



Hebridean Whale and Dolphin Trust

Research - Education - Conservation

**Hebridean Whale and Dolphin Trust
28 Main Street, Tobermory
Isle of Mull, Argyll, PA75 6NU**

Dear volunteer,

As I write this end of season letter to you all on a blustery autumn day on Mull, I have been looking through your blogs to remind me of the summer's highlights. It's been a fantastic read! I've been able to remind myself of the amazing adventures the crew of *Silurian* have enjoyed with you all – memorable cetacean sightings, visits to beautiful and remote areas of the Scottish west coast and, of course, the opportunity to share all this with some brilliant people.

Thank you all for your hard work this summer. In fair and less-than-fair weather, through long days at sea and limited access to a shower, you have without exception been enthusiastic, keen and excellent fun. I am quite sure you each have particular memories of what you enjoyed about your trip with us. I certainly do; hundreds of common dolphins (Team IV), not one but two killer whale sightings in a week (Team VII), not to mention daily Swedish lessons (Team II). I would especially like to thank Teams I and VIII – at the beginning and end of the season surveying is especially hard work, but the data you helped collect are essential.

Many of you have seen minke whales this summer, and whilst the number of animals sighted this season was not as low as in 2006, minke sightings are still down on what used to be seen in the area (before 2005). We are still not sure why this change is happening, or how long-term it may be, but it's likely to be due to a change in distribution of the small schooling fish on which they feed. Basking sharks, on the other hand, continue to thrive. We are also seeing increasing numbers of common dolphins, a species usually found in warmer waters.

Silurian, our research vessel and your temporary home, will shortly be on her way up from Tobermory Bay to the Caledonian Canal near Fort William, where she will spend the winter sheltered from the worst of the weather to come. Meanwhile, the HWDT science team will be hard at work analysing the excellent dataset that you've helped so much in collecting.

It's been great meeting you all – please do stay in touch and come back soon.

With warmest wishes,

Susannah Calderan, Science Officer and Co-Principal Investigator

EARTHWATCH INSTITUTE FIELD REPORT 2007

Whales and Dolphins of the Hebrides

Reporting on objectives

Objective 1: To use visual and acoustic survey methods to document the distribution, relative abundance and habitat use of cetaceans in south-western Scotland.

Summary of progress: There has been good spatial and temporal coverage of the core Argyll Islands region during 2007. Spatial habitat models developed using data from previous survey years (2003-2006) and applied to evaluate the distribution and habitat use of harbour porpoise, which resulted in a PhD project (Embling, 2007), have been further explored and built-upon by our current PhD candidate. Additionally, continuing from 2006, coverage of the coast beyond the Argyll Islands region has been extended, in particular to the north and west (areas such as the Small Isles, north of Skye and the Outer Hebrides), to enable a more comprehensive description of cetacean fauna in these areas.

Objective 2: To collect environmental and oceanographic information about cetacean habitats in this region

Summary of progress: Having established that remotely-sensed data were not always available at a sufficiently fine-scale for some of the surveying and modelling being undertaken, in August we commenced use of a constantly-deployed temperature probe to record sea surface temperature every minute of survey effort. The acquisition of further environmental and oceanographic information is currently being investigated.

Objective 3: To identify hotspot areas on which to base future fine-scale work.

Summary of progress: Broad-scale surveys and habitat modelling identified some candidate high-use areas which were surveyed more intensively in 2007. The results of these surveys are currently being analysed, but initial indications show some promising areas, both for single species, and diversity hotspots. Work is commencing to better understand the biophysical and trophic relationships which lead to concentrations of cetaceans in these areas and the patterns of cetacean use of these sites.

Objective 4: To undertake and maintain long term monitoring of the area.

Summary of progress: Having established a baseline against which to compare future monitoring, 2007's programme has continued our monitoring work which, by its nature, is ongoing. As the baseline of data for the Argyll Islands area has been quite firmly established, in 2007 we have slightly decreased sampling in this area, whilst maintaining regular and thorough coverage throughout the season. Instead, broad-scale baseline surveys have been conducted in adjacent areas (such as the Small Isles) and more dedicated sampling carried out in high-use habitats.

