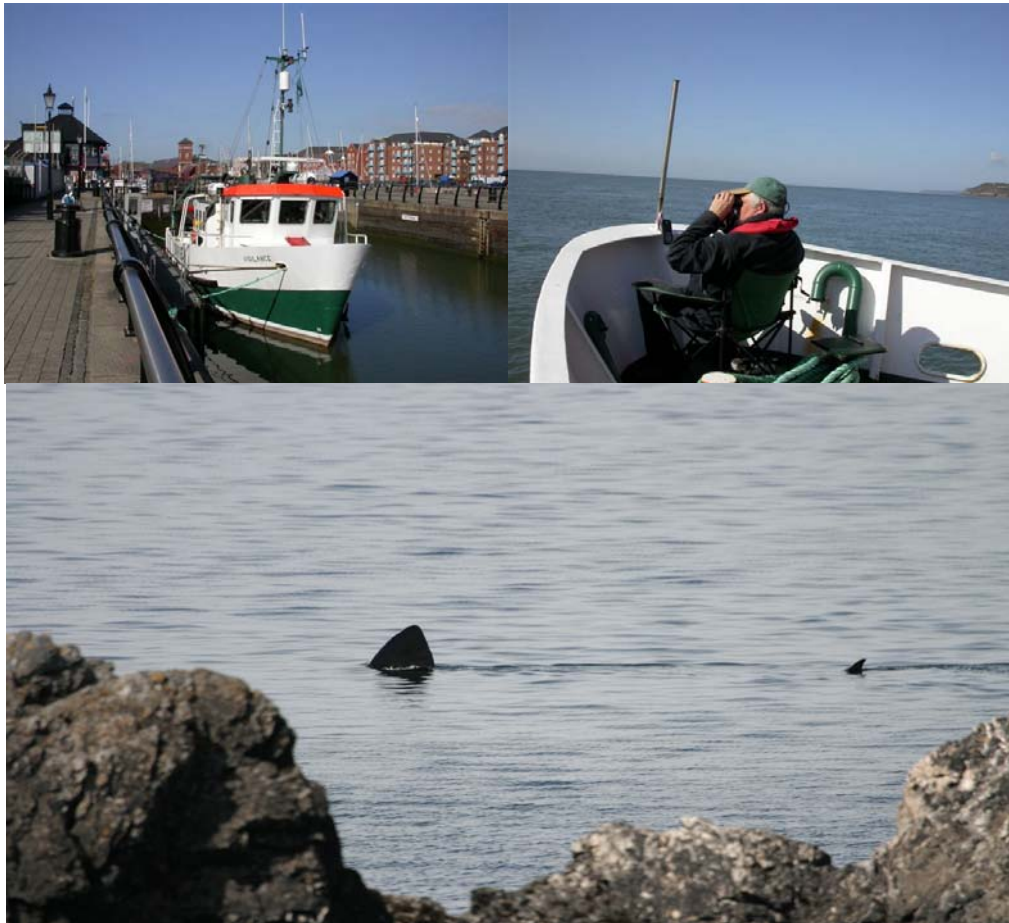


# Marine Conservation Society Outer Bristol Channel Megafauna Surveys 2007



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A collaborative project between  
The Environment Agency and the Marine Conservation Society



Supported by  
The Countryside Council for Wales Species Challenge Fund



## Introduction:

The Marine Conservation Society is the Lead Partner on the Basking Shark and Grouped Action Plan for marine turtles. MCS has compiled a database of opportunistic public sightings of basking sharks in UK waters since 1987, yet up to 2004, only 41 sightings of a total of 71 sharks were reported from Welsh waters (Doyle *et al.*, MCS 2005). The majority of these sightings emanate from Pembrokeshire and in offshore waters west of the Smalls in the 'Celtic Deep' (Fig 1 and 2).

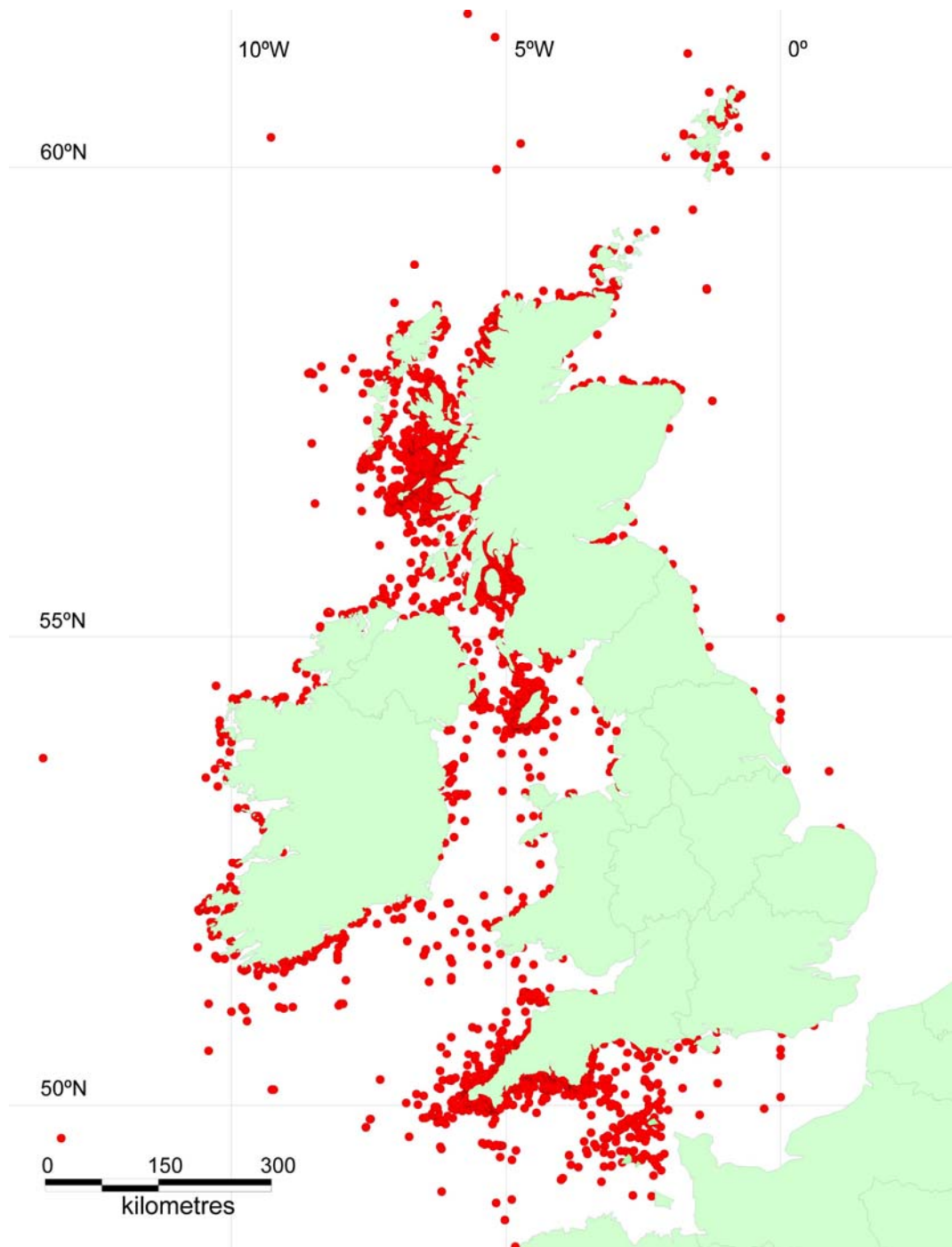


Figure 1: Basking shark sightings between 1987 and 2006

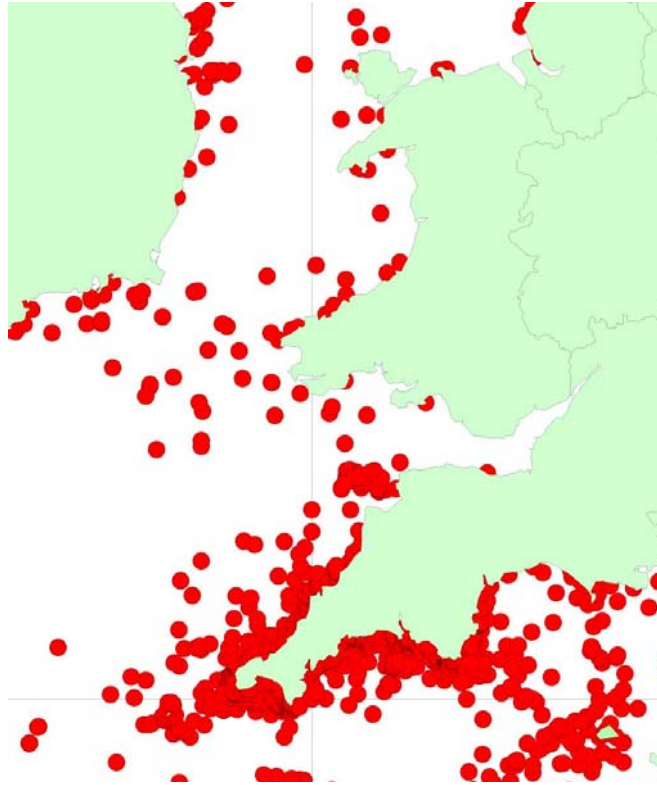


Figure 2: Basking shark sightings between 1987 and 2006 from Welsh and Southwest English waters.

