



FIELD REPORT TEMPLATE

Marketing title

Whales and Dolphins of the Hebrides

PI name

Dr. Jonathan Gordon; Dr. Peter Stevick

Research site/ region

Inner and Outer Hebrides, West Coast of Scotland

Country

UK

Research site latitude/ longitude

56° 40'N 6° 00' W

Protected area status

Within the survey area there are numerous areas with conservation designations including marine Special Areas of Conservation (SACs) Special Protected Areas (SPAs) and Special Sites of Scientific Interest (SSSIs)

Date field report completed

Jan 2010

Period covered by this report. From

From 9 Apr 2009 to 13 Oct 2009

Report completed by (name)

Nienke van Geel (MSc)



Dear volunteer,

The wonderful season onboard Silurian unfortunately came to an end. Currently, at HWDT, we are focusing on analysing the collected data. Some of you have sailed with me as Science Officer, and some with my colleague Sarah Barry. On behalf of both of us, and all the staff and crew involved with HWDT and Silurian, I'd like to thank you all very much for your great efforts and great company this summer! It's a privilege to have the opportunity to introduce those of you new to the west coast of Scotland to our extraordinary wildlife, scenery and culture, and how our cetacean research can contribute to the future conservation of our local species. Some groups were luckier than others in respect to observed cetacean species, weather and sea conditions. Some surveys were done in excellent conditions whereas others were carried out in rough seas and in the plunging rain (particularly during EW5). Nevertheless, everyone kept their spirits up and the marine mammal and basking shark encounters were worth it! Overall, we managed to survey visually and acoustically for many hours, covering a substantial part of the Hebrides, with almost 10,000km sailed over the field season. This winter, data analysis will focus on distributions and relative abundances of species. Preliminary data analysis shows that the number of minke whale sightings this year has been very similar to the last few years, but remained quite low compared to numbers seen in the area before 2005. Although the decline in sightings levelled off, these low numbers are of concern and highlight the importance of continuing to monitor our survey area in the future. Recently, several scientific articles have been published using HWDT data, including one on harbour porpoise distribution in relation to suitable sites for marine protected areas, articles about 'our' small resident pod of orcas, and a publication about the presence of common dolphin and white-beaked dolphin focusing on their competition and coexisting. A very big THANKS for the major effort, enthusiasm, involvement and eagerness of all of you participating in the research this year! I am quite sure you each have particular memories of what you enjoyed about your trip with us. Hopefully you enjoyed being out there looking for and at the marine mammals and other wildlife, the sailing, baking challenges in rocking conditions, the shore leaves and amazing sceneries and skies as much as I did. It's been great meeting you all – please do stay in touch and come back soon!

With warmest wishes,

Nienke van Geel

Top highlight from the past field season

One of the highlights was the more than 100 nautical mile (NM) trip with our Earthwatch volunteers to the Stanton Banks in June. Even before 6am we already had more than 40 basking sharks and that just turned out to be the beginning; more basking sharks, several groups of white-beaked dolphins, white-sided dolphins, common dolphins, harbour porpoises, minke whales and seals followed during the day, highlighting the diversity of the area. Another very special and relatively rare sighting that Earthwatch volunteers could enjoy was the encounter with a humpback whale in July) which altogether lasted for about 1.5 hours!

Non-technical overview of results

Silurian surveys

Since 2003, cetacean monitoring surveys have been conducted from the Hebridean Whale and Dolphin Trust's research vessel *Silurian*. The current obtained dataset contains significant and unique data on cetacean distribution and abundance in the Hebrides. The Hebridean Whale and Dolphin Trust (HWDT) is the only organisation collecting this data on this large scale; i.e. for several successive years, throughout the summer months (generally April-September inclusive) and covering as much of the Hebridean region as possible. Traditionally, surveys were primarily focussed on the Argyll Islands region, but in recent years, effort has increasingly changed to include more northerly and more westerly areas of the West Coast, in order to increase the cover over the whole Hebridean region both in space and time. Effort has increased substantially since 2003, and until end 2009, visual surveys have been conducted over more than 29,200km, whereas acoustic monitoring has been undertaken over 37,120km (See table 1).

For the first time, data was collected in October. Six trips were run using volunteers and support from Earthwatch (EW), including one Teacher Team trip. During all these trips combined, HWDT welcomed 34 volunteers from Earthwatch.

Methodology

Data collection protocols have been adapted and improved slightly (some methodological and equipment adaptations), but remained very similar over the years since 2003. The survey methodology used in 2009 was almost identical on all monitoring trips. Dependent on weather conditions, duration of the trip, and light availability at the time of year, surveying was generally carried out for eight to nine hours per day and trips covered a distance between 300-550 nautical miles per trip.

Table 1. Visual and acoustic effort from *Silurian*, 2003 – 2009 whilst on survey transects.

Survey Effort (km)	2003	2004	2005	2006	2007	2008	2009
Visual	4007	3104	4371	6588	7069	6857	8728
Acoustic	N/A	5407	4634	5766	7127	5926	8260

During surveys, the following activities were undertaken:

- Visual observations were conducted for all cetacean species, plus basking sharks, seals, sunfish, seabirds, marine litter, and other vessels. Since 2008, as part of a project investigating minke whale entanglement, the occurrence of creels was also recorded by logging sightings of creel pot marker buoys.
- Continuous acoustic monitoring of harbour porpoises and other cetacean species was conducted using a towed hydrophone with high- and medium frequency elements and detection/analysis software. Recordings of detected anthropogenic sounds were made, particularly of Acoustic Deterrent Devices (ADDs).

- Photographs of minke whales, bottlenose dolphins, common dolphins, white-beaked dolphins, killer whales, Risso's dolphins and basking sharks were collected for individual identification. The focus for photo-identification pictures are the dorsal fins and any body scars or flank patterns that could be used to distinguish individual animals. A Canon EOS 10D with a 300mm lens was used for photo-identification. Images have been contributed to the appropriate catalogues.
- From 2007, sea surface temperature was recorded using a temperature probe.
- All data were collected and stored using the real time data logging program LOGGER (developed by International Fund for Animal Welfare).

2009 Survey tracks

Silurian survey tracks carried out during each monitoring survey are presented in Fig.1 to Fig.6

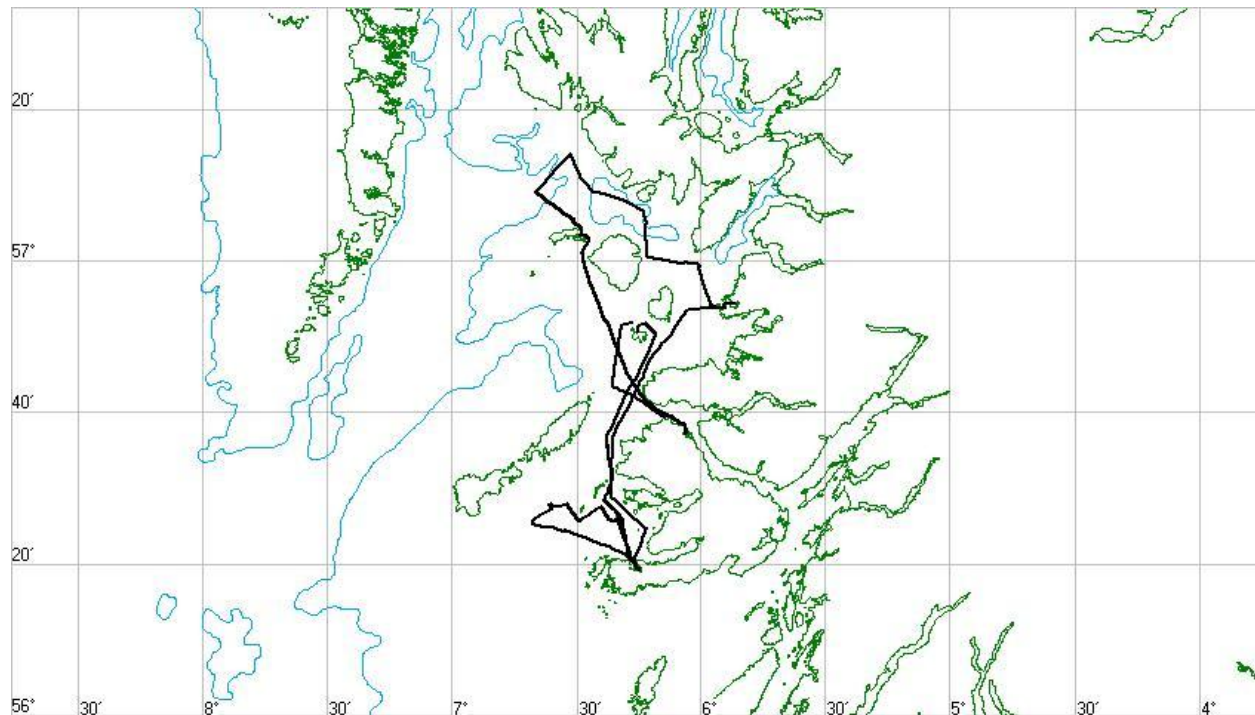


Fig 1. EW1 Survey route (9-17 April).