Project development

We are aware of the importance of our project evolving. As we have spent the last three years on this current set of objectives, this has inevitably given rise to new objectives and activities, which are as follows:

Our objectives from previous years have involved the modelling of temporal and spatial patterns of cetacean distribution and habitat preference. These are being expanded so that

we are not just exploring habitat preferences at a broad scale in our core sampling area, but increasing our fine-scale work; surveying areas outside our core region; increasing our focus on less commonly-sighted species; and collecting more oceanographic and environmental data.

HWDT has been compiling photo-identification catalogues of cetaceans – primarily minke whales and bottlenose dolphins – in the Hebrides for many years. However, we are increasingly focusing on using this resource to investigate cetacean movement patterns and demographics, and expanding our catalogue to include more species.

We are increasingly concentrating on monitoring and analysing anthropogenic impacts on the marine environment in general and cetaceans in particular, principally marine litter, noise and vessel traffic.

Our recording of marine noise, in particular Acoustic Deterrent Devices (ADDs), which are designed to deter seals from salmon farms, but which have also been shown to disturb cetaceans, has been enabled by the development of our acoustic system (see also section 3.3). We now make recordings at bandwidths of both 96kHz and 500kHz, so have collected recordings of both cetaceans (in particular common and white-beaked dolphins) and of ambient noise at full bandwidth, which can considerably enhance our understanding of the full acoustic properties of some marine noise and other sounds.

This year, we have largely been able to put previous years' difficulties with our acoustic systems behind us. In past years, problems have been encountered with noise interference in both audio and high frequency bands. However, the refit work on *Silurian* in the winter resulted in several modifications to the boat's electrical systems and noise filters. We also changed some of the acoustic hardware configurations. The result was a largely noise-free system which, in 2007, has operated better than ever, providing excellent quality acoustic data. We have also remedied a problem with our referenced recordings of Acoustic Deterrent Devices (ADDs) to enable them to be used more fully. Even though our systems are now working to our satisfaction, the use of Passive Acoustic Monitoring in cetacean research is still a new and rapidly-evolving technique, and improvements to hardware, software and data analysis will continue to be made. Our current PhD student, Cormac Booth, is particularly involved in this process, so we anticipate a continuing amelioration of our acoustic systems next year.

Our work in identifying hotspots requires us to obtain a range of environmental and oceanographic data on our survey area. Some of these data already exist, but need to be sourced, whilst others are yet to be collected. We have found that many remote sensing data are not at an adequate resolution for our purposes, and to that end we are now deploying our own temperature probe to collect sea surface temperature data. This will continue next year, with a fine-tuning of the frequency and accuracy of temperature samples taken.

Non-technical summary of results

Data collected and results (inputs and data)

HWDT conducted seven Earthwatch survey trips from April to September 2007. An eighth trip (Team III) did not run owing to insufficient volunteer numbers. Trips were either nine or 12 days long (seven and 10 of those respectively being dedicated survey days, with an arrival and departure day at the beginning and end of the trip).

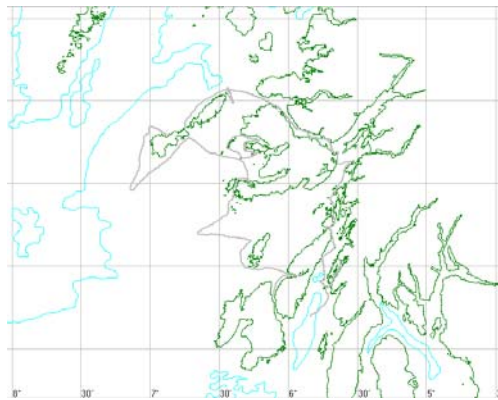
The trip dates were 20th April – 28th April, 7th May – 18th May, 4^h June – 15th June, 25th June to 6th July, 13th August – 24th August, 26th August – 3rd September and 13th September – 21st September. The usual distance covered was between 300 – 500 nautical miles depending

on the weather conditions and the duration of trip. Surveying was generally carried out for eight to nine hours per day, again depending on conditions and levels of light available at the time of year. During these surveys we undertook the following:

