

NADAIR 2 PROJECTS 82 AND 83 2005 TO 2008

FINAL REPORT

HEBRIDEAN WHALE AND DOLPHIN TRUST



NÀDAIR



RESEARCH

Silurian



Silurian at anchor, 2008 © G.Leaper/HWDT

Since 2003, surveys on the Hebridean Whale and Dolphin Trust's research vessel, *Silurian*, have been conducted throughout the summer months, amassing a significant and unique long-term dataset on cetacean distribution and abundance in the Hebrides. Visual surveys have been conducted over more than 2600km (which does not include 2008 data, which are yet to be analysed). Surveys have been most intensive and consistent in the Argyll Islands region, with additional effort in other regions of the West Coast (see Figs. 6). Effort has increased substantially since 2003 (Table 1), with more than twice the coverage in 2007 of either 2003 or 2004. Acoustic survey effort was added to the protocols during the 2004 season. This effort also increased dramatically in subsequent years, effort more than doubling from 2004 to 2007 (Table 1). This year is anticipated to be another high-effort season.

Thus far in 2008, HWDT has conducted six survey trips from April to July. Three of these trips were run using volunteers and support from Earthwatch, and one formed part of the Sea Mammal Research Unit MRes programme (see below). A further six trips will take place through the second part of the 2008 season, two of which are Earthwatch. The survey methodology was identical on all monitoring trips. Trips were either nine or twelve days long (seven and ten of those respectively being dedicated survey days, with an arrival and departure day at the beginning and end of the trip). 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 activities:

- Visual observations were conducted for all cetacean species, plus basking sharks, seals, seabirds, marine litter, and other vessels. In 2008, as part of a project investigating minke whale entanglement (see below), the occurrence of creels was also recorded by logging sightings of creel marker buoys
- Photographs of minke whales, bottlenose dolphins, common dolphins, white-beaked dolphins, killer whales, Risso’s dolphins and basking sharks were collected for individual identification. These photographs showed 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
- Continuous acoustic monitoring of harbour porpoises and other cetacean species was conducted using a high frequency towed hydrophone and detection/analysis software
- Recordings were made of any anthropogenic sounds detected, in particular Acoustic Deterrent Devices (ADDs)
- 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).

Table 1. Visual and acoustic effort from Silurian, 2003 – 2007 (2008 data under analysis)

Survey Effort (km)	2003	2004	2005	2006	2007
Visual	4007	3104	4371	6416	8187
Acoustic	N/A	5407	4634	7395	11170

Volunteers



Volunteers at work on *Silurian*, 2008 © G.Leaper/HWDT

Approximately 60 volunteers work on *Silurian* monitoring trips each year, with a maximum of six per trip. Volunteers stay onboard *Silurian*, and work as observers to collect data during visual surveys for cetaceans. They also conduct acoustic monitoring, enter data and assist with the deployment of hydrophones and other project equipment. For all these tasks, volunteers receive full training from our staff. In addition to training provided for research work, our science staff also deliver lectures and lead discussions on a variety of topics related to marine research and conservation. *Silurian* is a fully-equipped sailing vessel, and being involved in its running is an important aspect of the survey. Volunteers have ample opportunity to learn about sailing, and also assist with the day-to-day running of the research vessel, including cooking and cleaning.

Volunteers can come from any walk of life, and each volunteer brings with them an invaluable range of skills and experience, from those who understand the sea and sailing to those who may never have set foot on a boat, or seen a cetacean in the wild before. Our volunteers make our research possible, and present excellent value-for-money in the work they carry out. They work long hours carrying out visual observations and logging data, especially in the middle of summer when daylight hours are very long. Teams of two rotate as visual observers, entering data into our computer system and logging seabird sightings. Teamwork is extremely important if the research is to run smoothly.

What volunteers learn and gain from volunteering on one of our surveys is as varied as their backgrounds. They get full training in scientific research techniques, and benefit greatly from having marine science and sailing experts constantly at hand. They have the opportunity to see an amazing variety of wildlife in its natural habitat, visit remote and beautiful places, and get to know and work closely with a small team of like-minded people. Volunteers know that their hard work and enthusiasm contribute directly to knowledge and conservation of cetaceans in the Hebrides.