What is apparent from the broad patterns of distributions of basking shark sightings at surface waters is that there are three ‘hotspots’ of basking sharks in spring/summer months – the Southwest peninsula (from Devon to the Scillies); the Isle of Man (south and west coasts) and the entire west coast of Scotland (Doyle *et al.*, MCS 2005; Southall *et al.*, 2004).

It is apparent that the horizontal broad scale distribution (within 10’s of kilometres) of these surface sightings is linked with the seasonal distribution of thermal fronts between stratified and mixed waters (Sims *et al.*, 1997). Sharks have been tracked in previous studies moving along these frontal areas, selectively foraging on *Calanus* spp. copepods which gather in surface waters in areas of fronts (Sims and Quayle, 1998).

Recent research by the Marine Biological Association has shown that basking sharks in frontal areas appear to follow the diurnal upward migration of their *Calanus* prey to surface waters. Sharks follow their copepod prey to the surface in daylight hours in frontal areas, but appear to show a reverse trend in more stratified waters. In regions where stratified waters dominate (the majority of UK sea areas), sharks are more inclined to forage at the surface in the night, once again following their copepod prey (Sims *et al.*, 2005a). This research has led to some concern that the sightings of sharks at the surface only gives a skewed result as to the distribution of basking sharks in UK waters.

It is therefore clear that the distribution of basking shark sightings derived from the basking shark sightings scheme administered by the Marine Conservation Society is related to the distribution of thermal fronts.

A review study co-ordinated by the MBA as part of the Conserving Endangered Basking Sharks (CEBS) project between 2003-2006 revealed that basking sharks are much more widespread and wide ranging in UK waters, with tagged sharks moving between England, France, Ireland, Northern Ireland and Scotland in a matter of weeks (Southall *et al.*, Sims *et al.*, 2005b) (Fig. 3).

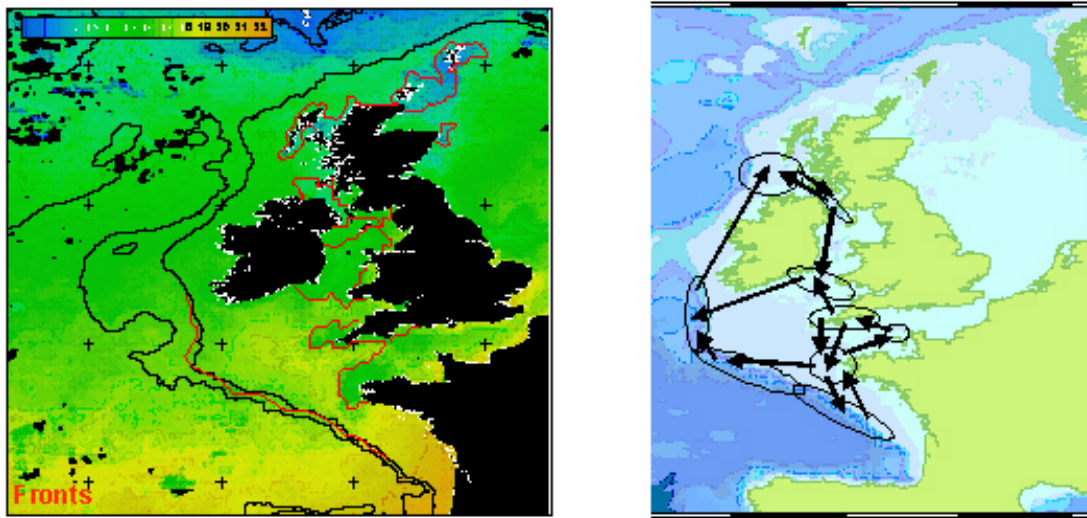


Figure 3. Frontal areas (left) derived from AVHRR NOAA satellite information on SST distribution as a composite of SST during August 2002. Basking shark hotspots (right) derived from MBA shark-tagging studies using pop-up archival tags from nine animals tracked between 2000 and 2002 (Sims *et al.*, 2005b).

The wide-ranging multi-national nature of shark migration between different EC states (Fig. 3) led to the Marine Conservation Society working with UK government and the JNCC to write a proposal for listing the species on the Convention of Migratory Species (CMS) in Spring 2005. The discussions that stimulated this proposal emanated from the Basking Shark BAP meeting held in Plymouth in December 2004, where scientists from UK and France, NGOs, JNCC and Defra were in attendance to discuss the conservation measures that would benefit the species.

The listing of the species on the CMS subsequently led to the species being banned for sale, transshipment or landing in all EC (ICES) waters in January 2007. This closed the loophole that previously allowed basking sharks to be landed as bycatch in those European states which don't have national laws to protect the species in coastal (<12nm) waters (Solandt and Bloomfield, MCS 2007).



Figure 4: The last UK commercial fishery operating on basking sharks was in the Clyde in 1997 (as seen here). Listing of the species on the Wildlife and Countryside Act led to a ban on killing, or sale in Scotland, Wales and England in 1998.

### **Past work on megafauna species from the area**

It's clear that the surface waters of Wales (other than off west Pembrokeshire) aren't a UK hotspot for basking shark activity (Figures 1 and 2). However, there has been limited effort to gather sightings and recording of basking sharks in South Wales, with most previous surveys focusing on cetaceans, as recorded in the Atlas of cetacean distribution (Reid *et al.*, 2003; de Boer and Simmonds, 2003). This work detailed the coastal waters of south Wales as being important foraging grounds for harbour porpoise and common dolphins, with bottlenose and Risso's dolphins also observed, but at a lesser frequency. The latter survey of the entire Welsh coast, and southwest English peninsula found that the highest number of sightings was reported from Pembrokeshire, but the largest number of individuals was recorded from the Bristol Channel (de Boer and Simmonds, 2003). In fact the outer Bristol Channel appears to attract the largest schools of common dolphins seen in Wales.

Large cetaceans are rarely reported from south Wales, although humpback whales and orca have been seen off the waters southwest of Pembrokeshire, and a 40-ton fin whale was stranded in South Wales in 2004 off St. Brides (Rod Penrose, *pers. comm.*)<sup>1</sup>.

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<sup>1</sup> Visit - <http://www.strandings.com/Wales.html>

Sightings and reports of leatherback turtle distributions in the UK indicate that the waters of Carmarthern Bay in south Wales are a hotspot for this species. It appears that it is the seasonal abundance of jellyfish in the bay that attracts the turtles<sup>2</sup>. The leatherback is the only turtle that can partially regulate its temperature, and as such, they are the only turtle able to migrate between their nesting and breeding waters in the Caribbean to cold, northern latitudes waters during the summer months (Canada and British Isles) to exploit seasonally abundant jellyfish blooms, before returning to the Caribbean (Hays *et al.*, 2006).

## **Project Aims**

The objectives of this study were to:

1. Carry out effort-based surveys in the waters of the Outer Bristol Channel on: Basking sharks; seals; cetaceans; porpoises; dolphins; jellyfish and turtles.
2. Gather information on oceanographic conditions collected by the Environment Agency vessel, MV Vigilance.
3. Make recommendations for protected measures for marine megafauna in the Outer Bristol Channel in Welsh waters.

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<sup>2</sup> - visit - <http://www.mcsuk.org/marineworld/turtles/turtles+in+the+uk>

## Methods:

All surveys were carried out in daylight hours (8am-7pm) by a single dedicated observer approximately 3m above the sea surface. Surveys were carried out along fixed transects used by the Environment Agency vessel 'Vigilance' to record oceanographic conditions in the waters of the outer Bristol Channel (Fig 5 and 6).



Figure 5. The viewing platform aboard the MV Vigilance.

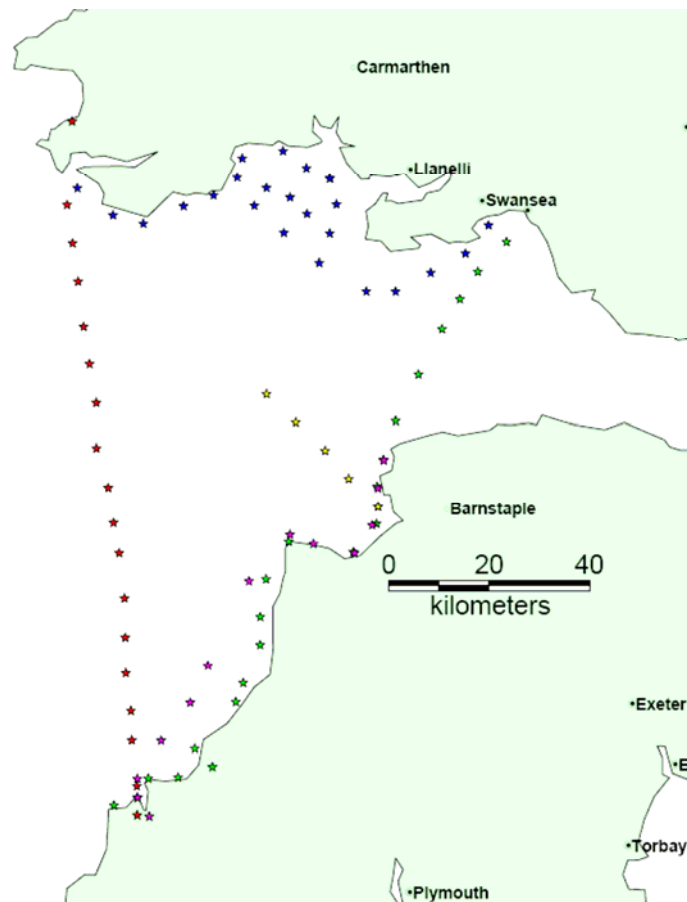


Figure 6: The transects carried out in the survey. Highlighted points indicate the passage of the vessel MV Vigilance. The passage between Neyland and Padstow didn't involve water sampling, but megafauna recording did take place.