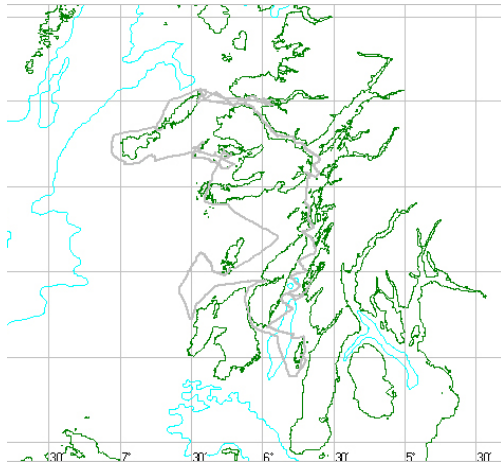
- Visual observations for all cetacean species, plus basking sharks, seals, seabirds, marine litter, and other vessels
- Photo identification images of minke whales, bottlenose dolphins, common dolphins, white-beaked dolphins, killer whales, Risso's dolphins and basking sharks showing the dorsal fins and any body scars or flank patterns. A Canon EOS 10D with a 300mm lens was used for photo-identification shots and images have been contributed to the appropriate catalogues
- Continuous acoustic monitoring of harbour porpoises and other cetacean species using a high frequency towed hydrophone and detection/analysis software
- Recordings of any anthropogenic sounds detected, in particular Acoustic Deterrent Devices (ADDs)
- All data were collected and stored using the real time data logging program LOGGER (developed by International Fund for Animal Welfare).

Survey routes

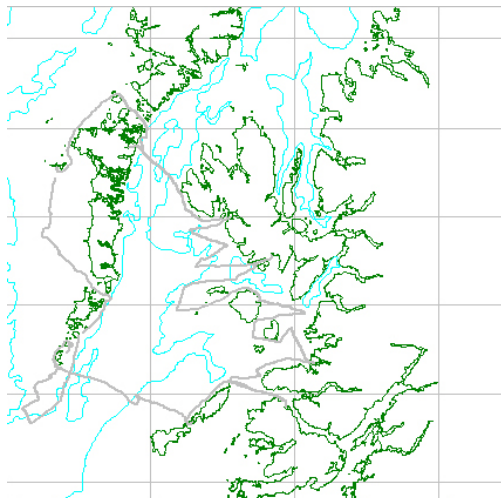
The maps below indicate the survey routes undertaken during each trip. The route was chosen to take into account weather and sea conditions and to obtain an even coverage of survey effort throughout the area. In spite of poor weather on some trips, we achieved good coverage of all our core survey areas, and extended our surveys to investigate previously unsurveyed regions, in particular to the north and west of our core area. Team IV was particularly adventurous, obtaining survey coverage both to the south and west of the Outer Hebrides.