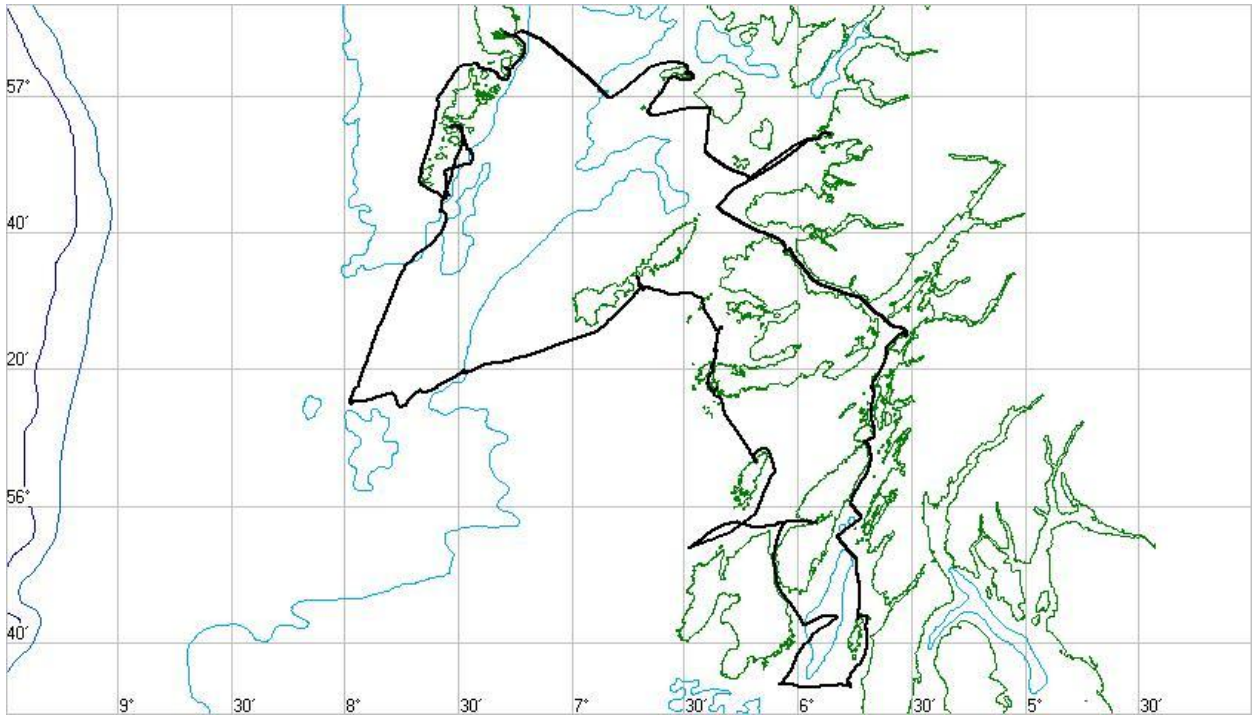


Fig. 2. EW2 Survey route (26 May - 6 June).

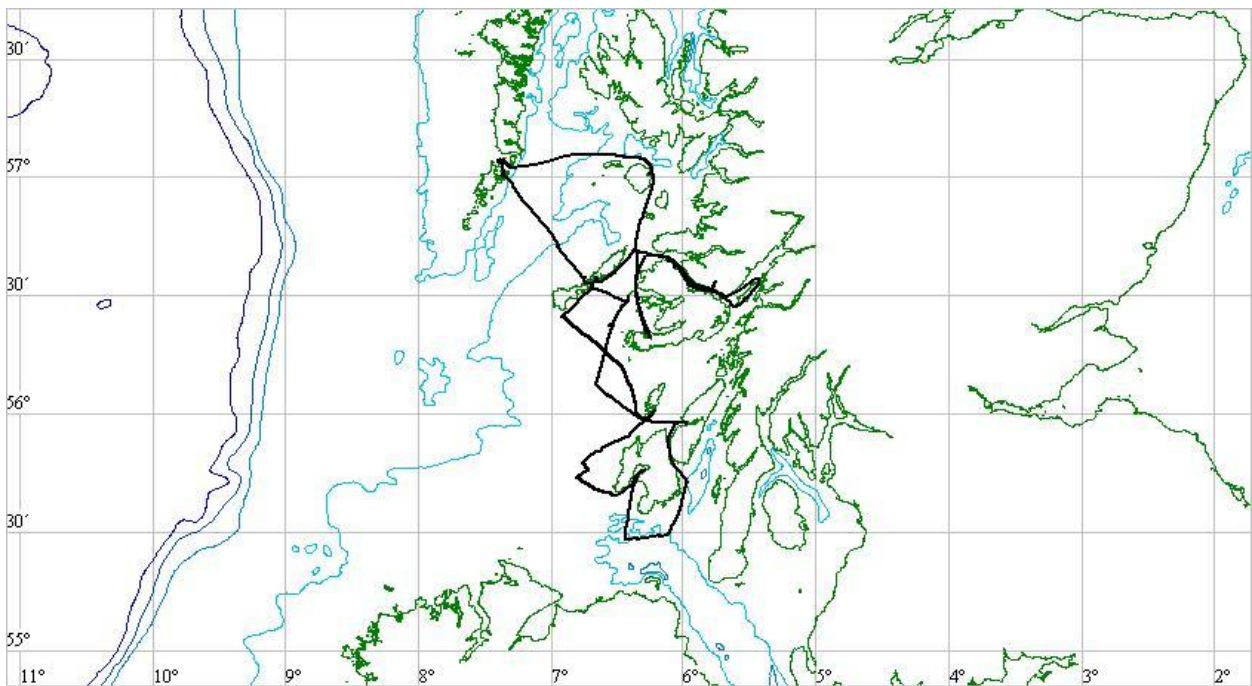


Fig. 3. EW3 Survey route (9-20 June)

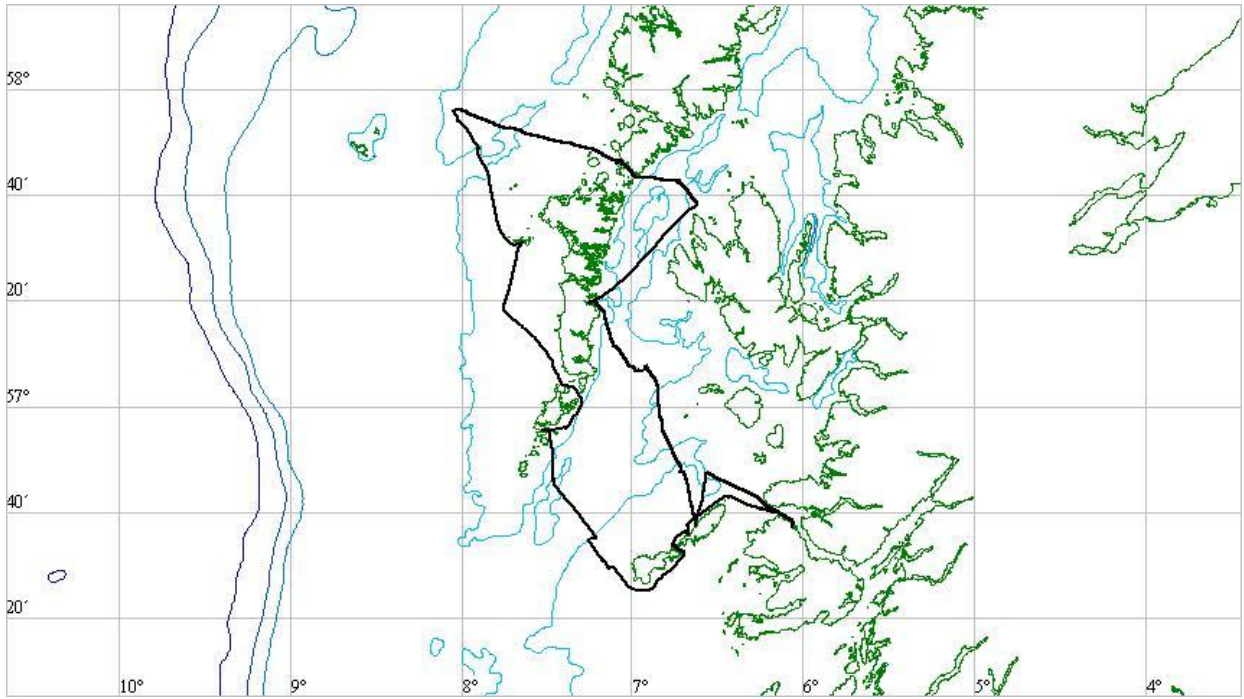


Fig. 4. EW4 Survey route (23 June -1 July).