Table 1: Metadata detailing surveys carried out aboard MV Vigilance, April-September 2007.

Transect	Number of trips	Total effort (hours)
1. Neyland – Padstow	3	23.3
2. Padstow – Swansea	3	23
3. Swansea – Neyland	2	22
4. Padstow – Appledore	1	8
5. Appledore – Lundy	1	4.5
6. Neyland – Aberystwyth	1	4
<b>Total</b>	<b>11</b>	<b>90.75</b>

Surveyors followed a standardised monitoring protocol developed by Dr Ruth Leeney (Leeney, *pers comm.*), who at the time of the survey work was a post-doctoral researcher at the University of Exeter, Cornwall campus (see Annex 1-3 for the forms). Surveyors were trained in the methodology prior to joining the vessel. They included Cliff Benson (Seatrust); Dr JL Solandt; Dr Sue Kinsey; Gill Bell and Angus Bloomfield (all MCS staff).

The periodicity of the surveys depended on weather conditions. Broadly speaking it was a wet, rough summer where many trips were cancelled (it was only considered worthwhile joining the vessel if the sea state was 4 or lower). April was very calm and hot, allowing excellent survey conditions (Fig 5). The other survey occasions were in mid June, mid and late July, and mid-September.

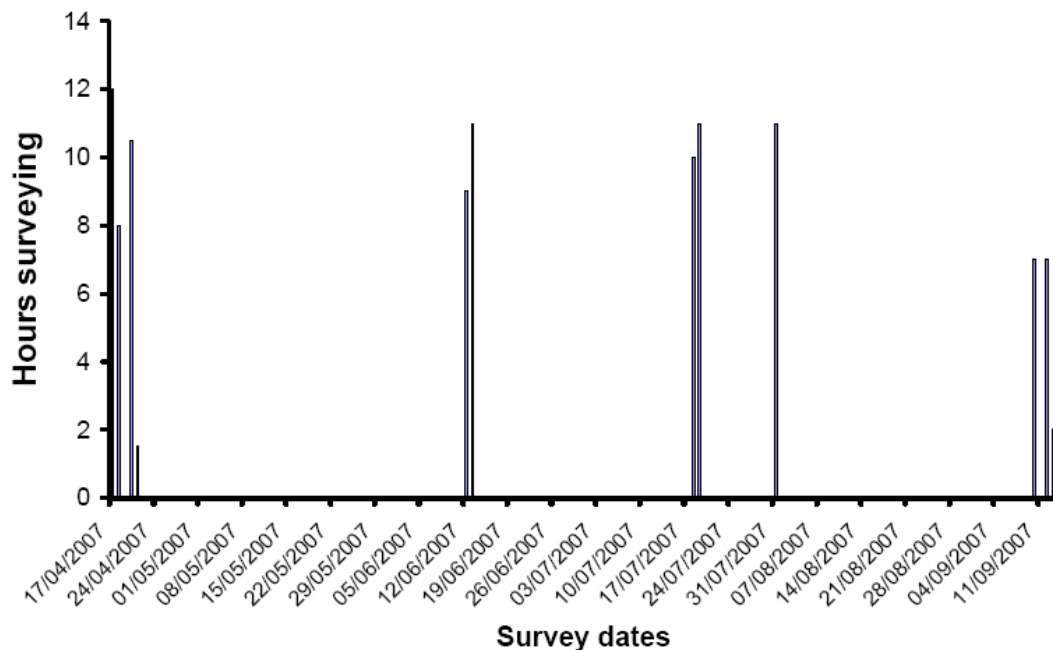


Figure 7: Periodicity of surveys throughout Spring / Summer 2007.

**Results:**

**Sightings by transect (Figure 8-13):**

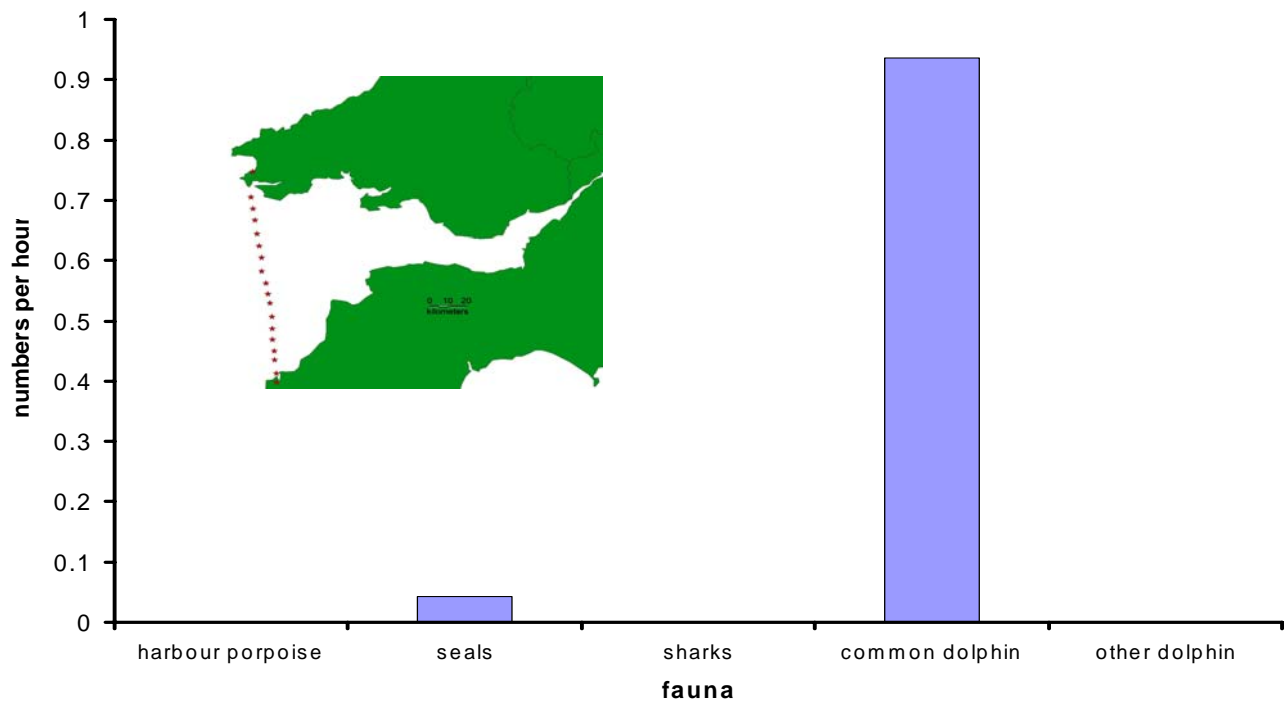


Figure 8: Surveys between Neyland and Padstow (transect map and sightings per hour).

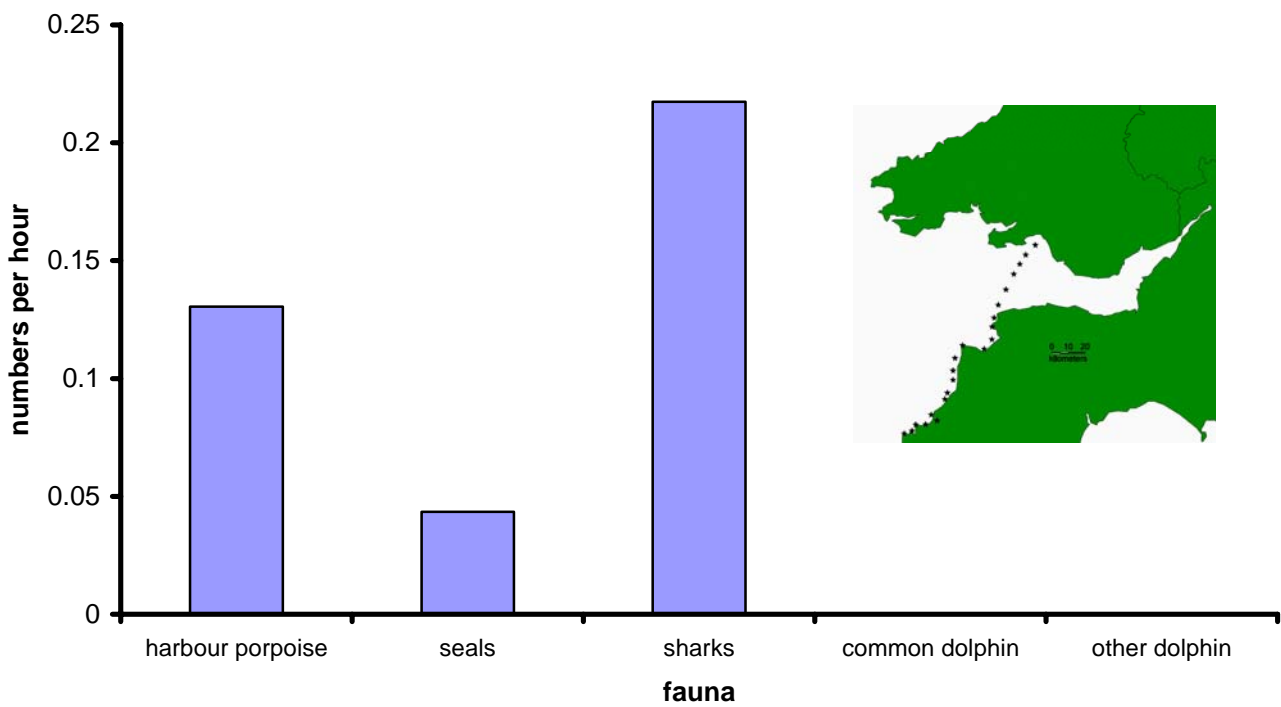


Figure 9: Surveys between Padstow and Swansea.