Survey routes

Our coverage of our survey area has been extensive and thorough. The survey tracks taken from 2003 to 2007 are as follows:



Fig. 1. 2003 survey tracks

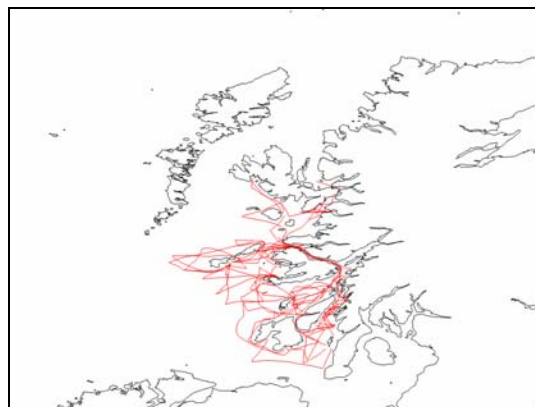


Fig. 2. 2004 survey tracks

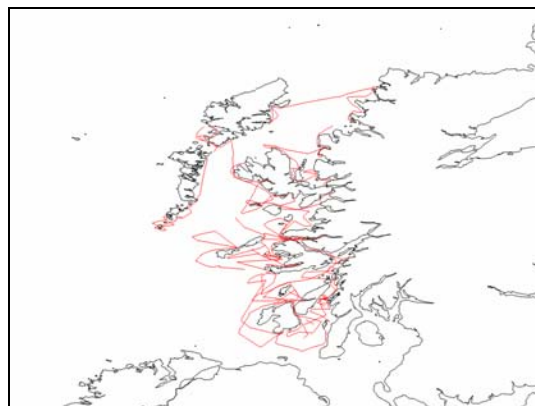


Fig. 3. 2005 survey tracks

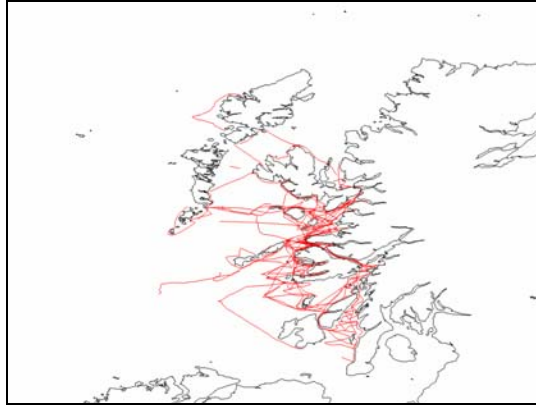


Fig. 4. 2006 survey tracks

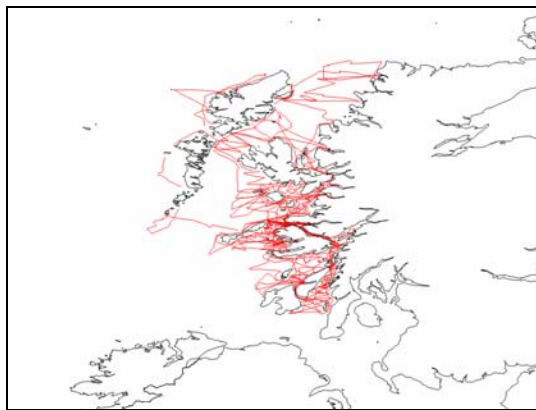


Fig. 5. 2007 survey tracks

As discussed, survey effort has been highest around the Argyll Islands, with additional coverage in more recent years in more northerly and westerly areas of the Hebrides. Figure 6 demonstrates the relative intensity of survey coverage across the area, both visually and acoustically from 2003 to 2007 (no acoustic surveys were conducted in 2003).