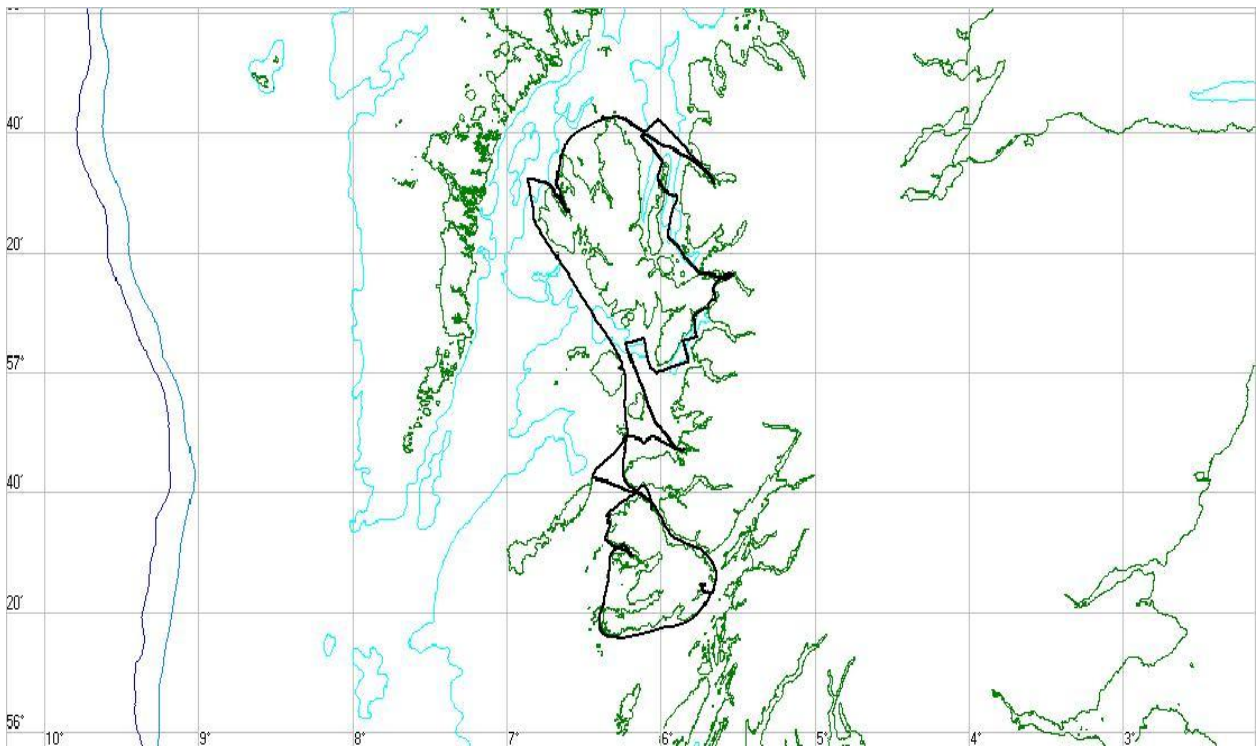


Fig. 5. EW5 Survey route (17-28 August).

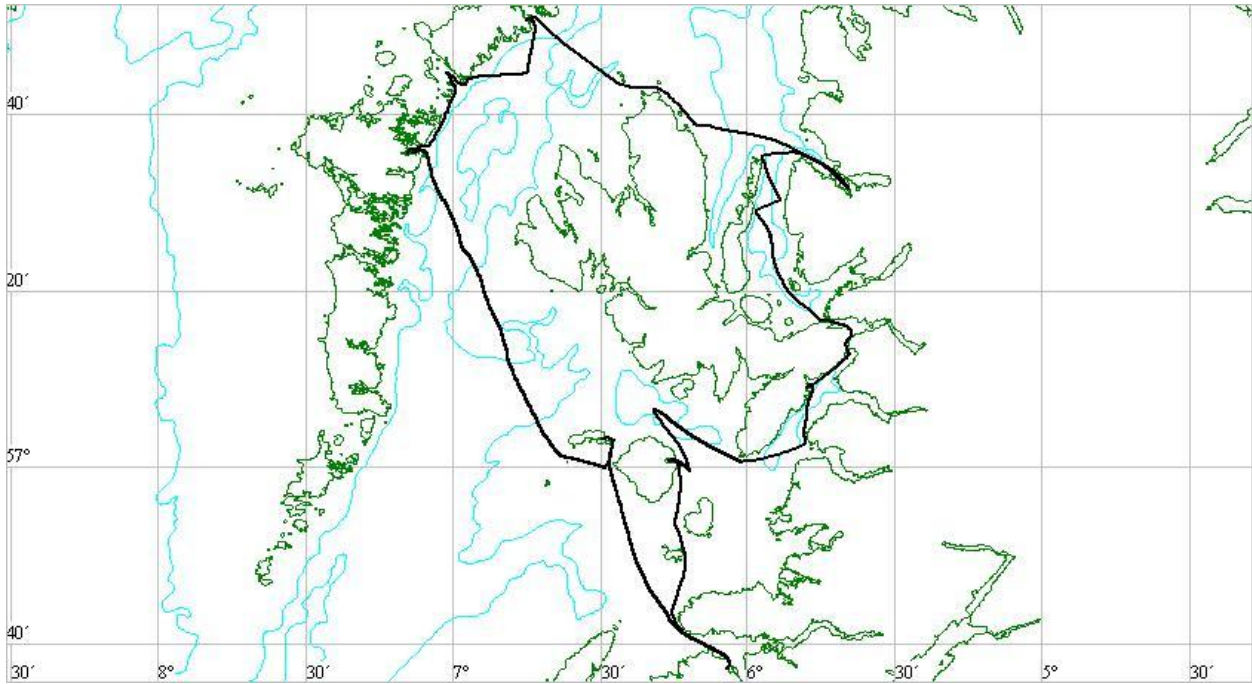


Fig. 6. EW6 Survey route (22-20 September).

In addition to Earthwatch trips, there were seven trips directly run through HWDT, of which two trips were based out of Kyle of Lochalsh, enabling the baseline surveying of the more poorly understood northerly and westerly areas of the Hebrides to take place. Three trips were carried out with a combined education/research purpose, with students from St Andrews University's Sea Mammal Research unit MRes programme (SMRU) and students from University Marine Biological Station Millport (MILL) onboard. One more trip was dedicated to renewals research (RENEW) for the Scottish Government in the Sound of Islay. The routes for Earthwatch teams are shown above. The total coverage of routes from all teams is shown in Fig. 7.

Survey routes are greatly dependent on weather- and sea state conditions. Most trips had their start and end in Tobermory. Due to this fixed 'home harbour', greater effort is put into the areas used as passage areas, particularly the north entrance of the Sound of Mull and around Ardnamurchan Peninsula. Finally, while planning monitoring trips, daily achievable distances and locations of suitable anchorage places have to be taken into account. Nevertheless all these restrictions, the survey tracks performed in 2009 varied greatly per trip and together show a substantial coverage of the research area.

Sightings 2009

24 Cetacean species are recorded for the West Coast of Scotland, however not all species are equally common, and this list also includes rarely sighted species and stranding reports. In 2009, 9 cetacean species were observed during Silurian surveys, and as for previous years, harbour porpoise continued to be the most frequently sighted cetacean in 2009, followed by the minke whale (See table 3).

Also in terms of numbers of individuals observed, harbour porpoise was the most sighted species, closely followed by common dolphin.

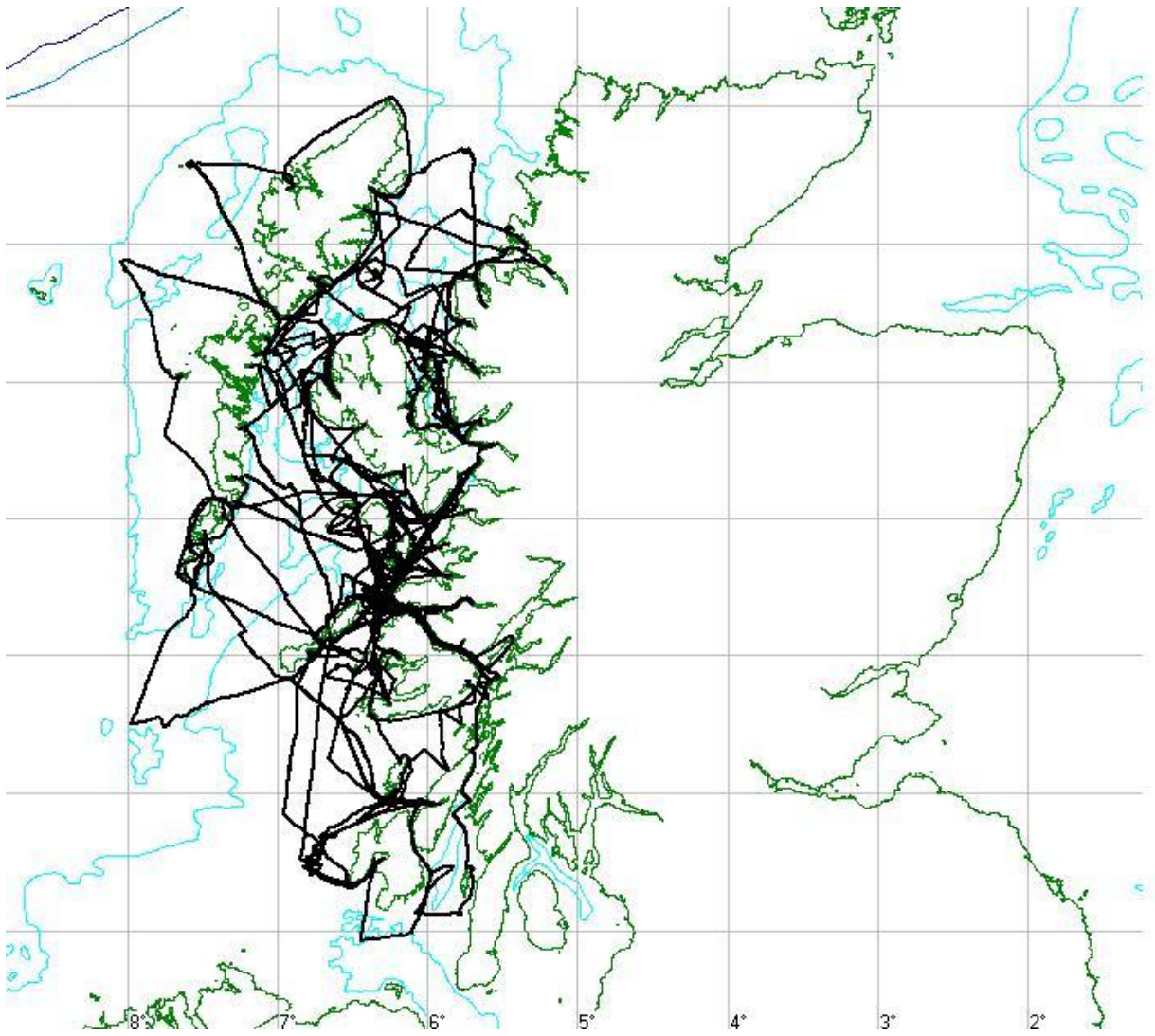


Fig. 7. Total 2009 survey route (31 March - 13 October).