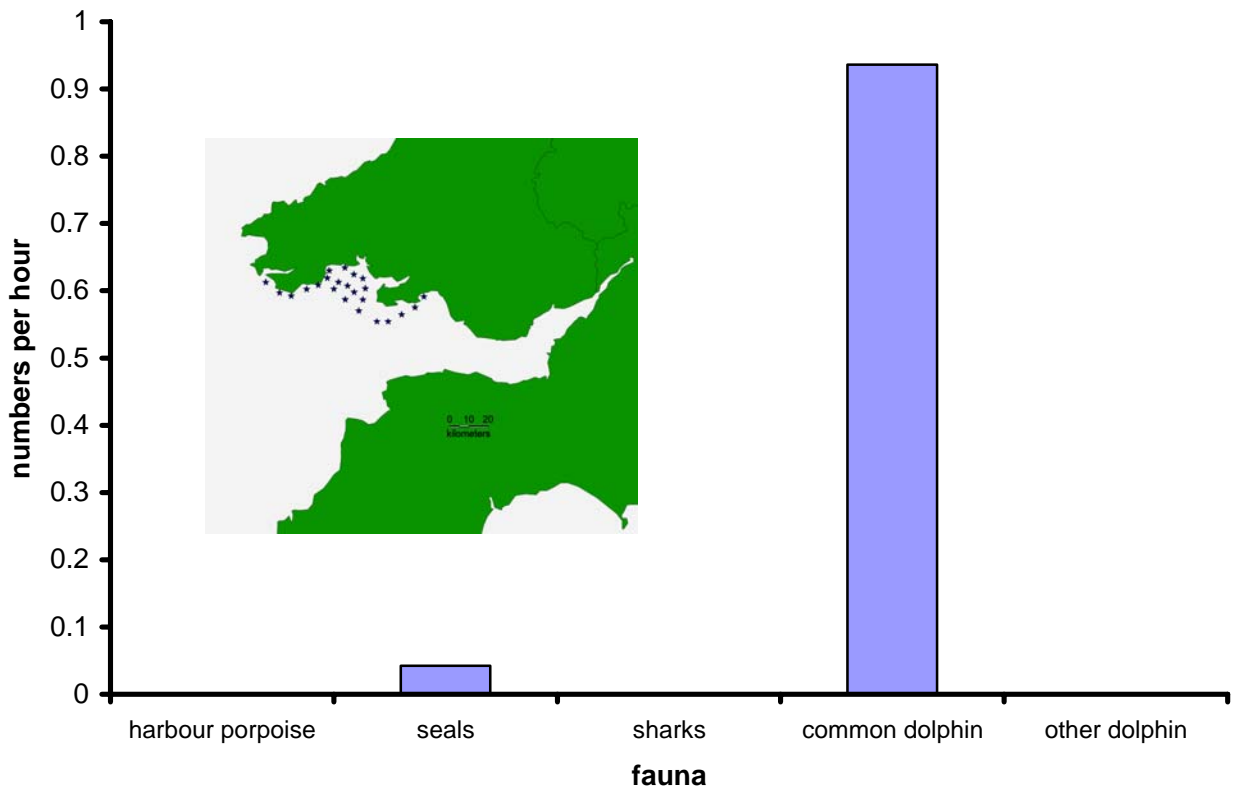


Figure 10: Sightings between Swansea and Neyland

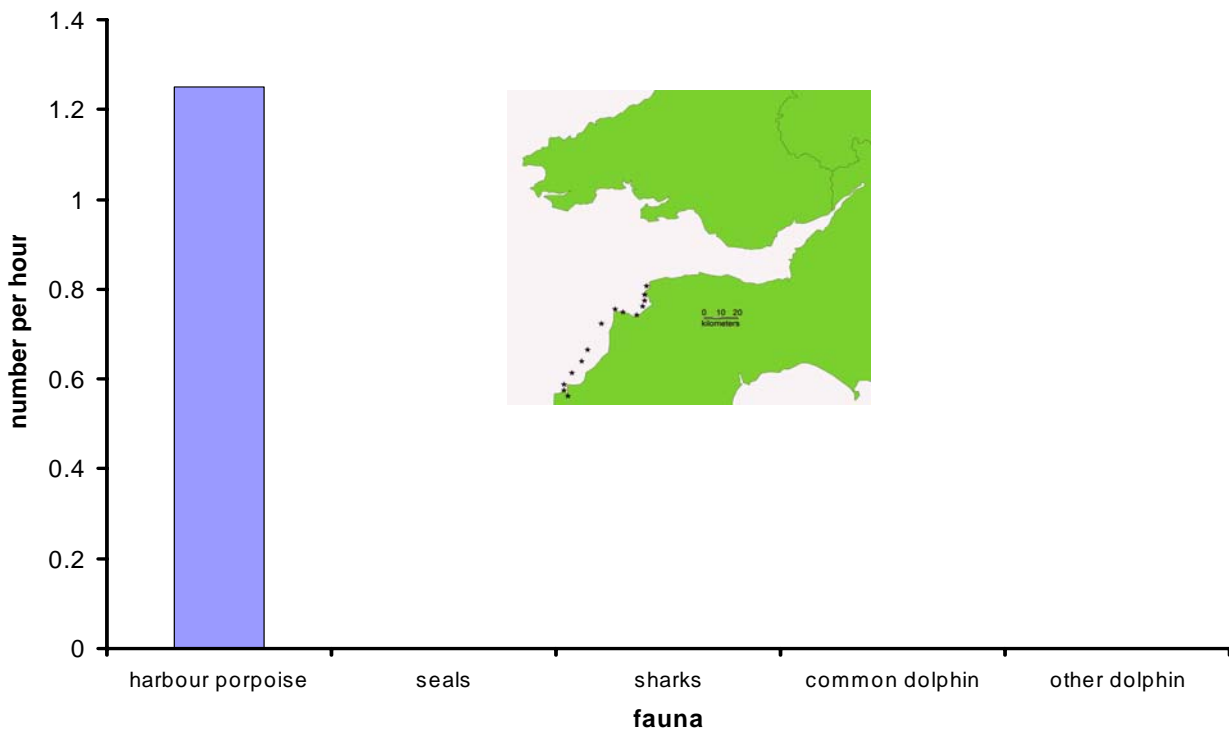


Figure 11: Sightings between Padstow and Appledore

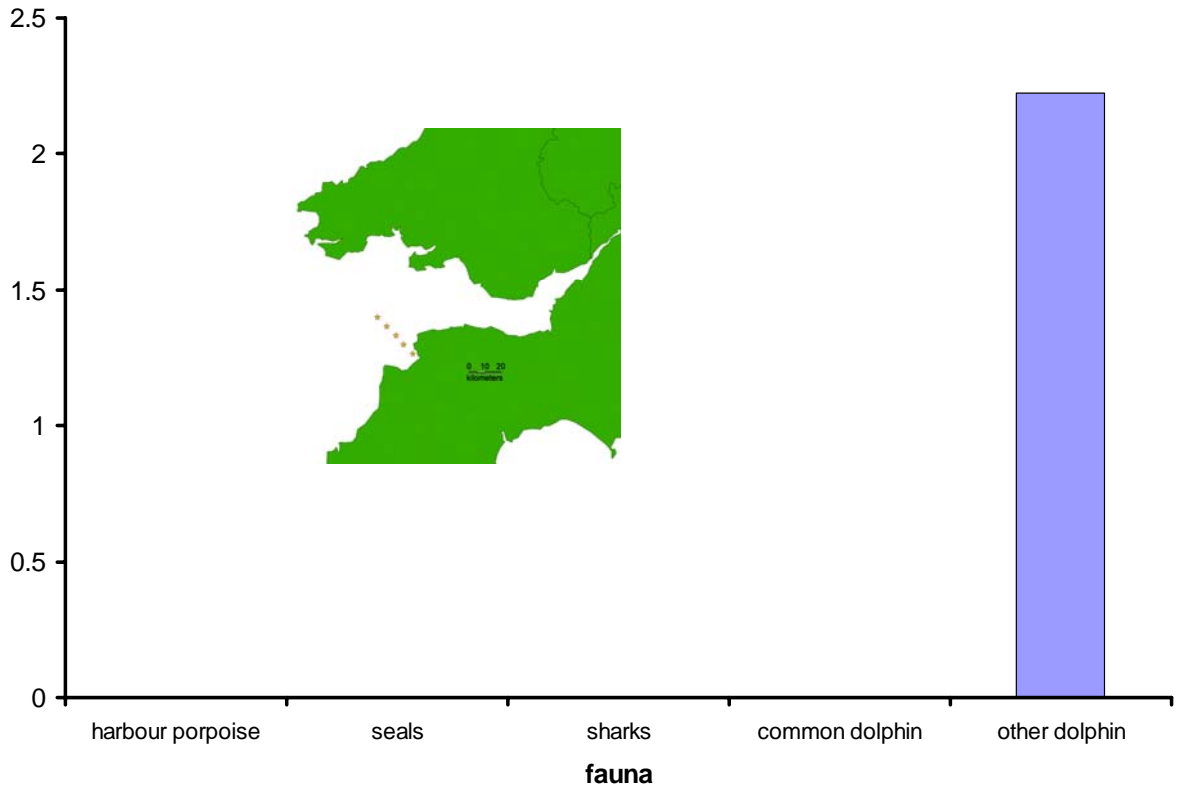


Figure 12: Sightings between Appledore and Lundy Island.