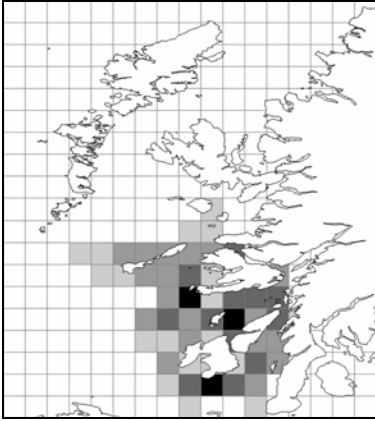


Fig. 6.1. visual effort 2003

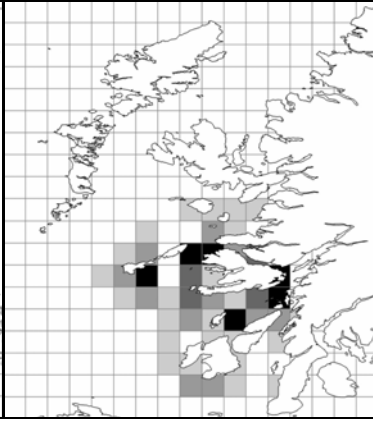


Fig. 6.2. visual effort 2004

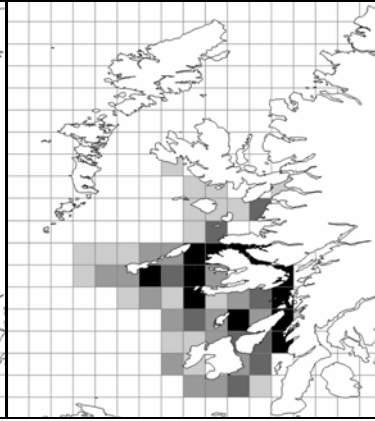


Fig. 6.3. acoustic effort 2004

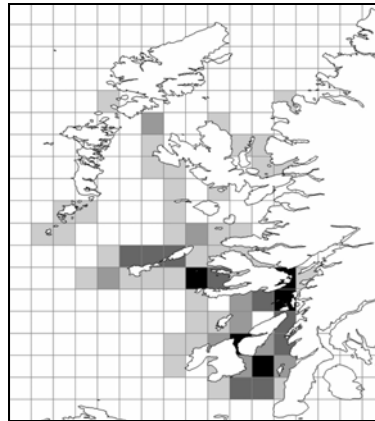


Fig. 6.4. visual effort 2005

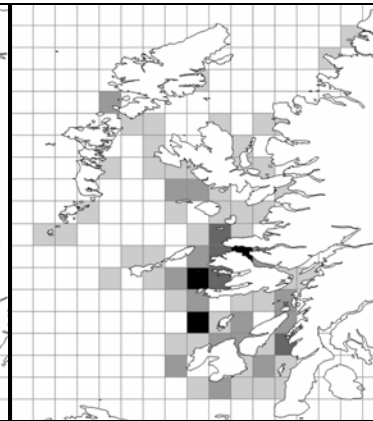


Fig. 6.5. acoustic effort 2005

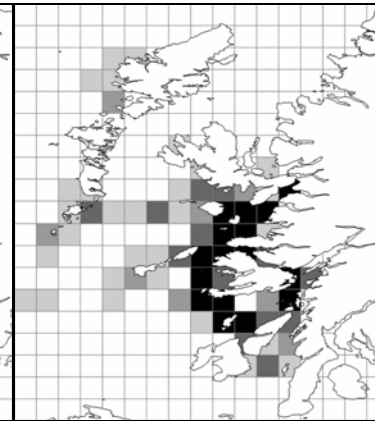


Fig. 6.6. visual effort 2006

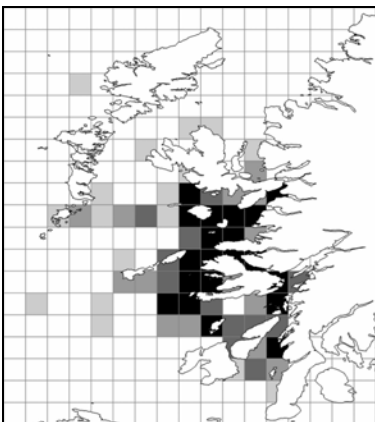


Fig. 6.7. acoustic effort 2006

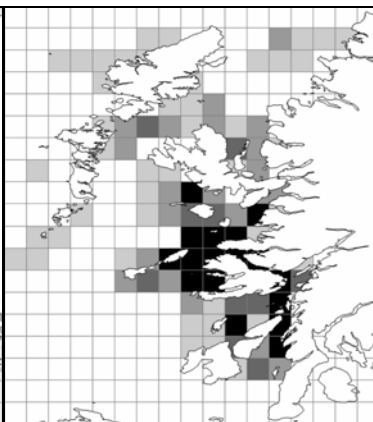


Fig. 6.8. visual effort 2007

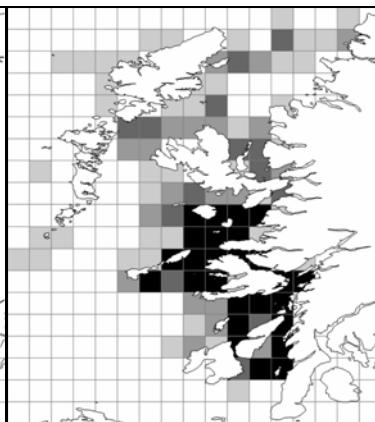
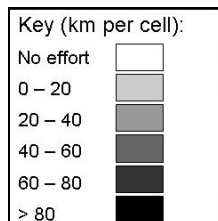


Fig. 6.9. acoustic effort 2007



From 2003 to 2007, sightings of Hebridean cetacean species from *Silurian* are as follows:

Table 2. On effort sightings in sea states of <4 from 2003 to 2007

Species	Sightings	Individuals	Years sighted