Table 3. Total sightings 2009 field season, including data from non-Earthwatch teams.

Species	Total (uncorrected effort and sea state)		2009 On effort sightings for in sea states of <4	
	Sightings	Individuals	Sightings	Individuals
Cetaceans				
Atlantic white-sided dolphin (<i>L. acutus</i>)	1	75	1	75
Bottlenose dolphin (<i>T. truncatus</i>)	4	14	4	14
Common dolphin (<i>D. delphis</i>)	24	514	21	499
Harbour porpoise (<i>P. phocoena</i>)	374	697	316	582
Humpback whale (<i>M. novaeangliae</i>)	1	1	1	1
Killer whale (<i>O. orca</i>)	2	8	1	4
Minke whale (<i>B. acutorostrata</i>)	64	69	59	64
Risso's dolphin (<i>G. griseus</i>)	1	20	1	20
White-beaked dolphin (<i>L. albirostris</i>)	17	107	16	82
Unidentified dolphin	10	19	7	14
Unidentified whale	6	6	5	5
Unknown cetacean	13	15	2	12
Other sightings				
Basking shark (<i>C. maximus</i>)	124	199	104	177
Common seal (<i>P. vitulina</i>)	128	165	113	149
Grey seal (<i>H. grypus</i>)	219	247	204	232
Sunfish (<i>M. mola</i>)	2	2	2	2
Unidentified seal	112	117	102	107
Total	1101	2271	969	2039

The harbour porpoise is listed on Annex II of the EU Habitats Directive, which lists species of European communitarian importance whose conservation requires the designation of special areas of conservation. Identifying the most important areas suitable for conservation is especially difficult for this species due its small size and illusive behaviour, and to date no proposed protected areas for porpoises have been designated in UK waters. The ability to sight harbour porpoise decreased significantly with increasing sea states, emphasising the importance of our acoustic survey equipment, which can continue to function and collect data irrespective of weather, sea state or light levels. Using both HWDT visual and acoustic data from previous years, Clare Embling (former PhD students from Sea Mammal Research Unit (SMRU), University of St Andrews) investigated harbour porpoise distribution in the Inner Hebrides. Results showed that although the species is distributed throughout the survey area, there are certain areas with environmental and oceanographic features more favourable to harbour porpoises. On large scale, distribution patterns of this conservation priority species have been identified to be closely related to tidal currents and bottom type. Recently these habitat models have been used to identify suitable sites for marine protected areas for harbour porpoises. Cormac Booth, also a PhD student from SMRU, is intensively developing the research carried out by Embling, by exploring scale and seasonality in finer scale predictive modelling.

Minke whales are seasonal visitors arriving in the Hebrides for foraging in spring when water temperatures increase and generally leave in autumn when waters cool down again. Previous research by HWDT revealed dropping numbers of minke whale sightings since 2005. In 2006, the number of minke whale sightings per unit of effort was only 12% compared to the sighting numbers of 2002. In the period 2007-2009, the decrease in minke whale sightings levelled off, but sighting numbers remained at a very low level compared to numbers seen before 2005.

The probable cause of these changes in distribution, an alteration in the patterns of availability of the small schooling fish on which minke whales feed (e.g. sandeel and herring), was clearly affecting the region's minke whales, also after 2006. This winter, corrections will be made for mileage effort for 2007-2009 to be able to compare more accurately with the period 2002-2006. Besides decreased sighting numbers, changes in the abundance of food availability might also explain the observed changes in feeding behaviour. Whereas minke whales traditionally were frequently observed lunge feeding where they rush up to the water surface with their mouths agape, engulfing large volumes of prey-laden sea water and swallowing the prey once the water has been expelled through the baleens, this type of feeding behaviour has not been seen in recent years either from Silurian or by local operators. Not only do minke whales seem to be affected in presence and behaviour; a poor breeding season for seabirds feeding on sandeel and other small shoaling fish has also been reported.

Comparing observation effort and sea state corrected data of 2009 with 2008 (2008 data not included), double the amount of common dolphins were seen in 2009, particularly because of the sightings of a large group (approx. 250 individuals) west of Skye in May and various groups (approx. 70 individuals) at Stanton's bank in June. Noticeable is also the larger number of harbour porpoise groups, but the lower number of total individuals counted for harbour porpoises in 2009. However, in order to be able to properly compare between years, correction for survey coverage also has to be made. Analysing this will be the focus for this winter.

In general in 2009, a wide range of species have been sighted, reflecting the rich cetacean biodiversity of the west coast of Scotland. In addition to the species sighted with some regularity (e.g. porpoise, common dolphin, basking shark, minke whale), some rarer sightings can be reported for this season. Again, we had an encounter with Atlantic white-sided dolphins (a species more often associated with waters outside of the Continental Shelf edge on the west coast of Scotland). Additionally, although the area is home to a small resident pod of killer whales, encounters with these wide-ranging animals are relatively rare nevertheless. For this reason, the encounter, lasting 1.5 hours, with four of these whales was enjoyed by all volunteers and crew onboard. Finally, for the second time since 2003, a humpback was sighted from Silurian in the area, a rare treat which all together lasted for about 1.5 hours. Generally, the months of May and June are good months for cetacean and basking shark sightings due to the warmer waters, long days and most stable weather conditions, and also this year, high sighting numbers were observed during trips in these months (See table 4; overview for Earthwatch trips). The only Atlantic white-sided dolphins, Risso's dolphins and humpback whale of the season were observed during Earthwatch expeditions.

Acknowledgements

HWDT would like to thank our funders and sponsors for enabling the continuation and expansion of our work; Earthwatch Institute, Scottish Natural Heritage (SNH), Heritage Lottery Fund (HLF) and WWF. Particularly, we would like to thank all the volunteers and students that have contributed towards our research over the years, without you this research would not have been possible! HWDT would also like to thank the Sea Mammal Research Unit (SMRU) for their scientific support and advice.

Table 4. Total sightings during Earthwatch trips 2009, number of observed animals between brackets.

Species	EW1 09/04 - 17/04	EW2 26/05 - 06/06	EW3 09/06 - 20/06	EW4 23/06 - 01/07	EW5 17/08 - 28/08	EW6 22/09 - 30/09	Total
Cetaceans							
Atlantic white-sided dolphin	0	1 (75)	0	0	0	0	1 (75)
Bottlenose dolphin	0	0	0	1 (2)	0	0	1 (2)
Common dolphin	0	3 (70)	2 (3)	0	0	1 (3)	6 (76)
Harbour porpoise	7 (9)	22 (36)	24 (34)	36 (65)	33 (76)	9 (15)	131 (235)
Humpback whale	0	0	0	1 (1)	0	0	1 (1)
Minke whale	0	10 (13)	9 (10)	10 (10)	8 (8)	0	37 (41)
Risso's dolphin	0	0	0	1 (20)	0	0	1 (20)
White-beaked dolphin	0	5 (49)	0	5 (21)	0	0	10 (70)
Unidentified dolphin	0	1 (1)	0	0	0	1 (1)	2 (2)
Unidentified whale	0	2 (2)	0	0	0	0	2 (2)
Unknown cetacean	2 (2)	1 (1)	0	2 (2)	0	0	5 (5)
Other sightings							
Basking shark	0	69 (98)	15 (16)	6 (43)	6 (6)	0	96 (163)
Common seal	16 (34)	5 (5)	4 (4)	4 (4)	24 (24)	4 (6)	57 (77)
Grey seal	4 (4)	33 (38)	30 (32)	50 (51)	7 (7)	0	124 (132)
Unidentified seal	3 (3)	9 (12)	14 (14)	5 (5)	4 (4)	8 (9)	43 (47)
Total	32 (52)	161 (400)	99 (114)	212 (224)	82 (125)	23 (34)	517 (948)

SECTION TWO

1. REPORTING ON RESEARCH OBJECTIVES

Objective 1

Modelling temporal and spatial patterns of cetacean distribution and habitat preference.

Progress report on objective 1

The diversity, distribution and abundance of marine life are influenced by environmental interactions and trophodynamics. However, the mechanisms that determine cetacean habitat preferences are poorly understood. Understanding and being able to predict the distribution of whales and dolphins is significant for many aspects of conservation, including mitigating the effects of harmful human activities by time-area management.

HWDT is modelling cetacean distribution as a function of predictive environmental factors such as topography, and oceanographic variables such as temperature and tides. Some prior work has already taken place in conjunction with Clare Embling (former PhD student at Sea Mammal Research Unit (SMRU) of St Andrews University), looking at more large-scale patterns of harbour porpoise distribution using both visual and acoustic Silurian data. Results have been recently been used to investigate suitable sites for marine protected areas for this conservation priority species (Embling et al., 2009). Currently, Cormac Booth (also PhD student at SMRU), is intensely developing Embling's research by addition of complementary environmental datasets, by increasing the distribution data (including Silurian data from 2003-2008), and by performing fine-scale habitat modelling. Analysis results from this PhD, with

anticipated completion in spring 2010, will provide major products of the research conducted so far and will give more detailed fine-scale insight on harbour porpoise distribution and habitat preferences on the west coast of Scotland.