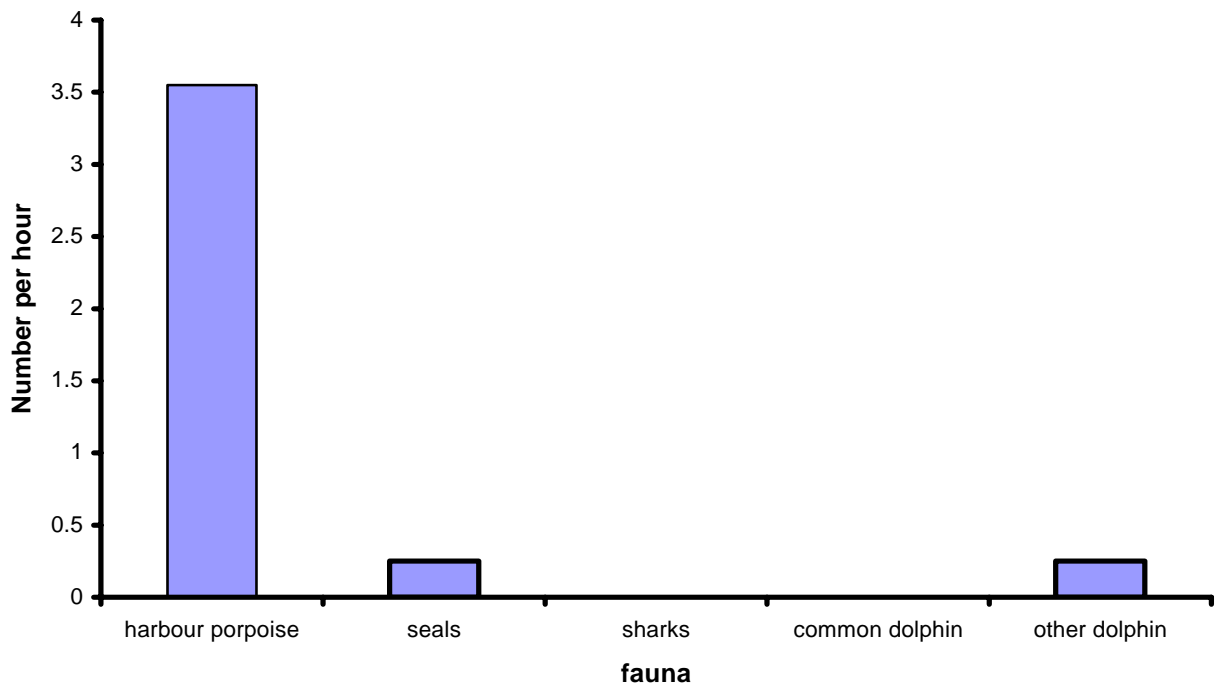


Figure 13: Sightings between Neyland and Aberystwyth.

## Megafauna distribution

The most common species recorded on the surveys was the harbour porpoise, with a total of 28 sightings (of 42 individuals) – most records of harbour porpoise were near the coast, either near to Carmarthen Bay, or in the waters off north Cornwall/Devon border, and also on the single transect between Neyland and Aberystwyth. They were not seen outside coastal waters (i.e. on the transect between Neyland and Padstow). Common dolphins were recorded on nine occasions (66 individuals including one pod of 35 animals recorded on 31 July between Neyland and Padstow, Table 2).

The results for cetacean distributions mirrors the density distributions within the JNCC marine cetacean atlas (Reid *et al.*, 2003), with harbour porpoise sighted more frequently in inshore rather than offshore waters, with a mean ( $\pm$ SE) pod size of  $1.5\pm 1.04$  individuals from 27 sightings. The range of harbour porpoise pod size was from 1-6 animals. Meanwhile, common dolphins were commonly observed in larger pods, generally further offshore with a mean pod size of  $7.33\pm 3.28$  individuals from 9 sightings. The range in common dolphin pod size was from 1 to 35 individuals.

Basking sharks were reported on three occasions from north Cornwall/Devon, and on one occasion just to the south of Swansea – the most easterly record of a basking shark ever into the Bristol Channel. Bottlenose dolphins and seals were rare, although the latter included a report of a grey seal in the pelagic survey between Neyland and Padstow.

Table 2: Numbers of records of megafauna on surveys.

Species/taxa	Number of sightings	Number of individuals
Harbour Porpoise	28	42
Common dolphin	9	66
Basking shark	4	5
Other dolphin	3	10
Seals (UD)	1	1
Humpack whale*	1	1
Leatherback turtle*	1	1
Total	47	126

\* - off transect

## Other sightings (other species and off transect)

Off transect, a leatherback turtle was reported to the Marine Conservation Society near Carmarthen Bay on 27.9.07, and a humpback whale was reported from near to Swansea Bay on 27.11.07. A dead humpback whale stranded at Aberavon, Port Talbot a month later on 15.12.07. It wasn't confirmed if this was the same individual that was seen off Swansea Bay in November.

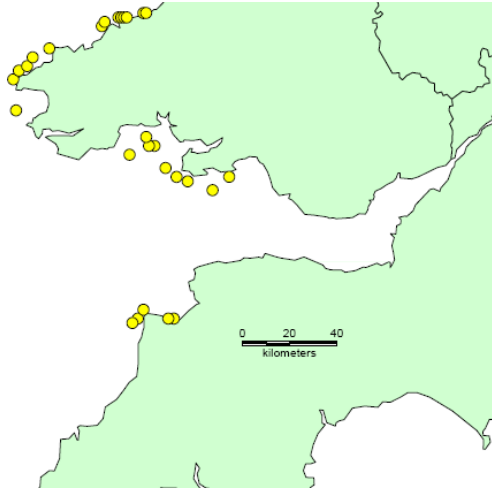


Figure 14: Harbour porpoise

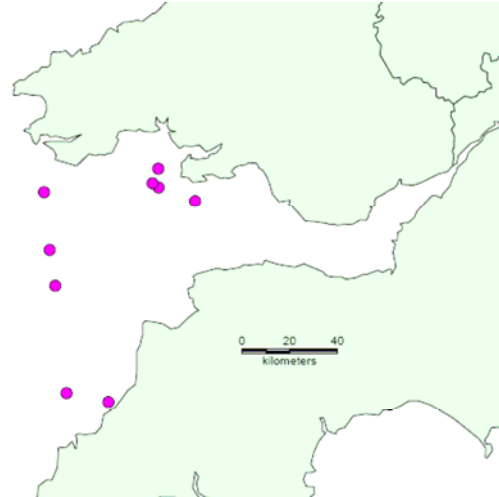


Figure 15: Common dolphin

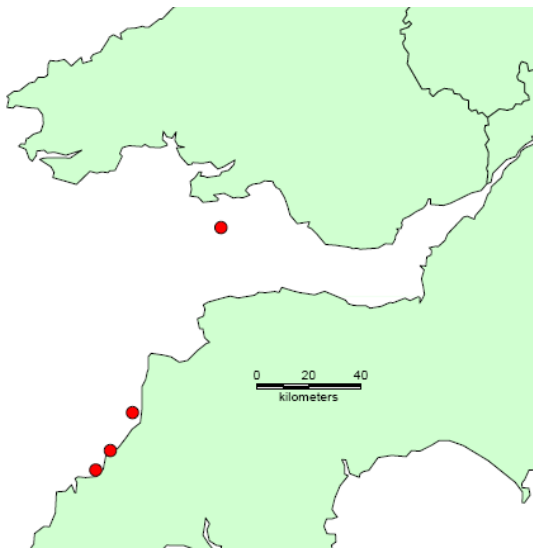


Figure 16: Basking sharks

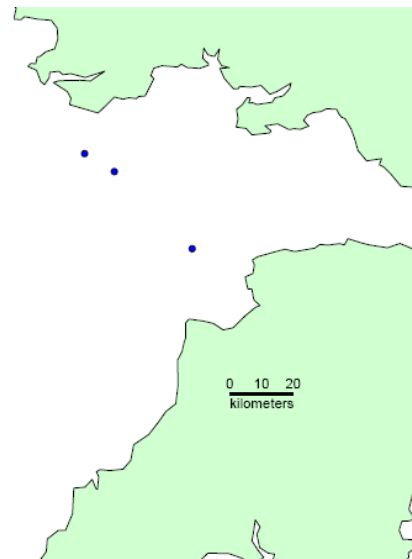


Figure 17: Other dolphins

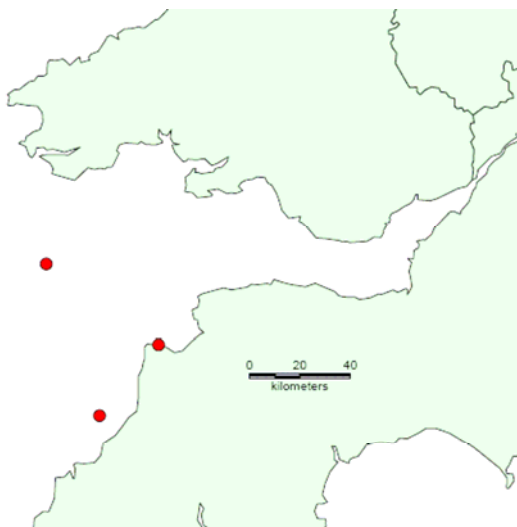


Figure 18: Seals (unidentified)

Figure 14-18: Distribution of megafauna sightings recorded whilst on effort.