Harbour porpoise (<i>Phocoena phocoena</i>)	1096	1916	all
Common dolphin (<i>Delphinus delphis</i>)	37	1398	03, 05, 06, 07
Minke whale (<i>Balaenoptera acutorostrata</i>)	140	171	all
White-beaked dolphin (<i>Lagenorhynchus albirostris</i>)	17	78	03, 06, 07
Risso's dolphin (<i>Grampus griseus</i>)	17	58	all
Bottlenose dolphin (<i>Tursiops truncatus</i>)	12	50	all
Killer whale (<i>Orcinus orca</i>)	5	13	03, 04, 07
Humpback whale (<i>Megaptera novaeangliae</i>)	1	1	06

As the 2008 season is still in progress at the time of this report (mid-July 2008), data are yet to be analysed. The individual routes taken each trip so far in 2008, and the species encountered are as follows (Figures 7 to 12 and Table 3).

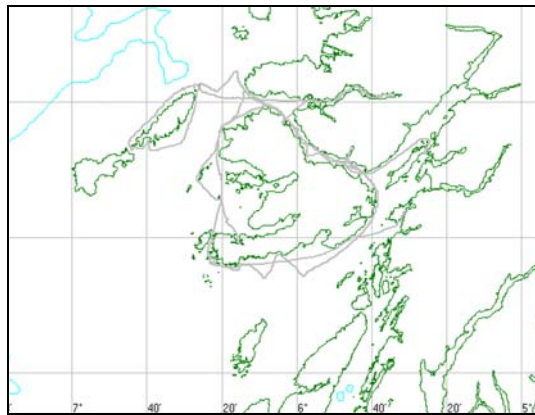


Fig. 7. HWDT 1 (31/03/08 – 10/04/08)

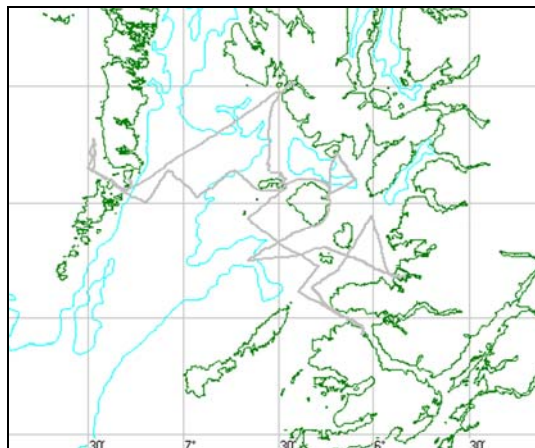


Fig. 8. HWDT 2 (29/04/08 – 07/05/08)

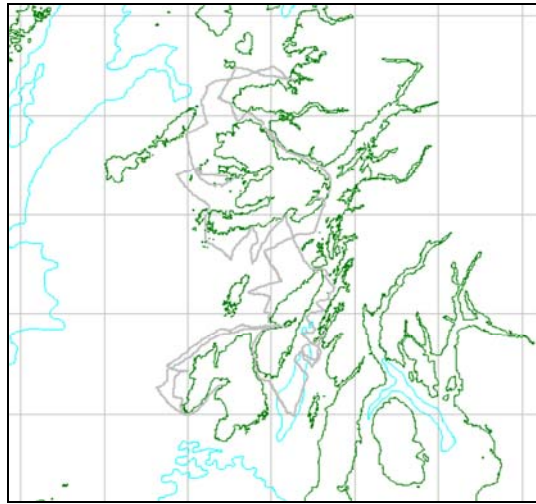


Fig. 9. HWDT 3 (19/05/08 – 30/05/08)