Passive acoustics can improve surveys for cetaceans that are hard to survey visually, such as harbour porpoises, but are less useful for species that vocalize infrequently (minke whales have rarely been heard to vocalize off the West Coast of Scotland), and it can be difficult to distinguish between the vocalizations of different dolphin species. This indicates that habitat modelling for other species other than harbour porpoises mainly relies on visual data. Further broad-scale analysis and data collection is taking place to monitor temporal presence and relative abundance (mainly on minke whales and bottlenose dolphins), to increase sample sizes of less commonly sighted species (e.g. white-beaked dolphin, Risso's dolphin) to add power to analyses for these species, and to increase coverage in habitats beyond the initial core sampling area (e.g. Minch, Outer Hebrides).

Up to the present time, we have seven years of distribution data, establishing a baseline against which to compare future monitoring. Our work, by its nature is ongoing and therefore long-term monitoring of the area and investigating the patterns and causes of changes in distribution and abundance of species will remain an ongoing programme for the next season.

Objective 2

Investigating cetacean movement patterns and demographics of Hebridean cetaceans.

Progress report on objective 2

Cetaceans are highly mobile, and live in a fluid environment free from most obvious boundaries. For conservation management, it is important not only to know distributions and habitat preferences of species, but knowledge on movement within areas and between areas and population characteristics are also very important. Individually distinctive natural markings can be used to study animal movement patterns without the need to capture, restrain or mark animals. These 'natural tags' can also be used to estimate demographic parameters such as animal abundance, social structure, survival and reproductive rates. Several species in the study area are the subject of ongoing studies using natural markings for identification. On Silurian, photo-identification pictures are taken for minke whales, bottlenose dolphins, killer whales, Risso's dolphins, white-beaked dolphins, common dolphins and basking sharks. Pictures are also obtained from wildlife tour operators and via HWDT's Community Sightings Network. Currently we have catalogues for the first four species. There are several other species that occur in the area that are readily identified by natural markings (e.g. humpback whales), but these are not the primary focus of research, principally because they are too rarely sighted in the region. Basking shark pictures are sent to the Shark Trust to be catalogued.

A national project to study the distribution of bottlenose dolphins in Scotland in which HWDT participated has now finished and the final report to Scottish Natural Heritage (SNH) is in press. Two discrete groups of dolphins inhabit the west coast of Scotland; one using the waters around the Sound of Barra in the Outer Hebrides, showing an unusual small home-range and high degree of site fidelity; and the other using the waters of the Inner Hebrides and mainland coast, and being extremely wide-ranging. There is no evidence to suggest mixing between these two groups. The Barra group exists of between 12 and 15 individuals, and the Hebridean group is thought to contain between 25 and 30 individuals. The small sizes of both these sub-populations are a matter of conservation concern. The report concluded that there was lack of significant movement between the east and west coast populations. However, since this report has been finished new evidence has emerged to suggest that there has been mixing between the two populations historically. A total of six distinctively marked animals from

the HWDT catalogue were positively identified in the catalogue held by the Cetacean Research and Rescue Unit. At least three of these individuals were also confirmed to be seen off the coasts of Cork and Galway in Ireland. These findings are a significant contribution towards our current understanding of movement and genetic mixing between neighbouring bottlenose communities.

Analysis of images from minke whale photo-ID encounters has now been completed up to 2008 inclusive, and the west coast minke whale photo-ID catalogue now contains approx. 144 individuals identified between 1990 and 2008. Links have been set up with the University of Iceland and minke whale catalogues have been exchanged for comparison. Preliminary analysis showed no matches but this work is ongoing. There is much scope for setting up similar collaborations with other research groups working on minke whales elsewhere, and this is a recommended area for future research, especially in the scope of the marked decline in the rate of minke whale sightings in recent years.

There is only a very small group of killer whales present in Hebridean waters. A collaborative project on Scottish killer whales between the HWDT and Andy Foote (PhD student at the University of Aberdeen) continued in 2009, analysing killer whale data from the west coast of Scotland in the context of the eastern North Atlantic population as a whole. There are now thought to be just 9 regularly sighted killer whales off the west coast. One animal has not been seen since 2001, and is suspected to be dead. No new calves have been photographed going back to our earliest data of 1992 (usual inter-calf interval for a killer whale adult female is five years) and there are five adult females in this group. Some animals have been identified over many years, and the re-sighting rate is high. One animal, 'John Coe', (see picture below) has been sighted regularly over the past 15 years around the west coast of Scotland, and has also been sighted off County Donegal, in Pembrokeshire, and as far North as the Western Isles. He has been an adult male since first being sighted making him at least 35 years old.



John Coe west of Barra. Copyright N. van Geel/HWDT. 'John Coe', has been sighted regularly over the past 15 years around the west coast of Scotland

There were 11 photographic encounters of the Hebridean group in 2009, 6 of which were sightings off the west coast of Ireland. There was one sighting off the Pembrokeshire coast of John Coe and two unidentified females and the remaining sightings were off the west coast of Scotland. Recent findings have shown that there are genetic and morphological differences between the Hebridean animals and other killer whales found in UK waters: there appear to be two distinct 'types'; 'type 1' killer whales are found across the north-east Atlantic and around Britain and have severely worn down teeth, typical of 'fish-eating' killer whales. The 'type 2' whales are the Hebridean animals and have hardly any tooth wear, more typical of mammal-eating killer whales. There is also a size difference between the two 'types', with 'type 2' males

being up to 2 metres larger in size than 'type 1' males, and also the white eye patches differ in size and orientation. Genetic analysis has shown that the two 'types' belong to two different populations with 'type 1' whales being from closely related populations and 'type 2' whales more closely related to Antarctic killer whales (Foote, 2009; Foote et al, 2009). It is now clear that the two 'types' occupy different ecological niches and over time have started to diverge morphologically. The small size of this group as shown through this study, the apparent isolation of this group from killer whales in adjacent regions, and the apparently low incidence of calves within the group raise conservation concerns.

Objective 3

Mapping anthropogenic environmental inputs (e.g. sound, debris)

Progress report on objective 3

Both UK and local Biodiversity Action Plans (BAPs) have identified potential threats to cetaceans including marine debris, shipping and aquaculture activities. Noise pollution in particular is a substantial and under-recognised threat. During surveys, information is regularly recorded on three sources of human generated potential impact: surface marine debris, anthropogenic sound and vessel traffic - a primary source of noise and also a risk of collision for some species. Each of these may influence cetaceans in the region.

The west coast of Scotland is an important area for aquaculture, in particularly salmon farming, which is an important part of the local economy. However, Scotland's coasts are also home to the majority of the UK's seals populations of common and grey seals. Interactions between seals and fish farms have long been a difficult and controversial management issue. A research collaboration between HWDT and Sea Mammal Research Unit (SMRU) for the Scottish Aquaculture Research Forum (SARF) came to the end at the end of 2009. The project has been investigating predator control at fish farm sites, and the role, efficacy and impacts of acoustic deterrent devices (ADDs; designed to prevent seal predation) in mitigating seal attacks. The project has comprised the deployment of static acoustic loggers at fish farm sites on the west coast to assess whether porpoise distribution changed in response to ADD use, other acoustic experiments, and an extensive programme of interviews with aquaculture site managers to assess their views and experiences of predator control. Additionally, recorded noises of ADDs are used by Cormac Booth to map the extent and degree to which cetaceans are exposed to ADD sounds and in particular to what extent harbour porpoises are affected in their distribution by ADDs. Results show that ADD sound levels mapped for the Sound of Mull are very high (Booth et al, 2009).

Floating marine debris, notably plastics, which can result in problems for cetaceans and other wildlife through entanglement or ingestion, are also routinely recorded. The west coast of Scotland is an important area for fishing, contributing significantly to the local economy. The area is also important for minke whales, which visit the area every summer to feed. Minke whale, humpback whale and basking shark entanglements in fishing gear have been reported from stranding events in 1992. However, the scale of entanglement mortality and the exact cause of such entanglements are unknown. In 2008 and 2009, HWDT took part in a collaboration project with SMRU and the Scottish Agricultural College in project investigating the interaction between Scottish fisheries and minke whales, using the established minke whale catalogue. Identified individuals photographed between 1991 and 2008 were analysed for scars caused by possible entanglement events using a scar coding scheme and an entanglement probability status code from other authors. In the first part of this analysis, the occurrence of possible entanglement scars in the catalogue was found to be low. HWDT are awaiting the final results and a draft copy of the report.

The Scottish Government - in line with EU legislation – has set a target to obtain 20% of Scotland's required energy use to be provided by renewable energy resources by 2020, and for electricity as a whole, the target is to produce 50% of Scottish gross consumption of electricity from renewable energy resources by 2020, with an interim 'milestone' of 31% by 2011 (Scottish Parliament Economy, Energy and Tourism Committee, 2009). Possible sources of renewable energy related to the marine environment are offshore windmill parks, using wind energy, and tidal turbine parks, using tidal energy. Renewable energy in the form of wind, tide and wave power are exciting new technologies which offer a promising low-carbon option for our energy needs. Tidal and wind power installations are planned for several areas of Hebridean waters such as off Tiree, Islay and Kintyre. However, the possible impact, both in their operation and during construction, on marine life is still poorly understood (e.g. underwater noise, collision risk and habitat loss), especially for tidal energy which is a very new field. For this reason, HWDT conducted some extra survey days in areas allocated as proposed sites for renewable projects, such as west of Islay and the sound of Islay.