## Off-effort sightings of rare megafauna in 2007

### Humpback whale sighting

Date: 27.11.07

Location: Swansea Bay (probably stranded in December)

Size: Unknown

Water Temperature: Unknown



Figure 19: Humpback whale - Dean Williams (fisherman) off Swansea pier.

### Leatherback turtle sighting

Date: 27.9.07

Location: east Carmarthen Bay

Size: 2m

Water temperature: 15.5 °C



Figure 20: Chris Bellas (from on board the Vigilance)

## Oceanographic conditions

The dataset wasn't considered large enough at this stage to attempt analysis between population distributions of these species and oceanographic conditions. With longer term monitoring, these patterns may be compared in the future.

## Discussion

### 1. Cetaceans

It is clear from these survey results that the Bristol Channel represents a significant area for cetacean distribution in coastal and offshore (>12nm) waters. The results for cetacean distributions mirrors the density distributions within the JNCC marine cetacean atlas (Reid *et al.*, 2003), with harbour porpoise sighted more frequently in inshore rather than offshore waters, whilst common dolphins were more commonly observed in larger pods, generally further offshore.

The harbour porpoise is particularly vulnerable to near-coast industrial activities - the construction of the new LNG pipeline and jetty at Milford Haven could have a significant effect on the population that occurs near to the waters of Milford Haven (Dolman *et al.*, 2003). They occur in considerable numbers all around the Pembrokeshire coast, up to and including the waters near St Brides Bay. Common dolphins were also commonly seen off the south Wales coast, but tended to be more often observed in offshore waters (>1nm from the coast) than harbour porpoise.

The report of a humpback whale in the Bristol Channel is extremely unusual. The Seawatch Foundation reports that there are generally a maximum of 12 humpback sightings for the entire UK per year, therefore the recent spate of sightings since 2005 is surprising. Most Welsh humpback sightings have been from offshore waters west of Pembrokeshire, compared to the more estuarine influenced waters to the east of Milford Haven. The sighting off Swansea marina is the most easterly sighting of a humpback whale recorded from the Bristol Channel, and given that a humpback washed up dead near Port Talbot on December 15<sup>th</sup>, would indicate that the animal was stressed. It may have been starving and dehydrated (as was stated in the necropsy report for the northern bottlenose whale that stranded in the Thames in January 2006).

### 2. Basking sharks

The number of sightings reports of basking sharks in 2007 from the southwest sent to the MCS was average (with 400 reports), but the preceding year was a record year for the southwest with nearly 900 reports received from the southwest alone<sup>3</sup>. The low number of sightings in this report indicates the relative densities of cetaceans compared to basking sharks in the region, and that the waters of the Welsh coast of the Bristol Channel appear not to be a hotspot for the basking shark.

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<sup>3</sup> <http://www.mcsuk.org/marineworld/baskingsharks/2006+annual+report>

Although the number of basking shark sightings was low for the region, the individual sighted to the south of Swansea Bay is a significant sighting, as it is the most easterly every reported to the MCS, and may have implications for management measures in this part of the Bristol Channel. The press interest from this sighting generated further anecdotal historical reports of sharks in and around the Gower peninsula. It may be that the general public and sea users are less aware of the species than in the southwest, hence the number of reports of basking sharks from south Wales having been historically lower for the region than in Devon and Cornwall.

A research team based at the University of Exeter, Cornwall campus, was undertaking a concurrent collaborative project in the Cornish peninsula. Basking sharks were regularly reported from these surveys around the Cornish coast between the months of August and October. It appeared that the sightings from this survey, and from the public sightings sent in to the MCS, indicated that it was a 'late year' for basking shark sightings, with the best month for sightings being June and August. Historically the sightings of sharks in the southwest are generally high in late spring / early summer, timed with the onset of the spring bloom of plankton in this region.

### **3. Leatherback turtle**

The leatherback turtle sighted off east Carmarthen Bay isn't unusual. This bay is a hotspot for turtle sightings<sup>4</sup>, as it is known as an area where jellyfish – the principle food source for leatherback turtles – frequently bloom.

### **4. Other sightings**

Sightings of other animals were anecdotally recorded – jellyfish were recorded infrequently, and there was a single record of a bottlenose dolphin on the survey between Neyland and Aberystwyth in Cardigan Bay.

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<sup>4</sup> <http://www.strandings.com/Graphics%20active/TURTLE~3.PDF> - page 27

## Recommendations

1. The waters of Gower/Carmarthen Bay marine SAC should be designated for harbour porpoise, the common dolphin and the leatherback turtle as well as for the current designated features.
2. The seaward boundary for the Gower/Carmarthen Bay marine SAC should be extended to the 12nm limit from baseline to encompass the near and offshore movements of these animals.
3. The waters of Pembrokeshire marine SAC should be designated for the harbour porpoise and common dolphin as well as the current designated features.
4. The seaward boundary for the Pembrokeshire marine SAC should be extended to the 12nm limit from baseline to encompass the near and offshore movements of these animals.
5. Competent authorities need to carry out appropriate assessments on the activities for which they are the relevant authorities to avoid disturbance or harm to these species in the coastal waters of south Wales.
6. A scientific study should be undertaken on the prevalence of feeding, breeding and social grounds for harbour porpoise and common dolphins in the waters of southern Wales, and to investigate the effects of current human activities on their populations.

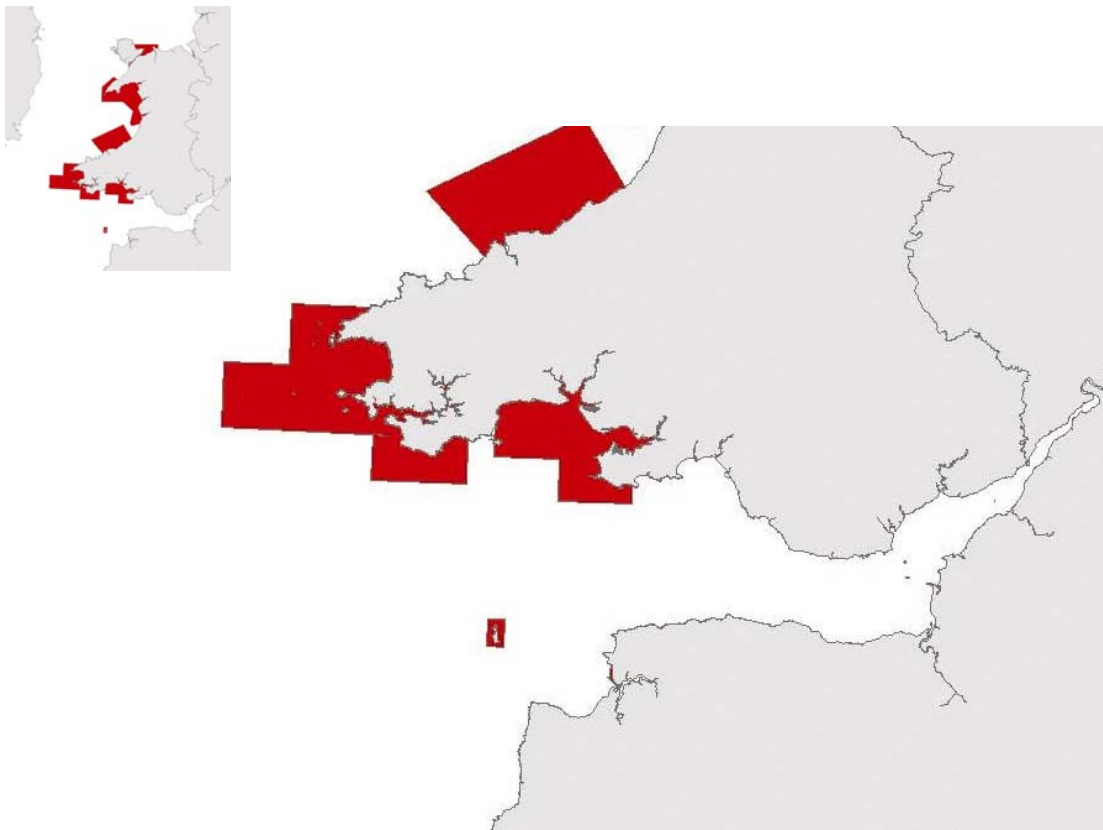


Figure 21: Current extent of south Wales Special Areas of Conservation. The current designated features of the south Wales sites do not list either the harbour porpoise or common dolphin as protected features for these sites. MCS considers this an anomaly when the distributions of protected species from this and other reports are considered. (Map derived from JNCC).

## Acknowledgements

MCS would like to thank Cliff Benson (Seatrust) and Samantha Camp of the Environment Agency for helping organise and carry out the surveys. The other crew of the *Vigilance* were helpful – particularly the skipper Mark Williams. Support for the surveys came from the CCW Species Challenge Fund, both for the surveys, analysis of the data and reporting, including the invitation to present the results of this survey at the annual CCW marine monitoring workshop in Aberystwyth in November 2007.

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## Codes for effort and sightings recording forms

### Effort recording form:

#### Sea state (Beaufort scale)

- 0: mirror calm
- 1: slight ripples, no foam crests
- 2: small wavelets, glassy peaks
- 3: large wavelets, crests beginning to break, scattered whitecaps
- 4: longer waves, many whitecaps
- 5: long waves with some spray
- 6: large waves, whitecaps everywhere, frequent spray
- 7: sea heaps up, white foam blown in streaks, give up surveying!

