survey and abundance estimate calculations were made based on standard line transect methods only. These, therefore, may well also be subject to a positive bias due to responsive movement. There is evidence of this in the SCANS data since the estimated strip width for common dolphins (for the same vessel in the same area) was apparently less than that for harbour porpoises, a surprising result indicating that either responsive movement was the cause of the very narrow strip width or that harbour porpoises, which are usually solitary, have a higher detection probability than common dolphins with a mean group size of ten.

The NASS-95 Faroese survey, used the Buckland-Turnock dual platform method (Cañadas *et al., in press)*. This allowed the actual value of *g(0)* to be estimated and, in theory, responsive movement to be taken into account. This survey was conducted in the Faroese sector, western British Isles and offshore Atlantic during the summer months. Responsive movement was modelled by comparing detections made by the Tracker platform (from which 7x 50 binoculars were deployed) and detections by the Primary platform. The detection function based on perpendicular distances for that study shows similar properties to our findings. For instance, Cañadas *et al.* found a rather low Effective Half Strip Width. The *g(0)* estimate for the NASS-95 survey was 0.8 (*CV* 0.14) and these researchers found that a standard 'Distance Approach' based on naked eye observations would have resulted in estimates that were positively biased by a factor of 5.9. However, they were not able to establish categorically whether the observers using the high power binoculars were detecting dolphins prior to the animals responding to the survey vessel, so there remains a possibility of bias in this estimate too.

There is clear evidence that many common dolphins and many harbour porpoises are being killed and other species are also being washed ashore dead.

Inevitably attention will be drawn to the various population estimates that now exist for the common dolphin in the North Atlantic and the relationship between these and bycatch removals. However, great care needs to be taken when making extrapolations or conclusions from such estimates. For example, the relatively large population estimate provided by Cañadas *et al.* (*in press*), based on data collected in 1995, raises a number of issues that are highlighted by the authors themselves. These include an extrapolation from one part of one survey block to the remainder and that the density of animals in this area is high relative to other similar studies. This could represent a particular concentration of animals associated around a particular feature, making extrapolation to a wider area questionable. The authors also note that 'the representativeness of the survey in this block [their survey Block W] is somewhat suspect and the abundance estimate obtained for this block may be biased as a result'. It is also possible that even the special technique used by Cañadas et al. (*in press*) in order to address the responsive movement of the dolphins to the survey vessel was not able to fully address this problem, which could also have caused bias in the population estimate. (Comparisons with other estimates are further discussed in the full report available at www.wdcs.org).

Moving to the issue of removals, a bycatch level for small cetaceans of more than 1.7% of the best available estimate of abundance has been deemed in international fora to be unacceptable (ASCOBANS, 2000). Based on our provisional abundance estimate (for our Stratum E), this would equal some 48 animals. (Note that no correction for responsive movement is made in the provisional abundance estimate.) During the 2003/4 fishing season, a bycatch of 169 common dolphins was recorded in the area in the UK bass fishery alone, producing an extrapolated total estimated mortality for the UK fishery of 439 animals (SMRU, 2004). There is additionally mortality in other (*e.g.* gill and tangle net) fisheries, for instance, 200 common dolphins were estimated to be caught annually in the Celtic Sea hake gillnet fishery during the early 1990s (Tregenza & Collet 1998), and an assumed (but unquantified) mortality in the French bass fishery and potentially other trawl fisheries.

In conclusion, the data from this survey show that the common dolphins in the Channel area (which may or may not be part of a discrete population) could well become depleted as a result of bycatch. We therefore have significant cause to be concerned about what is happening to this species in this region. Pelagic trawl fisheries and gill nets are implicated in the problem for this species and the latter even more so for bycatch of harbour porpoises.

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