2. PARTNERSHIPS

Science collaborations and research partnerships during projects in 2009 include:

University of St. Andrews, Sea Mammal Research Unit (SMRU), University of Aberdeen, Dunstaffnage Marine Laboratory, Scottish Association for Marine Science (SAMS), Scottish Agricultural College (SAC) - Veterinary Services, Cetacean Research and Rescue Unit (CRRU), Sea Watch Foundation (SWF), University of Iceland, Shark Trust.

Porpoise- and killer whale data is analysed in collaboration with PhD students from SMRU and Aberdeen University. We have collaborated with SMRU, Aberdeen University and SAMS on the Scottish bottlenose dolphin project. The SARF ADD project was undertaken in collaboration with SMRU. Minke whale entanglement was investigated in collaboration with SMRU and SAC. Movement of bottlenose dolphins between east and west Scotland are investigated in partnership with CRRU. Additionally, minke whale catalogues between HWDT and the University of Iceland are being compared. A survey focusing on the potential impact of tidal turbines has been undertaken together with SAMS. There has been an exchange of sightings, survey data and photo-ID images relevant to our study area with Sea Watch Foundation (reports from public sightings are provided to be incorporated in the Joint Cetacean Database) and Shark Trust (HWDT provides all basking shark pictures to the Shark Trust to be analysed and catalogued). Reports of marine mammal strandings and genetic samples taken from dead animals, have been sent to SAC who coordinates the Scottish National Stranding Network. SMRU also provided scientific support and advice, mainly on survey design and acoustics.

3. PROJECT DEVELOPMENT

Addition to objective 3. Increased monitoring at proposed renewable sites.

The Scottish Government - in line with EU legislation – has set a target to obtain 20% of Scotland's required energy use to be provided by renewable energy resources by 2020, and for electricity as a whole, the target is to produce 50% of Scottish gross consumption of electricity from renewable energy resources by 2020, with an interim 'milestone' of 31% by 2011 (Scottish Parliament Economy, Energy and Tourism Committee, 2009).

Possible sources of renewable energy related to the marine environment are offshore windmill parks, using wind energy, and tidal turbine parks, using tidal energy. Renewable energy in the form of wind, tide and wave power are exciting new technologies which offer a promising low-carbon option for our energy needs. Tidal and wind power installations are planned for several

areas of Hebridean waters such as off Tiree, Islay and Kintyre. However, the possible impact, both in their operation and during construction, on marine life is still poorly understood (e.g. underwater noise, collision risk and habitat loss), especially for tidal energy which is a very new field. For this reason, in 2009 HWDT started to increase survey coverage in proposed renewable sites gaining increased baseline pre-construction data on distribution and usage of these proposed sites by marine mammals and basking sharks.

4. DISSEMINATION

4.1. Printed:

If our research is to impact on policy-makers, fellow researchers and members of the public, it is essential that our results be communicated to as wide a range of audiences as possible, both within and outside the scientific community. Besides, scientific articles, HWDT disseminates the results of our surveys locally, both directly to those involved in the wildlife watching industry, a significant sector of the West Coast economy, and to the general public via newsletters and local press. This helps to keep local community and wildlife watching business informed of what species are being seen and where. This in turn encourages more people to continue reporting their sightings and build up our dataset.

Papers and Presentations using HWDT data dated from 2008/2009 are presented below.

Printed:

PAPERS

Accepted:

Bolt, H.E., Harvey, P.V., Mandleberg, L., Thompson, P.M. and Foote, A.D. (2009) Occurrence of killer whales in Scottish inshore waters: temporal and spatial patterns relative to the distribution of declining harbour seal populations. *Aquatic Conservation: Marine and Freshwater Ecosystems* 19: 671-675.

Embling, C. B., Gillibrand, P.A., Gordon, J., Shrimpton, J., Stevick, P.S. and Hammond, P.S. (2009, In Press) Using habitat models to identify suitable sites for marine protected areas for harbour porpoises (*Phocoena phocoena*). *Biological Conservation* (2009). Doi:10.1016/j.biocon.2009.09.005.

Foote, A.D., Newton, J., Piartney, S.B., Willerslev, E. and Gilbert, M.T. (2009) Ecological morphological and genetic divergence of sympatric North Atlantic killer whale populations. *Molecular Ecology* 18 (24): 5207-5217.

Foote, A.D., Similä, T., Vikingsson, G.A., Stevick, P.T. (2009, In Press) Movement, site fidelity and connectivity in a marine top predator, the killer whale. *Evolutionary Ecology* (2009). Doi:10.1007/s10682-009-9337-x.

Weir, C.R., MacLeod, C.D. and Calderan, S.V. (2009) Fine-scale habitat selection by white-beaked and common dolphins in the Minch (Scotland, UK): evidence for interspecific competition or coexistence? *Journal of the Marine Biological Association of the United Kingdom* 89 (5): 951-960.

In Preparation:

Calderan, S.V., Stevick, P.T. and Mandleberg, L.C. Similarity in spatial occurrence of marine debris and cetaceans on the west coast of Scotland: does feeding ecology give cetaceans a disproportionately high exposure to marine debris?

Cheney, Culloch, Elwen, Hammond, Islas, Janick, Ingram, Mandleberg, Pope, Quicke, Robinson, Stevick, Thompson, Wier, Wilson (provisional authorship in alphabetical order) Distribution and abundance of bottlenose dolphins in Scottish waters.

Cheney, Culloch, Elwen, Hammond, Ingram, Mandleberg, Stevick, Thompson, Wilson (provisional authorship in alphabetical order) Differences in ranging patterns and site fidelity of two communities of bottlenose dolphins using the west coast of Scotland.Cheney.

Culloch, Elwen, Hammond, Ingram, Mandleberg, Stevick, Thompson, Wilson (provisional authorship in alphabetical order) Using sightings reports to track coastal bottlenose dolphins.

Foote, A.D., Vikingsson, G., Øien, N., Bloch, D., Davis, C.G., Dunn, T.E., Harvey, P., Mandleberg, L.C., Whooley, P. and Thompson, P.M. Distribution and abundance of killer whales in the North East Atlantic. In preparation for Mammal Review.

Mandleberg, L.C., Calderan, S.V., Stevick, P.T., Embling, C.B., Shrimpton, J. and Booth, C.G. Patterns of cetacean biodiversity in west Scotland are related to oceanographic features.

Stevick, P.T., Calderan, S.V., Speedie, C., Shrimpton, J. and Embling, C.B. A trophic shift off West Scotland: minke whales and basking sharks.

ACADEMIC DISSERTATIONS:

Booth, C.G. (In prep) PhD Thesis. School of Biology. University of St Andrews. St Andrews.

Foote, A.D. (2009) Evolutionary ecology of North Atlantic killer whales. PhD thesis. University of Aberdeen. Aberdeen.

HWDT REPORTS

(In prep.) Annual report 2009. Hebridean Whale and Dolphin Trust. Tobermory.Mandleberg, L., Booth, C., Gordon, J. and Calderan, S.V. (2009) Report to ScottishPower Renewables on the marine mammal species and basking sharks occurring in the Sound of Islay study region. Hebridean Whale and Dolphin Trust: 27 pp.Scottish Aquaculture Research Forum

(In prep) SARF Project report.Thompson, P.M., Cheney, B., Ingram, S., Stevick, P., Wilson, B. and Hammond, P.S. (Eds) (In Press) Distribution, abundance and population structure of bottlenose dolphins in Scottish waters. Scottish Natural Heritage Commissioned Report.

POSTERS

Booth, C.G., Calderan, S.V., Gordon, J., Van Geel, N.C.F. (2009) Marine noise: the changing nature of Scotland's underwater soundscape and possible impacts on marine mammals. SNH Conference: The Changing Nature of Scotland. 17th-18th September 2009, Perth, Scotland.

NEWSLETTERS

HWDT (2008) Wave. Edition winter 2008/2009. Hebridean Whale and Dolphin Trust.

HWDT (2008) Wavelet. Edition Winter 2008/2009. Hebridean Whale and Dolphin Trust.

Visual:

HWDT runs a Visitor Centre, which is open all year to the general public and provides educational and interpretative information. New display boards for the Taigh Solais Sealife tourist visitor centre in Tobermory are in preparation.

Digital:

HWDT's website is a key method of communicating to a geographically widespread audience. The new website was launched in March 2009. A daily blog has been written by volunteers onboard research trips, the blog is published on the HWDT website (<http://www.whaledolphintrust.co.uk/blog.asp>). News items on our homepage have been regularly renewed to provide latest sightings, report findings and raise awareness of forthcoming events. Since October, HWDT also actively shared information via facebook. In the past year, HWDT produced an electronic full-colour edition of Wave (adult magazine) and Wavelet (junior edition) for Summer/Autumn 2009. An e-newsletter has been compiled monthly since the new website launch in March 2009.

Mass media:

On several occasions, HWDT was brought to wider general public attention by articles, news items and radio pieces in local, national and international media (See table 5), generally explaining and emphasising the importance of our work, highlighting research findings and / or reporting on unusual events.

Since limited resources are available to completely evaluate HWDT's mention in the media, the list is far from complete. It is estimated that about half of the articles based on HWDT's work will come to our attention. Additionally, HWDT often obtains request from journalists and magazine editors for anecdotes and pictures to contribute to their stories. This kind of media coverage is also not included in the overview.