#### Swell height

- 1: 0-1 m
- 2: 1-2 m
- 3: >2m

#### Precipitation

- None (**N**)
- Light rain (**LR**)
- Heavy rain (**R**)
- Fog (**F**)
- Snow (**S**)

#### Visibility

- Excellent (**ex**): >16 km
- Good (**g**): 11-15 km
- Moderate (**m**): 6-10 km
- Poor (**p**): 1-5 km
- Bad (**b**): < 1 km

### Sightings form:

#### Species

Cetaceans: Common dolphin **CD**; Harbour porpoise **HP**; Bottlenose dolphin **TT**; striped dolphin **SD**; pilot whale **PW**; Risso's dolphin **RD**; Killer whale **KW**; fin whale **FW**, minke whale **MW**

#### Other:

Basking shark **BASK**, Sunfish **SUN**, Grey seal **GSL**, Common seal **CSL**, Leatherback turtle **LBT**

#### Behaviour (Behav)

Spyhopping (**spy**), leaping (**leap**), bowriding (**bow**), tail slap (**Tslap**), head slap (**Hslap**), feeding behaviour (includes fish tossing/associated birds; **feed**), surface rushing (**rush**), logging (remains still at the surface; **log**), milling (**mill**)

#### Notes

Record any bird activity (large groups of feeding/diving/circling birds) associated with groups of cetaceans or other recorded species.

Record any fishing activity near cetaceans, or interactions between fishing boats and recorded species.



## Appendix 2: Raw data

Date	Leg	start time	end time	Species	Number	latitude	longitude	time	Sea State	Vessel position
										Latitude Longitude
17/04/2007	Padstow - Swansea			HP	1	51 00.30	04 33.73	12:33	3	sea state varying from 4/5 occ' 3 from start of survey from Padstow. Start time 0703 GMT to Swansea arrive 1829. Unsuitable survey conditions therefore sightings counted as casual.
17/04/2007	Padstow - Swansea			GSL	1	51 01.87	04 26.83	13:07	4	
17/04/2007	Padstow - Swansea			HP	1	51 29.58	04 06.76	17:16	5	
18/04/2007	Swansea - Neyland			HP	2	51 32.55	04 00.50	9:39	2	Swansea dep 0900GMT to Neyland arr18.30. Good conditions up to 17.06 but fierce glare in direction of travel caused abandonment of effort.
18/04/2007	Swansea - Neyland			HP	1	51 31.02	04 15.59	10:31	2	
18/04/2007	Swansea - Neyland			HP	1	51 32.07	04 19.75	10:41	2	
18/04/2007	Swansea - Neyland			HP	1	51 34.41	04 23.79	11:10	2	
18/04/2007	Swansea - Neyland			HP	1	51 39.58	04 27.63	12:15	2	
18/04/2007	Swansea - Neyland			HP	2	51 39.70	04 29.06	12:21	2	
18/04/2007	Swansea - Neyland			HP	1	51 41.82	04 30.11	15:19	2	
18/04/2007	Swansea - Neyland			HP	2	51 37.44	04 36.61	17:08	2	
20/04/2007	Neyland - Aberystwyth			HP	2	52 06.86	04 46.95	13:30	1	Neyland dep 0800 GMT to Aberystwyth Arr18.30 perfect conditions throughout survey. Aberystwyth dep 0800 GMT Abandoned due to Fog 0920 to Pwllheli star
20/04/2007	Neyland - Aberystwyth			HP	3	52 07.14	04 45 76	13:30	1	
20/04/2007	Neyland - Aberystwyth			HP	1	52 08.52	04 40.86	14:05	1	
20/04/2007	Neyland - Aberystwyth			HP	1	52 08.67	04 39.04	14:15	1	
20/04/2007	Neyland - Aberystwyth			HP	1	52 08.70	04 38.56	14:17	1	
20/04/2007	Neyland - Aberystwyth			HP	1	52 08.81	04 37.21	14:34	1	
20/04/2007	Neyland - Aberystwyth			HP	2	52 09.21	04 31.76	15:09	1	
20/04/2007	Neyland - Aberystwyth			HP	1	52 09.53	04 30.85	15:14	1	
21/04/2007	?			TT	2	52 24.53	04 06.12	8:07	fog	
21/04/2007	?			GSL	1	52 31.09	04 13.44	9:00	fog	
21/04/2007	?			HP	1	51 47.92	05 17.67	9:45	fog	
21/04/2007	?			HP	1	51 54.92	05 18.76	10:33	fog	
21/04/2007	?			HP	1	51 56.28	05 16.34	10:43	fog	

21/04/2007	?	HP	1	51 57.94	05 13.55	11:05	fog							
21/04/2007	?	HP	1	51 59.15	05 11.12	11:10	fog							
21/04/2007	?	HP	1	52 01.71	05 05.70	11:47	fog							
													The Grey Seal was dead: its head looked badly injured. It was an adult.	
12/06/2007	Neyland-Padstow	07:55	08:24					1	51	46	676	5	7	614
12/06/2007	Neyland-Padstow	08:25	08:54					1	51	37	749	5	8	92
12/06/2007	Neyland-Padstow	08:55	09:24					2	51	33	387	5	7	269
12/06/2007	Neyland-Padstow	09:25	09:54					2	51	29	284	5	6	556
12/06/2007	Neyland-Padstow	09:55	10:24					2	51	24	937	5	5	700
12/06/2007	Neyland-Padstow	10:25	10:54					2	51	20	656	5	4	722
12/06/2007	Neyland-Padstow	10:55	11:24					2	51	16	247	5	3	173
12/06/2007	Neyland-Padstow	11:25	11:54					2	51	11	960	5	3	110
12/06/2007	Neyland-Padstow	11:55	12:24					2	51	7	188	5	1	0
12/06/2007	Neyland-Padstow	12:20	12:49					2	51	3	987	5	0	370
12/06/2007	Neyland-Padstow	12:50	13:19					2	51	0	97	4	59	521
12/06/2007	Neyland-Padstow	13:20	13:49					2	50	55	926	4	58	882
12/06/2007	Neyland-Padstow	13:50	14:19					2	50	51	148	4	58	379
12/06/2007	Neyland-Padstow	14:20	14:49					2	50	47	634	4	58	27
12/06/2007	Neyland-Padstow	14:50	15:19					3	50	43	628	4	57	530
12/06/2007	Neyland-Padstow	15:20	15:49					3	50	40	131	4	57	2
12/06/2007	Neyland-Padstow	15:50	16:19					3	50	35	863	4	56	484
12/06/2007	Neyland-Padstow	16:20	16:49					3	50	32	505	4	56	235
13/06/2007	Padstow - Swansea	06:10	06:39					1	50	34	49	4	56	214
13/06/2007	Padstow - Swansea	06:40	07:09					1	50	33	652	5	0	114
13/06/2007	Padstow - Swansea	07:10	07:39					1	50	36	126	4	54	672
13/06/2007	Padstow - Swansea	07:40	08:09	BS	150 37.907	004 48.164	7:52	1	50	36	534	4	49	404
13/06/2007	Padstow - Swansea	08:10	08:39	BS	150 41.856	004 43.910	8:42	1	50	39	565	4	46	857
13/06/2007	Padstow - Swansea	08:40	09:09					1	50	37	907	4	43	910
13/06/2007	Padstow - Swansea	09:10	09:39					1	50	44	387	4	39	947
13/06/2007	Padstow - Swansea	09:40	10:09					1	50	46	449	4	38	9

13/06/2007	Padstow - Swansea	10:10	10:39					1	50	50	906	4	35	402
13/06/2007	Padstow - Swansea	10:40	11:09					2	50	53	929	4	35	370
13/06/2007	Padstow - Swansea	11:10	11:39					2	50	57	829	4	34	389
13/06/2007	Padstow - Swansea	11:40	12:09					2	51	1	937	4	30	859
13/06/2007	Padstow - Swansea	12:55	13:24					1	51	0	495	4	19	779
13/06/2007	Padstow - Swansea	13:25	13:54					1	51	3	626	4	15	966
13/06/2007	Padstow - Swansea	13:55	14:24					2	51	7	746	4	15	608
13/06/2007	Padstow - Swansea	14:25	14:54					2	51	10	188	4	14	373
13/06/2007	Padstow - Swansea	14:55	15:24					3	51	14	594	4	12	50
13/06/2007	Padstow - Swansea	15:25	15:54					1	51	19	271	4	8	477
13/06/2007	Padstow - Swansea	15:55	16:24					1	51	24	32	4	4	365
13/06/2007	Padstow - Swansea	16:25	16:54					1	51	27	722	4	1	175
13/06/2007	Padstow - Swansea	16:55	17:24					1	51	30	482	3	58	6
13/06/2007	Padstow - Swansea	17:25	17:54					2	51	33	900	3	53	396
18/07/2007	Neyland-Padstow	09:35	10:04					2	51	42	546	4	56	564
18/07/2007	Neyland-Padstow	10:05	10:34					2	51	42	086	5	01	925
				JF - R. oct 2;										
18/07/2007	Neyland-Padstow	10:35	11:04	cyclam 1	51 40 25	05 05 49	10:40	3	51	41	695	5	06	457
18/07/2007	Neyland-Padstow	11:05	11:34					3	51	37	319	5	08	148
18/07/2007	Neyland-Padstow	11:35	11:54					3	51	34	62	5	07	634
18/07/2007	Neyland-Padstow	11:55	12:34	CD	151 30 00	05 06 67	12:05-12:06	3	51	31	638	5	06	943
18/07/2007	Neyland-Padstow	12:35	13:04					3	51	27	70	5	06	33
18/07/2007	Neyland-Padstow	12:55	13:30					3	51	24	73	5	06	15
18/07/2007	Neyland-Padstow	14:00	14:25					2	51	14	53	5	03	83
18/07/2007	Neyland-Padstow	14:25	14:50	CD	551 09 82	05 02 85	14:21-14:32	2	51	11	40	5	03	20
18/07/2007	Neyland-Padstow	14:50	15:23					2	51	06	89	5	02	05
18/07/2007	Neyland-Padstow	15:24	15:50					2	51	02	11	5	0	89
18/07/2007	Neyland-Padstow	15:51	16:20					2	50	58	03	5	0	10
18/07/2007	Neyland-Padstow	16:21	16:51					2	50	53	549	4	59	240