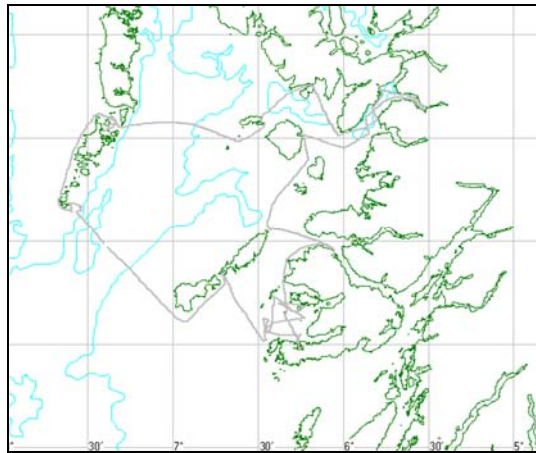


Fig. 10. EW 1 (02/06/08 – 13/06/08)

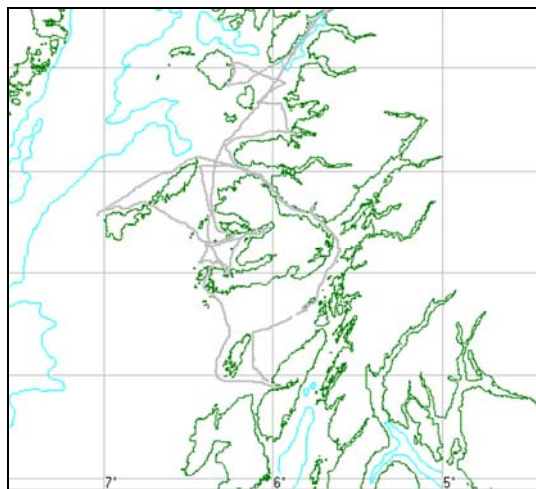


Fig. 11. EW 2 (16/06/08 – 27/06/08)

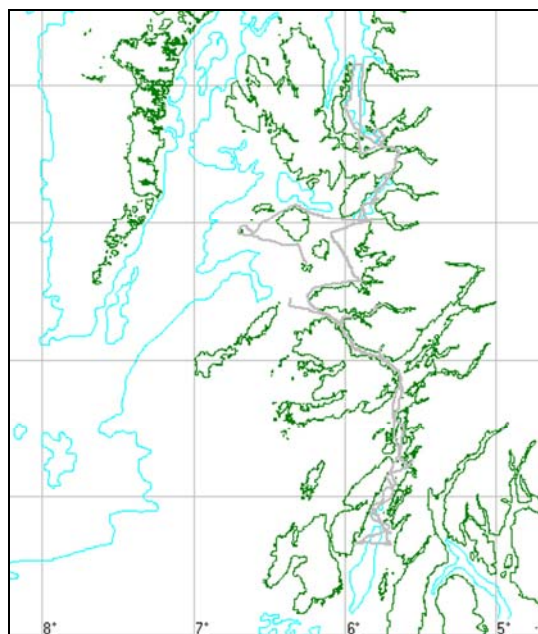


Fig. 12. EW 3 (31/06/08 – 11/07/08)

Table 3. Sightings up until mid-July 2008 (total)

Species	Sightings	Individuals
Harbour porpoise (<i>Phocoena phocoena</i>)	175	279
Common dolphin (<i>Delphinus delphis</i>)	3	27
Minke whale (<i>Balaenoptera acutorostrata</i>)	19	20
White-beaked dolphin (<i>Lagenorhynchus albirostris</i>)	2	29
Risso's dolphin (<i>Grampus griseus</i>)	1	14
Bottlenose dolphin (<i>Tursiops truncatus</i>)	2	20
Killer whale (<i>Orcinus orca</i>)	2	7
Humpback whale (<i>Megaptera novaeangliae</i>)	0	0

As for previous years, harbour porpoise continue to be the most frequently sighted cetacean in 2008. 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, which can continue to function and collect data irrespective of weather, sea state or light levels, is again, clear. 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 has identified patterns in porpoise distribution that are related to oceanographic features such as tidal currents and bottom type (Figure 13). This work, conducted 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 in 2006. To this end, survey design has been modified, allowing considerable time to be spent intensively surveying in areas which have been identified as potential harbour porpoise hotspots or

which may help to refine the habitat models. It is only through focussed research on favourable habitats for harbour porpoises that the data can be collected to enable their long-term conservation and management.