Meetings and conferences:

Over the last four years, HWDT has organised and attended a wide variety of workshops, talks and events to increase public awareness and understanding of cetaceans sighted on the west coast of Scotland. Through these key events, thousands of people have been involved in learning about their natural marine and coastal heritage and have been encouraged to feel a sense of responsibility for the marine biodiversity of this area. The events have proved valuable in increasing interest and awareness of cetaceans and raising the profile of HWDT's work within local communities. An overview of workshops, talks and events delivered by HWDT between October 2008 and October 2009 is provided in table 6.

Besides the generally non-scientific events listed in table 6, Cormac Booth presented on the influence of ADDs on porpoises at a scientific conference:

Booth, C. G., Gillespie, D., Calderan, S.V., Hammond, P.S., Stevick, P. and Gordon, J. (2009) Investigating the sound fields of Airmar seal scarer devices and the potential impacts on harbour porpoises (*Phocoena phocoena*). Presented at the 18th Biennial Conference on the Biology of Marine Mammals. 12th – 16th October 2009, Québec, Canada.

Educational resources:

Three new school teaching resources have been developed and have been posted on the new HWDT website. HWDT also organised an Earthwatch Teacher Team trip in 2009, resulting in additional lesson plans and resource packs to be used in schools of the participating teachers.

Table 5. HWDT media coverage from October 2008- present.

Medium	Publication	Title	Date
Newspaper	Round & About - local	Rare whales cause traffic jams	Oct-08
Newspaper	Oban Times	So much to learn about at environmental fair	02/10/2008
Newspaper	The Press and Journal	Hebrides Dolphin Surprise	20/12/2008
News	BBC Wildlife Extra (online)	Scotland's Secret Dolphins	Jan-09
Newspaper	The Oban Times	Hebrides holds smallest pod of dolphins	01/01/2009
Magazine	Scotland Outdoors	Scottish Safari	Spring 2009
Magazine	Scots Magazine	Around Scotland	Apr-09
Newspaper	The Iteach (Islay local)	Scotland's whales at risk from military exercises	May-09
Magazine	Scottish Field	Scotland's whales at risk from military exercises	May/June 2009
Newspaper	Press & Journal	Scotland's whales at risk from military exercises	24/05/2009
Newspaper	The Oban Times	whale watchers call for naval sonar investigation	28/05/2009
News	BBC Wildlife Extra (online)	Scotland's whales at risk from military exercises	29/05/2009
Magazine	Scotland Outdoors	Breaking Cover	Summer 2009
Newspaper	Press & Journal	Scottish dolphins set point-to-point record with Ireland trip	11/06/2009
Radio	BBC Radio Scotland	The Fred MacAuley show	16/06/2009
News	BBC Wildlife Extra (online)	Rare treat for cetacean researchers (humpback whale sighting)	01/07/2009
Newspaper	Underwater Times	Rare treat for cetacean researchers (humpback whale sighting)	01/07/2009
Newspaper	Underwater Times	Whale And Dolphin Environmental Agencies Seek Volunteers To Monitor NATO Exercise Off Scot Coast	18/08/2009
News	Scottish wildlife tourism association (Wild Scotland online)	Volunteer for active service	18/08/2009
News	BBC Wildlife Extra (online)	Whale And Dolphin Environmental Agencies Seek Volunteers To Monitor NATO Exercise Off Scot Coast	20/08/2009
Newspaper	Ullapool News	Whale And Dolphin Environmental Agencies Seek Volunteers To Monitor NATO Exercise Off Scot Coast	24/08/2009
Newspaper	Press & Journal	Whale And Dolphin Environmental Agencies Seek Volunteers To Monitor NATO Exercise Off Scot Coast	24/08/2009
Magazine	SCENES	Article about HWDT and WDCS calling for volunteers to survey military exercise	Sep-09
Magazine	Scottish Islands Explorer	Large 3 page spread about the work of HWDT	Sept/Oct 2009
Magazine	Scotland Outdoors	Article about the military survey	Autumn 2009
Newspaper	Lochaber News	Whale And Dolphin Environmental Agencies Seek Volunteers To Monitor NATO Exercise Off Scot Coast	02/09/2009
Newspaper	Ullapool News	Destructive jellyfish spotted off Mull's coast	19/10/2009
News	For Argyll – Radio Fyneside CIC	Killer jellyfish spotted off Mull	19/10/2009
Newspaper	Underwater Times	Destructive jellyfish spotted off Mull's coast	21/10/2009
News	BBC Wildlife Extra (online)	Destructive jellyfish spotted off Mull's coast	24/10/2009
Magazine	NERC	New areas for porpoise conservation	Dec-09
News	Visit Scotland	Britain's last 'resident' orca pod	12/01/2010
News	BBC Wildlife Extra (online)	Britain's only resident orca pod – No breeding for 20 years	15/01/2010

Table 6. (Public) events attended by HWDT, October 2008 to October 2009.

Event	Description	Date	Location
Christmas craft fair	Interpretation & retail stand	16/12/2008	Aros Hall, Tobermory, Mull
Wildlife from the ferry during Wild Isles week	3 return sailings, providing interpretation & cetacean watch	09/05/2009	Calmac 'Isle of Mull' ferry, Craignure-Oban
Wild Isles week	Public talk, DVD and presentation	10/05/2009	Taigh Solais harbour building, Tobermory
Wild Isles week	Lighthouse walk and cetacean watch	11/05/2009	Tobermory lighthouse viewpoint
Public Talk	Presentation and interpretation	26/05/2009	Drimnin Community Hall, Morven
Film screening on World Oceans Day	'End of the Line' film documentary screening, introductory talk and Q&A session	08/06/2009	Vue Cinema, Inverness
Beach workshop	Workshop for public	09/07/2009	Tobermory, Isle of Mull
Classic Malts	Interpretation stand at yachting event	11/07/2009	Oban
Talk	Presentation by Andy Foote on PhD work	03/07/2009	Tobermory, Isle of Mull
National Whale and Dolphin Watch	Cetacean & wildlife watch	21/07/2009	Cailiach Point, Isle of Mull
Highland Games	Interpretation & retail stand at community event	23/07/2009	Tobermory, Isle of Mull
Wildlife from the ferry	Cetacean & wildlife watch	27/07/2009	Ullapool to Stornaway return ferry crossing
West Highland Week	Cetacean & wildlife watch	05/08/2009	Ardmore Point, Isle of Mull
Agricultural show	Interpretation & retail stand at local show	07/08/2009	Bunessan, Isle of Mull
RNLI Lifeboat Day	Beach activities on Tobermory beach	09/08/2009	Tobermory, Isle of Mull
Agricultural show	Interpretation & retail stand at local show	13/08/2009	Salen, Isle of Mull
Earthwatch Lecture: Marine Needs	Presentation about HWDT project	15/10/2009	Royal Geographical Society Building, London
Scottish Sustainable Marine Environment Initiative: Sound of Mull workgroup meeting	Work group meeting on Sound of Mull Marine Spatial Plan	Various meetings throughout the year	Various places

5. CAPACITY DEVELOPMENT AND EDUCATION

As HWDT is an integral part of the community both on Mull, and over the wider Hebridean area, our work in cetacean research, education and conservation is fully integrated into the area's economic and social structure and development. HWDT is in direct contact with the local community by working closely together with boat operators, ferry companies, fish farmers, and fisherman in the collection of data; we also visit local schools, colleges and community groups and organise and attend a wide variety of workshops, presentations, talks and events, to increase public awareness and understanding of cetaceans sighted on the west coast of Scotland. Through these key events, thousands of people have been involved in learning about their natural marine and coastal heritage and have been encouraged to feel a sense of responsibility for the marine biodiversity of this area. These outreach events have been located throughout Argyll and the Atlantic Island area and also occasionally in a wider area. Certain events focused on different sectors of the local community, for example, beach workshops targeted participation from families. Additionally, in 2009, a 2 day non-research trip was done for a special interest group to experience wildlife and to participate in sailing.

HWDT continues to work with and support students at all levels, and gains considerably from these valuable collaborations. As mentioned before, Clare Embling and Cormac Booth, both PhD students from SMRU, conducted research on the distribution and habitat preferences of harbour porpoises. Andy Foote (PhD student from the University of Aberdeen) included HWDT data in his research on Scottish killer whales, in relation to the killer whales of the north-eastern Atlantic as a whole. Besides providing data, HWDT is also involved in training University students; one trip was conducted with students of the University of St Andrews Marine Mammal Science MRes, to which our first monitoring trip of the year was devoted as a survey techniques module, and from which a student, Mirjam Held has participated in the minke whale entanglement project. Another two trips were done with students from University Marine Biological Station Millport as part of the course Marine Mammal and Turtle Biology. Throughout the field season, other students and early career scientists have been involved in the research work (either on Silurian, or in the office), to specifically learn skills relevant to marine mammal research and to gain (more) experience in this field.