18/07/2007	Neyland-Padstow	16:52	17:00				2	50	48	92	4	58	54	
18/07/2007	Neyland-Padstow		CD	250 45 82	04 58 04	17:13- 17:14	off effort							
18/07/2007	Neyland-Padstow	17:25	17:54	CD	450 43 38	04 43 38	17:34	1	50	40	67	4	57	13
18/07/2007	Neyland-Padstow	17:55	18:24					1	50	36	41	4	56	26
18/07/2007	Neyland-Padstow	18:25	18:55					reached port	50	32	50	4	56	18
19/07/2007	Padstow-Swansea	07:45	08:14					1	50	32	48	4	56	22
19/07/2007	Padstow-Swansea	08:15	08:44					2	50	32	83	4	59	52
19/07/2007	Padstow-Swansea	08:45	09:14					2	50	34	77	4	57	67
19/07/2007	Padstow-Swansea	09:15	09:44					2	50	36	33	4	51	21
19/07/2007	Padstow-Swansea	09:45	10:14	CSL	150 46 07	04 46 07	09:58- 09:58	2	50	38	33	4	47	54
19/07/2007	Padstow-Swansea	10:15	10:44					2	50	41	46	4	44	35
19/07/2007	Padstow-Swansea	10:45	11:15	BS	50 49 101	04 36 12	10:58- 10:58	2	50	44	48	4	40	48
19/07/2007	Padstow-Swansea	11:16	11:44					2	50	46	99	4	37	64
19/07/2007	Padstow-Swansea	11:45	12:15					2	50	50	84	4	35	37
19/07/2007	Padstow-Swansea	12:16	12:44					2	50	53	76	4	35	29
19/07/2007	Padstow-Swansea	12:50	13:15					2	50	57	94	4	34	37
19/07/2007	Padstow-Swansea	13:16	13:44					2	51	07	44	4	33	3
19/07/2007	Padstow-Swansea	13:45	14:14					2	51	02	02	4	28	96
19/07/2007	Padstow-Swansea	14:15	14:44	HP	151 00 42	04 20 47	14:36- 14:36	2	51	07	29	4	24	74
19/07/2007	Padstow-Swansea	14:45	15:14					2	51	00	32	4	19	95
19/07/2007	Padstow-Swansea	15:15	15:44					2	51	03	11	4	16	21
19/07/2007	Padstow-Swansea	15:45	16:14	JF - C. hysocell	151 07 71	04 20 47	15:52	2	51	06	87	4	15	42
19/07/2007	Padstow-Swansea	16:15	16:45					2	51	03	42	4	16	15
19/07/2007	Padstow-Swansea	16:45	17:14	JF - C.	151 14 64	04 14 55	17:00	2	51	12	52	4	15	93

		hysoscell													
		a													
19/07/2007	Padstow-Swansea	17:15	17:44					2	51	16	74	4	12	57	
		JF - C.													
19/07/2007	Padstow-Swansea	17:45	18:14	hysoscella	51 20 93	04 08 25	17:45	2	51	20	64	4	08	55	
19/07/2007	Padstow-Swansea	18:14	18:44	BS	151 27 61	04 07 06	18:37	2	51	24	68	4	04	17	
19/07/2007	Padstow-Swansea	18:45	19:14					2	51	28	80	3	59	92	
19/07/2007	Padstow-Swansea	19:15	19:44					2	51	31	74	3	56	8	
19/07/2007	Padstow-Swansea	19:45	20:14					2	51	35	06	3	53	40	
								reach							
								ed							
19/07/2007	Padstow-Swansea	20:15							port	51	36	97	3	55	82
31/07/2007	Swansea- Neyland	07:30						1	51	35	79	3	56	634	
31/07/2007	Swansea- Neyland	08:00						1	51	32	072	4	00	362	
31/07/2007	Swansea- Neyland	08:30						1	51	30	115	4	06	129	
														09:00 0	
31/07/2007	Swansea- Neyland	09:00	CD	351 28 01	4 12 53	-9:10		1	51	28	01	4	12	53	
31/07/2007	Swansea- Neyland	09:30						1	51	28	88	4	17	50	
														10:00 -	
31/07/2007	Swansea- Neyland	10:00	CD	35											
														10:05 -	
31/07/2007	Swansea- Neyland	10:30	CD	151 32 38	4 27 847	10:11		1	51	34	787	4	31	205	
31/07/2007	Swansea- Neyland	11:00						1	51	37	467	4	36	348	
31/07/2007	Swansea- Neyland	11:30						1	51	39	143	4	34	114	
31/07/2007	Swansea- Neyland	12:00						1	51	38	72	4	30	41	
														12:40 -	
31/07/2007	Swansea- Neyland	12:30	CD	551 35 920	4 25 671	12:42		1	51	36	933	4	27	412	
31/07/2007	Swansea- Neyland	13:00						1	51	34	559	4	23	868	
31/07/2007	Swansea- Neyland	13:30						1	51	37	966	4	22	375	
31/07/2007	Swansea- Neyland	14:00						1	51	40	208	4	23	816	
31/07/2007	Swansea- Neyland	14:30						1	51	40	208	4	23	816	
31/07/2007	Swansea- Neyland	15:00						1	51	41	700	4	27	798	
31/07/2007	Swansea- Neyland	15:30						1	51	43	104	4	31	774	

31/07/2007 Swansea- Neyland	16:00				1	51	42	873	4	38	540
31/07/2007 Swansea- Neyland	16:30				1	51	40	647	4	39	77
31/07/2007 Swansea- Neyland	17:00				1	51	38	870	4	43	189
31/07/2007 Swansea- Neyland	17:30				1	51	37	271	4	48	603
31/07/2007 Swansea- Neyland	18:00				1	51	35	727	4	55	062
31/07/2007 Swansea- Neyland	18:30				1	51	36	375	5	00	658
31/07/2007 Swansea- Neyland	19:00				1	51	39	044	5	06	972
10/09/2007 Neyland - Padstow	10:15				3	51	39	65	5	08	43
10/09/2007 Neyland - Padstow	11:00				4	51	32	34	5	07	27
10/09/2007 Neyland - Padstow	11:30				4	51	29	30	5	06	70
10/09/2007 Neyland - Padstow	12:00				5	51	25	00	5	05	98
10/09/2007 Neyland - Padstow	12:30	GSL	151deg18.845deg04.48	12:40	5	51	21	07	5	05	03
10/09/2007 Neyland - Padstow	13:00	14:00CD	1051deg17.785deg04.19	12:47	5	51	16	09	5	03	69
10/09/2007 Neyland - Padstow	14:00				5	51	07	02	5	01	35
10/09/2007 Neyland - Padstow	15:00				5	50	58	10	4	59	64
10/09/2007 Neyland - Padstow	16:00				5	50	50	56	4	58	58
10/09/2007 Neyland - Padstow	17:00	18:00			5	50	43	00	4	57	56
12/09/2007 Appledore	08:20				1	50	34	17	4	56	27
12/09/2007 Appledore	08:49				2	50	36	05	4	56	98
12/09/2007 Appledore	09:00				2	50	32	28	4	54	76
12/09/2007 Appledore	09:26				2	50	40	23	4	52	11
12/09/2007 Appledore	10:00	10:40			2	50	44	99	4	47	83

12/09/2007	Padstow - Woolacombe - Appledore	10:40				2	50	48	76	4	44	85
12/09/2007	Padstow - Woolacombe - Appledore	12:00	HP	350deg59.924deg35.20	12:17	1	50	57	43	4	37	23
12/09/2007	Padstow - Woolacombe - Appledore	12:45	HP	151deg02.234deg31.19	12:43	1	51	02	19	4	30	91
12/09/2007	Padstow - Woolacombe - Appledore	13:06	HP	651deg00.784deg22.36	13:38	1	51	01	81	4	26	84
12/09/2007	Padstow - Woolacombe - Appledore	13:54				1	51	00	33	4	19	91
12/09/2007	Padstow - Woolacombe - Appledore	14:23				1	51	03	12	4	16	21
12/09/2007	Padstow - Woolacombe - Appledore	15:06				1	51	07	70	4	15	56
12/09/2007	Padstow - Woolacombe - Appledore	15:36	16:38			1	51	10	15	4	14	39
12/09/2007	Appledore	16:38				1	51	05	12	4	15	13
13/09/2007	Appledore - Neyland	18:00				1	51	05	12	4	15	13
13/09/2007	Appledore - Neyland	18:30				0	51	08	40	4	20	36
13/09/2007	Appledore - Neyland	19:00	Dolphin sp.	151deg13.954deg29.63	19:26	0	51	11	09	4	24	87
13/09/2007	Appledore - Neyland	19:30	20:00			0	51	14	02	4	29	73
13/09/2007	Appledore - Neyland	20:00	Dolphin sp.	451deg26.024deg50.50	21:22	0	51	17	01	4	34	58

13/09/2007 Appledore - Neyland

Dolphin  
sp.

551deg29.91 4deg58.52