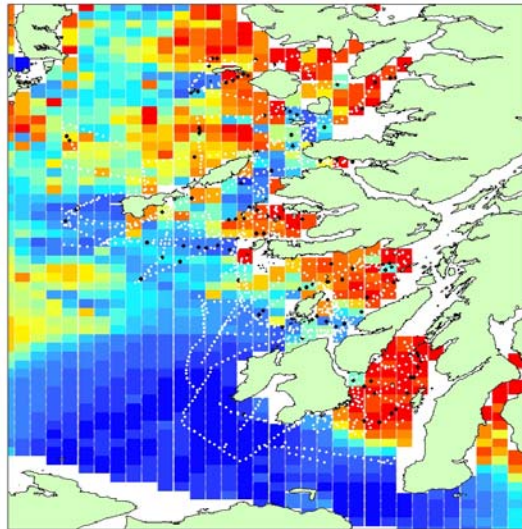


Fig. 13. Predictive model of harbour porpoise distribution on west coast of Scotland (from PhD C.Embling)

Minke whale sightings remain low in 2008, compared to numbers seen before 2005. Minke sightings began in mid-May, but have failed to gain any significant momentum to date. It continues to look likely 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.

In general in 2008, there has been a wide range of species sighted, in particular during the first trip in June, when harbour porpoise, bottlenose dolphins, common dolphins, white-beaked dolphins, Risso's dolphins, killer whales and minke whales were all sighted. However group sizes have generally been quite small, noticeable particularly in the case of common dolphins.

Photographic Identification

Bottlenose dolphins

Great progress has been made with HWDT's ongoing collection of photo-identification image catalogues in recent years. In the case of bottlenose dolphins, this has been in large part due to HWDT's participation in a government-funded project to study the distribution of bottlenose dolphins in Scotland which began in 2006. HWDT collaborated with Aberdeen University, the Sea Mammal Research Unit and the Scottish Association for Marine Science on the three-year study. HWDT operated a public sightings hotline for the project. This access to prompt information on dolphin location proved vital to the success of the programme. This season nine sets of identification photographs from

separate encounters have been submitted by the public and tour operators, adding considerable depth to the data from the 2007 season. To date, there are 35 animals in the bottlenose dolphin catalogue for the Inner Hebrides, and 18 animals in Barra Sound. So far no matches between the two populations have been found, although a solitary animal seen around Coll and Tiree in 2004 and possibly 2005 has been matched with an animal which is now regularly sighted in Barra (2006 and 2007).



Bottlenose dolphins, Barra Sound, 2008 © G.Leaper/HWDT

Minke Whales

Our minke whale catalogue now comprises 108 animals. This catalogue is now at a point which allows comparison with animals on the east coast of Scotland, analysis which is currently underway in collaboration with the Cetacean Research and Rescue Unit (CRRU). The catalogue is also being used in a collaborative project between the University of St Andrews and HWDT funded by the Scottish Government to investigate minke whale entanglement in fishing gear, especially creel lines. In conjunction with a student from the Sea Mammal Research Unit Marine Mammal Science MRes course, we have been examining images in our catalogues for evidence of scarring which could be attributable to interaction with fishing gear. Also as part of this project, on HWDT's *Silurian* surveys, all sightings of creel buoys are being logged to assess the differing density of creel fishing across the Hebrides.