6.1. CONTRIBUTIONS TO INTERNATIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Since 2003, HWDT has monitored marine biodiversity and conservation priority cetaceans in west coast waters, in particular harbour porpoises, minke whales and bottlenose dolphins. This monitoring has directly addressed actions identified in local and national Biodiversity Action Plans (BAPs) and is linked to the European Commission (EC) Habitats Directive priority species, thus delivering locally, nationally and internationally recognised biodiversity objectives. Without an understanding of the critical habitat requirements of cetacean species, it is not possible to provide effective protection measures. For example, the UK is required to establish Special Areas of Conservation (SACs) for harbour porpoise under the Habitats Directive, but has failed to take action in this matter because of uncertainty about what locations are of key importance and why. The Action Plan specifically calls for more study "on the areas frequented by harbour porpoise to identify waters which may qualify for further protection as SACs or Marine Nature Reserves." The west coast of Scotland has among the highest densities of harbour porpoise in European waters and HWDT surveys are providing vital information to address habitat use in the area. Recently, an article specifically targeted at Marine Protected Area designation for harbour porpoise has been published, based on HWDT data. Similarly, two small and apparently independent groups of bottlenose dolphins are found on the west coast. These groups do not use the only SAC for bottlenose dolphins in Scotland, as this is on the east coast. More information is needed to identify the ranges and habitat use of these vulnerable dolphin populations. Currently, requests are made to include the Barra bottlenose dolphin sub-group as a protected feature in the proposed Sound of Barra SAC, for this group shows an

unusual high degree of site fidelity to the area. Finally, a study of killer whale population dynamics across the North Atlantic revealed that Hebridean killer whales are genetically and morphologically different than other killer whale populations in the UK and the north-eastern Atlantic region, which provides challenges for the conservation of this wide-ranging pod.

Many of the species studied by HWDT have been recognised as priority species for conservation locally, nationally and internationally. Of the 20 BAP priority species of whales, dolphins and porpoises, 14 have been identified on the west coast by previous HWDT monitoring; seven of these have been seen regularly. Two of these species, harbour porpoises and bottlenose dolphins, are also European priority species and are listed under Annex II of the EC Habitats Directive. These two, along with minke whales, are the primary subjects of HWDT study. The objectives of the Action Plans for these species all include maintaining and, where possible, expanding the geographical range and the abundance of the species. However, there is very little information on the current range or relative numbers of these animals, thus several of the species Action Plans explicitly highlight the need for monitoring activities such as those pioneered by HWDT.

Since 2003, HWDT has been working to address these data needs and, as has been demonstrated, has greatly increased our knowledge of west coast species habitats and abundance, directly addressing the needs highlighted by local and national Biodiversity Action Plans.

6.2. CONTRIBUTIONS TO LOCAL, NATIONAL AND REGIONAL CONVENTIONS, AGENDAS, POLICIES, MANAGEMENT PLANS

Local / regional

Our work is largely focussed on identifying key habitats of importance to local species, with a view to their potential future protection. Providing information on sensitive sites for marine life is of considerable benefit for management of local waters.

HWDT shares all marine debris data collected with the Argyll and Bute Council. This information is used in awareness raising and education and is working towards Local Biodiversity Action Plan (LBAP) targets focused on reducing the levels of marine debris, which can cause harm and injury to many marine species.

Data gathered on bottlenose dolphins is adding to the sparse knowledge we have of the west coast bottlenose dolphin population. Bottlenose dolphins have been identified as a LBAP priority species. As one of the LBAP actions, HWDT initiated a photo-identification project, from which we currently gain more knowledge and understanding on population size, and bottlenose dolphin range and movement patterns through the area. Inclusion of bottlenose dolphin as an important feature for the proposed Sound of Barra SAC is emphasised by HWDT.

HWDT has been involved in the Sound of Mull SSMEI (Scottish Sustainable Marine Environment Initiative) project working group since its commencement and provided harbour porpoise distribution data for the Sound of Mull. Data and expertise are integrated in the Sound of Mull Marine Spatial Plan, with an anticipated official launch in summer 2010.

National

Cetacean sightings from our public sightings network are shared with and passed onto the Sea Watch Foundation, which is the national coordinator for all UK sightings for whom HWDT acts as the regional coordinator. Sightings and effort related data contributed are reviewed on a 10-yearly basis to provide a comprehensive picture of the status and distribution of UK cetaceans.

HWDT has been involved in the Scottish Environment LINK's Marine Task Force. Through this umbrella body, HWDT expresses its expert voice on cetacean and marine biodiversity issues on a national scale. This year, LINK has been intensively involved in development of the Scottish Marine Bill.

7. ACTIONS OR ACTIVITIES THAT ENHANCE NATURAL AND SOCIAL CAPITAL

The Hebridean Whale and Dolphin Trust is dedicated to enhancing knowledge and understanding of Scotland's whales, dolphins and porpoises and the Hebridean marine environment through education, research and working within Hebridean communities as a basis for the lasting conservation of local species and habitats. Basic knowledge about species' distributions and abundances is necessary in order to develop, implement and monitor conservation management plans. Biodiversity Action Plans have been made for many of the species present in the Hebrides, however, for most species found in the area, little is known to sufficiently develop conservation plans at appropriate spatial and temporal scales, although this is obligated by various national and international laws. Research carried out by HWDT contributes to the necessary information needed for area conservation (marine protected areas) and hence species protection. However, this is a time-consuming and an ongoing process. HWDT staff, (Earthwatch) volunteers, students, wildlife tour operators, fisherman, tourists and all other people (either local or visiting the area) by participating in the research onboard Silurian, or by providing data to the Community Sightings Network, contribute to the increased knowledge on Hebridean marine mammals.

As mentioned before, HWDT also organises and attends education and awareness events providing information on cetacean biology and ecology, marine mammal research techniques, marine ecosystems and food-web dynamics, marine pollution and cetacean conservation, increasing the knowledge and appreciation of cetaceans, the Hebridean environment and marine issues of a wide variety of attendees.

In an economic sense, protection and conservation of species and habitats is of major importance to the local economy. Wild life tourism, aquaculture and fishing are three important sources of income locally. All these three branches rely on a healthy biodiversity and benefit from the work conducted by HWDT. Finally, generally, volunteers joining the research on Silurian specifically come to the Hebrides for the trips. Often they spend additional days in the area contributing to the local economy.

8. LONG TERM IMPACT OF PROJECT

Taxa of conservation significance enhanced, restored or maintained

All species studied are indentified as Priority Biodiversity Action Plan Species. An overview of the 9 species sighted in 2009 is given in table 7, and includes common name, scientific name and conservation status. For conservation impacts on the species studied: see section 6.1.

Ecosystem services enhanced, restored or maintained

HWDT organised beach and coast cleaning activities, preventing litter to get into the marine environment and negatively affecting on other species found around the coast (either in the water or on the land). This activity increased people's awareness of the marine pollution problem, and increases the aesthetic value of Scotland's coasts.

Table 7. Overview of species recorded for 2009 including conservation status. Sources: JNCC (2009) and UK BAP (2008).

Species common name	Scientific name	IUCN	HD	BAP	Biod
Ceateans					
Atlantic white-sided dolphin	<i>Lagenorhynchus acutus</i>		A. IV	GPS	W,E&S
Bottlenose dolphin	<i>Tursiops truncatus</i>		A. II&IV	GPS	W,E&S
Harbour porpoise	<i>Phocoena phocoena</i>		A. II&IV	SAP	W,E&S
Humpback whale	<i>Megaptera novaeangliae</i>		A. IV	GPS	W&S
Killer whale	<i>Orcinus orca</i>		A. IV	GPS	W,E&S
Minke whale	<i>Balaenoptera acutorostrata</i>		A. IV	GPS	W,E&S
Risso's dolphin	<i>Grampus griseus</i>		A. IV	GPS	W,E&S
Short-beaked common dolphin	<i>Delphinus delphis</i>		A. IV	GPS	W,E&S
White-beaked dolphin	<i>Lagenorhynchus albirostris</i>		A. IV	GPS	W,E&S
Other species					
Basking shark	<i>Cetorhinus maximus</i>	Vul		SAP	W,E&S
Common seal	<i>Phoca vitulina</i>		A. II&V	BAP	E
Grey seal	<i>Halichoerus grypus</i>		A. II&V		

IUCN: IUCN Red List of Threatened species. Vulnerable (Vul).

HD: EC Habitat Directive (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora), Annex II: species requiring designation of special areas of conservation. Annex IV: species in need of strict protection. Annex V species whose taking from the wild can be restricted by European law.

BAP: Biodiversity Action Plan UK List of priority species. Grouped Plan Species (GPS); Species Action Plan (SAP).

Biod: Biodiversity List - Habitats and Species of Principal Importance. Whales (W; NERC S.42), England (E; NERC S.41) and Scotland (S; Scottish Biodiversity List).

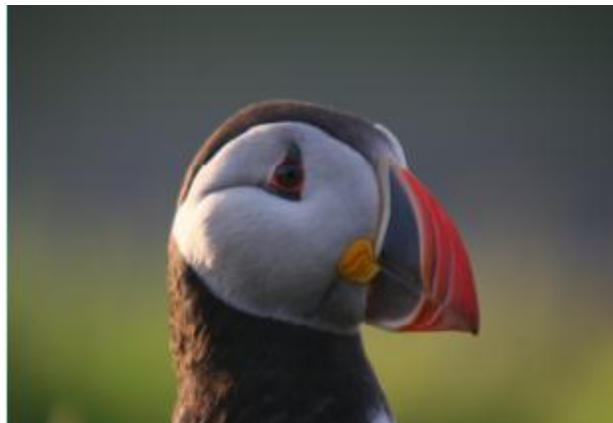
Appendix - Photographs



White-beaked dolphins at Stanton Banks. Copyright N. van Geel/HWDT.



Snoozing common seal. Copyright N. van Geel/HWDT.



Puffin. Copyright N. van Geel/HWDT.



Foraging basking shark. Copyright M. Brooke/HWDT.



Minke whale in mirror-like conditions. Copyright N. van Geel/HWDT.