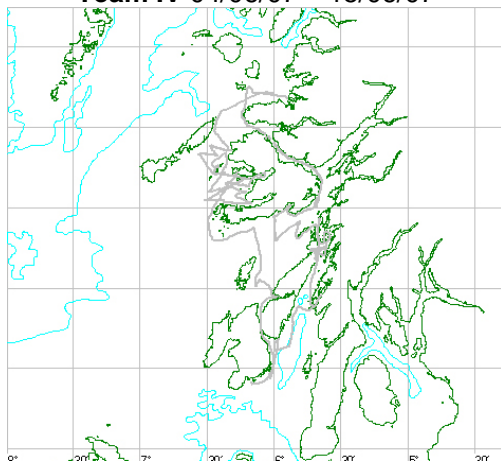
Team I 20/04/07 – 28/04/07



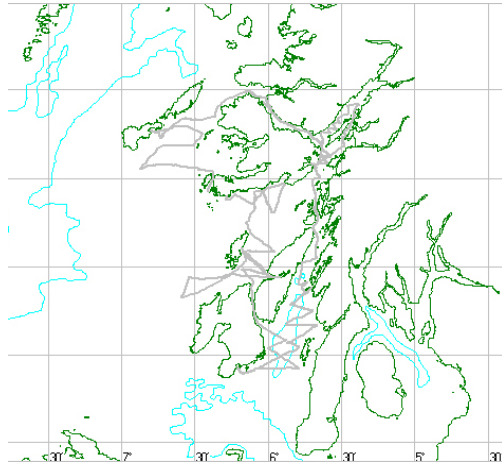
Team II 07/05/07 – 18/05/07



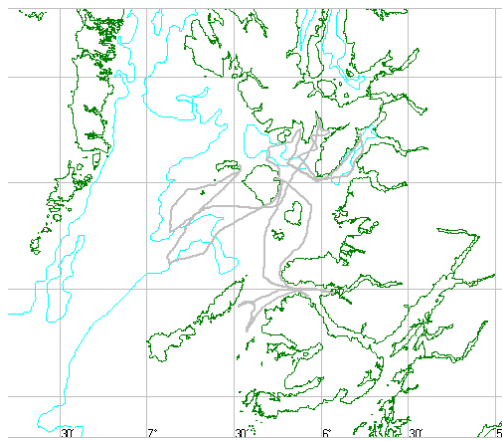
Team IV 04/06/07 – 15/06/07



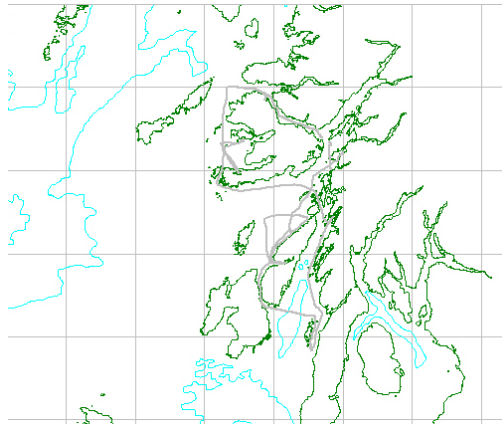
Team V 25/06/07 – 06/07/07



Team VI 13/08/07 – 24/08/07



Team VII 26/08/07 – 03/09/07



Team VIII 13/09/07 – 21/09/07

In addition to the Earthwatch surveys carried out in 2007, we conducted five other surveys following identical methodology, resulting in a total of over 100 survey days in this season. The species and number of animal encounters by the seven Earthwatch surveys are as follows:

Cetacean and basking shark sightings from Earthwatch trips 2007

Team	Harbour porpoise	Bottlenose dolphin	Risso's dolphin	Common dolphin	White-beaked dolphin	Killer whale	Minke whale	Basking shark
EW I 20/04/07 – 28/04/07	4	0	0	0	0	0	0	0
EW II 07/05/07 – 18/05/07	58	3	0	9	0	0	6	32
EW IV 04/06/07 – 15/06/07	33	7	3	>200	11	0	12	7
EW V 25/06/07 – 06/07/07	54	0	0	0	0	0	6	15
EW VI 13/08/07 – 24/08/07	155	12	0	3	0	0	2	26
EW VII 26/08/07 – 03/09/07	27	0	0	65	0	4	2	19
EW VIII 13/09/07 – 21/09/07	14	0	0	0	0	3	0	4

As for previous years, harbour porpoise continued to be the most frequently sighted cetacean in 2007. It was as apparent as ever how heavily influenced these visual sightings are by sea state, with anything but the calmest conditions significantly negatively impacting on sightings rates. The worth of our acoustic survey equipment was, again, clear. Over the 2007 season our visual surveys (both Earthwatch and non-Earthwatch) resulted in 442 porpoise encounters (a total of 830 individual animals), whilst 1,608 porpoise events were detected acoustically (it is not possible to determine the exact number of individual animals). The distribution of harbour porpoise on the west coast of Scotland is amongst the highest in Europe, but it is apparent that, although these animals are distributed throughout our survey area, there are certain areas with environmental and oceanographic features more conducive to harbour porpoise occurrence. This study of high-use areas, investigated by Clare Embling, from the Sea Mammal Research Unit (SMRU), University of St Andrews, as part of her PhD, is now being intensively developed by Cormac Booth, also at SMRU, who started his PhD research in conjunction with HWDT last year. To this end we have spent considerable time this season devoting particularly high survey effort to areas which have been identified as potential harbour porpoise hotspots.

Minke whale sightings remained low in 2007, compared to numbers seen before 2005. Minke sightings began in mid-May, but had tailed off noticeably by mid-August, peak months being June, July and early August. Many of our sightings were outside our traditional core area of the Argyll Islands regions, suggesting that minke whale distribution may be higher in more northerly and westerly areas of the Hebrides. 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, is clearly continuing to affect the region's whales. Anecdotal reports also suggest another poor breeding season for those seabirds in the area which feed on sandeel.

One particularly large group of common dolphins was sighted by an Earthwatch team this season. Team IV in June observed a group of over 200 animals feeding between Tiree and the Outer Hebrides. Other non-Earthwatch surveys carried out this summer, in particular a survey of the Northern Minch area in August, also recorded several common dolphin groups numbering a few hundred each. In the past, common dolphins have not been a regularly sighted species in Hebridean waters, especially not as far north and west as current observations are indicating. This is an emerging trend which will be interesting to track.

In 2007, a government-funded project to study the distribution of bottlenose dolphins in Scotland which began in 2006, has continued. HWDT has been collaborating with Aberdeen University, the Sea Mammal Research Unit and the Scottish Association for Marine Science on the three-year study, contributing our sightings and photo-identification images to the project. Of the bottlenose dolphins encountered and photographically identified by HWDT in 2007, only one animal was a new addition to our catalogue, having not been previously sighted in their area of distribution between the Kintyre Peninsula in the south, to Skye in the north. This supports our previous findings that a very small number of bottlenose dolphins (~30) is present in the Inner Hebrides.

Our photo-identification catalogues for minke whales, common dolphins, Risso's dolphins, white-beaked dolphins and killer whales have all been added to this season. Basking sharks are also photographed and the images sent to the Shark Trust. There is only a very small group of killer whales present in Hebridean waters, and sightings are rare. However, in 2007 *Silurian* encountered killer whales four times towards the end of August and beginning of September. Two of these encounters, by Team VII, were excellent and provided high-quality images for photo-identification purposes. The same two animals, a large male and small female, comprised both encounters, one of which took place southwest of the Small Isles, the other west of Mull a few days later. The female is a new addition to our catalogue, and it is possible that the male is also a previously unidentified animal.

In order to interact with animals for the length of time and at a proximity necessary to obtain photo-identification images, a research permit is required from Scottish Natural Heritage. The total time in 'encounter effort' with each species (both Earthwatch and non-Earthwatch trips) sighted in 2007 is as follows:

Species	Total encounter time (mins)
Bottlenose dolphin	233
Common dolphin	532
Harbour porpoise	38
Killer whale	108
Minke whale	493
Risso's dolphin	68
White-beaked dolphin	190
Basking shark	301

This year we have continued our research into marine litter, as its presence, particularly plastics, is a significant conservation concern for cetaceans owing to ingestion and entanglement. The litter data from 2006 and 2007 are similar in that in both years, approximately 70% of items observed were confirmed as plastics (either plastic bags,

bottles, or other plastic items). However, fewer litter items were recorded in 2007 than in 2006 (368 compared to 547). Possible explanations for this decrease have not yet been investigated. We have also continued to track other anthropogenic impacts on the marine environment, logging boat traffic and the use of Acoustic Deterrent Devices (ADDs), employed to deter seals from salmon farms. Recordings are made of these devices whenever they are heard using our hydrophone. Their presence is especially high in the Sound of Mull/Firth of Lorne area.

Our seabird research initiated in the 2006 season has also continued this year.

How these data contribute to achieving conservation impacts:

By working to discover more about the whale, dolphin and porpoise populations on the west coast of Scotland, we are providing more detailed information and knowledge about how marine species use this area. A marine mammal watching industry has developed in this area and HWDT is committed to encouraging appropriate, controlled ecotourism activities. We were actively involved in development of the recently launched Marine Wildlife Watching Code for Scotland and our data contribute to the ordered development of marine mammal watching both directly and indirectly. The Hebridean marine environment supports a range of activities such as tourism, fishing, fish farming, shipping, offshore energy development and military exercises, all of which help to sustain the west coast of Scotland as an economically viable area. It is important to provide as much information on the marine life found here as possible to ensure that these activities are carried out in a way that ensures the sustainability of the area, both economically and ecologically.

The significance/ benefits of your research at the following levels:

Local (in the area of the research site)

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. In addition, we disseminate and share our research results in the following ways:

- 1) 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 encourages more people to continue reporting their sightings and build up our dataset.
- 2) 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.
- 3) 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, to begin to gather information regarding the number of animals, their range and movement pattern through the area. As discussed above, we are also collaborating in the Scottish Bottlenose Dolphin Project.

National

- 1) All cetacean sightings 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.

- 2) HWDT is working with the Cetacean Research and Rescue Unit (CRRU), which is a cetacean organisation on the east coast of Scotland. We are comparing minke whale identification shots in order to see if there are any matches between west and east coast animals.
- 3) HWDT has been working with the Marine Conservation Society in lobbying the Scottish Parliament to introduce a plastic bag levy. All data collected during HWDT surveys have been collated and presented as evidence.

International

- 1) All photo-identification images are submitted to the Europhlukes project, which is a Europe wide repository for cetacean photo ID catalogues.
- 2) Links with minke whale research projects in Iceland, Japan and Canada (ORES) have been established and will be developed through a PhD on: 'Site fidelity, habitat preference, and coastal ecology of the minke whale'.
- 3) Local killer whale sightings are being used in a study of population dynamics across the North Atlantic through a PhD project at Aberdeen University.

Communication of results

Printed: peer reviewed scientific publications; books / book sections; reports, management plans or policies; fact sheets, brochures, leaflets, pamphlets, posters, academic dissertations, annual reports, proceedings of conferences or workshops; letters; newsletters.

Embling, C.B. (2007) Predictive models of cetacean distribution off the West Coast of Scotland from passive acoustic survey data. PhD thesis, School of Biology, University of St Andrews

Foote, A.D., Vikingsson, G., Oien, N., Bloch, D., Davis, C.G., Dunn, T.E., Harvey, P., Mandleberg, L.C., Whooley, P., Thompson, R.M. (2007) Distribution and abundance of killer whales in the Eastern North Atlantic. Document # SC-59-SM5. Submitted to the Scientific Committee of the International Whaling Committee, May 2007

Wave, the newsletter of HWDT, published three times per year

Visual: artwork; visitor centre, poster or display, slides, photographs

HWDT runs a visitor centre, which is open all year to the general public and provides educational and interpretative information.

Digital: database; internet - websites, email group/ blog/forum; CD Rom, e-newsletter

During the field research season, *Silurian* volunteers file a daily blog about their onboard experiences which is available through the HWDT website.

Mass media: broadcast production; film; TV, radio, print (newspaper/ magazine coverage); press releases; press conference; interview, article creation; press trip

BBC TV 'Saving Planet Earth' (July 2007)

The Times, 20/06/07 'Dolphins far from home could signal sea warming'

The Scotsman, 17/10/07 'Giants who are a barometer of ocean's health'

Meetings and conferences: presentations/ lectures; conferences; workshops; training sessions; discussions; local community meetings and events.

An Integrated approach to non-lethal research on minke whales in European waters. A workshop held at the 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007.

Embling, C.B., Gordon, J., Shrimpton, J., Hammond, P.S. Using environmental models to predict harbour porpoise distribution and relative abundance from visual and acoustic survey data. Talk for 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007

Calderan, S.V., Stevick, P.T., Mandleberg, L.C. Density estimates of marine litter in a key cetacean habitat in North West Scotland. Poster for 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007

Stevick, P.T., Calderan, S.V., Speedie, C., Shrimpton, J., Embling, C.B. A trophic shift off West Scotland: minke whales and basking sharks Poster for 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007

Mandleberg, L.C., Stevick, P.T., Tetley, M.J., Gaillard, T., Johnston, P.J. Characteristics of the bottlenose dolphin population off the west coast of Scotland Poster for 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007

Ingram, S.N., Culloch, R., Cheney, B., Mandleberg, L.C., Stevick, P.T., Hammond, P.S., Wilson, B., Thompson, P.N. Distribution and abundance of bottlenose dolphins off the West Coast of Scotland Poster for 21st Annual Conference of the European Cetacean Society, San Sebastián, Spain, 2007

Training in and promotion of Marine Wildlife Watching Code to local boat operators (21/02/07)

Promotion of outdoor learning at Scottish Outdoor Learning Festival (30/04/07)

Wildlife guiding from Mull ferry (part of Wild Isles Week) (04-06/05/07)

Sightings information events as part of National Whale and Dolphin Watch week (23/06/07)

Public lecture on killer whale ecology (06/09/07)

Educational Opportunities

Does your project directly or indirectly involve the following groups in your research topic?

Local communities

Students

Early career scientists

Other groups

Local communities – HWDT is in direct contact with the local community in the following ways: we work closely with boat operators, ferry companies, fish farmers, and fishermen in the collection of data; we also visit local schools, colleges and community groups to give presentations and talks. In 2007 a group of local young people participated in a two-day monitoring trip to learn about their local environment and wildlife and contribute to our data-collection.

Students – University students spend time onboard *Silurian* to gain practical experience of survey techniques. In conjunction with the University Marine Biological Station, Millport, we run marine mammal survey courses aboard *Silurian* during the summer.

We also have opportunities for school students to undertake work experience placements with HWDT. We also provide data and logistical support for undergraduate and, in the future, Masters student projects.

Early career scientists – Several people have been involved in our research work to specifically learn skills relevant to their chosen career. HWDT also provides data for PhD projects. E.g. 'Site fidelity, habitat preference, and coastal ecology of the minke whale' (M. Tetley, in progress) and 'Population structure of North Atlantic killer whales' (A. Foote, in progress).

Other groups – HWDT runs a visitor centre, which is open all year to the general public and provides educational and interpretative information.

The ways our research helps these groups better understand the conservation of a sustainable environment:

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. As we start to teach primary school children of their role within the natural environment when they are young through school visits, they grow up into environmentally conscious adults, with whom we continue to work if they stay within the area and work in the main economies of tourism, fishing, fish farming and shipping. When students work with us, whether as volunteers on *Silurian*, on placements, or on short courses, they experience this integration of the trust within the community at first hand, and learn directly the importance of conservation being part of a community's development, not an artificial superimposition.

How our project has contributed to the completion of Masters' theses, or other educational research findings:

We worked with a PhD candidate from the Sea Mammal Research Unit at the University of St Andrews for three years, whose work is largely based on research carried out onboard *Silurian*. Following the completion of her work, a new PhD candidate started working with us towards the end of the 2006 season. In 2007, two undergraduates from the University of Oxford presented the results of their field research undertaken onboard *Silurian*. During 2007 several other students from various higher education establishments have also completed project work contributing to their degrees based on their work on *Silurian*.

Acknowledgements

It is a pleasure to acknowledge our funders and sponsors for their continuing support of our work. SMRU's advice and loan of equipment is also of continuing and essential assistance. *Silurian* is fortunate in having a team of hard-working and enthusiastic skippers and crew. Many thanks to them. Our volunteers make our work both possible and highly enjoyable, and we salute them.