Killer Whales



Adult male killer whale, west coast of Mull, 2008 © G.Leaper/HWDT

There is only a very small group of killer whales present in Hebridean waters, and sightings are rare. A collaborative project on Scottish killer whales between the Hebridean Whale and Dolphin Trust and Andy Foote, a PhD student at the University of Aberdeen funded by the Scottish Executive, Scottish Natural Heritage and the Carnegie Trust is currently underway, analysing killer whale data from the west coast in the context of the eastern North Atlantic population as a whole. The total number of individuals identified on the west coast is 13. Some animals have been identified over many years, and the re-sighting rate is high. One animal, 'John Coe', has been sighted regularly over the past 15 years around the West Coast of Scotland. He 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 34 years old. However, this animal appears to be the only long-distance sighting, with no sightings of Hebridean animals in Shetland, Orkney the east coast of Scotland. The only match of west coast killer whales with those from the Northern Isles was a sighting from St Kilda, which may represent a different, offshore population. This work is resulting in a number of publications in peer-reviewed journals (see below).

In addition to our photo-identification catalogues for bottlenose dolphins, minke whales and killer whales, our image records of common dolphins, Risso's dolphins and white-beaked dolphins have also been added to this season. Our growing photographic database of whales and dolphins allows us to identify and track individual animals from year to year, increasing our knowledge of their movements and preferred habitats. Basking sharks are also photographed and the images sent to the Shark Trust.

Our research into marine litter continues in 2008. Its presence, particularly plastics, is a significant conservation concern for cetaceans owing to ingestion and entanglement.



Marine litter, Mull, 2008 © S.Calderan

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. These data are currently being used in a collaborative project between the University of St Andrews and HWDT for the Scottish Aquaculture Research Forum (SARF) investigating the effects of ADDs on cetaceans using two complimentary approaches working at different scales.

Our seabird research, using seabird distribution as an ecological indicator to provide information on environmental and habitat changes has also continued into 2008.

Sea Life Surveys

The data collection system used on *Silurian* (LOGGER) has also been installed on local whale watching vessels since 1992. This has provided us with 17 years of effort and sightings data, which are of continued research use, both for peer-reviewed publications, PhD work and commissioned reports.

Public sightings

The HWDT Public Sightings Network began officially in 2001, although records go back to the early 1990s. In 2007, the collection of sightings reported by the public was made more efficient through the provision of an online data recording facility. The majority of >250 sightings reports so far in 2008 continue to be of minke whales and bottlenose dolphins, although in 2008, more unusual reports have also been submitted, such as a beluga, sperm whale and humpback whale. The Network has been particularly useful in our collaborative work on killer whale populations (see above). The Network also includes the reporting of strandings, and played a key role in the early part of 2008, when multiple strandings of deep-diving cetaceans, in particular Cuvier's beaked whales and pilot whales, occurred on the west coasts of Scotland, Ireland and Wales (see below). It is

also invaluable as an important way of involving people in their marine environment, through increased awareness of their local wildlife, and of HWDT.

Military Activity

The effects of military activity, in particular the use of sonar, is a conservation concern for cetaceans, and is an issue which HWDT continues to monitor. In 2006, HWDT joined a 2006 Continental Shelf-edge trip in conjunction with WDCS to monitor military activity in the area. In early 2008, an atypical stranding even of deep-diving cetaceans in the Hebrides (see above) was considered to be possibly attributable to military activity. In conjunction with WDCS, HWDT submitted a Freedom of Information request to the Ministry of Defence to help ascertain whether this event could have been connected to the use of military sonar. Subsequently, HWDT co-authored a paper to the IWC on this multiple stranding event (see below). In April 2008 HWDT monitored Operation Joint Warrior, a large international NATO marine training exercise which was carried out over two weeks, and recorded prolonged use of sonar, which is to be analysed later this season.

Students

HWDT continues to work with and support students at all levels, and gains considerably from these valuable collaborations. Clare Embling completed her PhD in 2008 on predictive models of cetacean distributions off the west coast of Scotland. Cormac Booth, Andy Foote and Mike Tetley continue their PhDs all collaborating with HWDT on harbour porpoise, killer whales and minke whales respectively. 2008 saw the first year 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 is conducting a minke whale project. During 2007 and 2008, HWDT has also supported Chris Walker, a student of Multimedia Design at Sheffield Hallam University, for whom HWDT has been a 'client' and basis for project design work.

Communication of results

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 outwith the scientific community. In 2007/8, HWDT has been particularly successful in this respect.

Papers and Presentations using HWDT data

(Staff in bold, Students in bold italics)

2008 ECS presentations

Bolt H. E., P. V. Harvey, **L. Mandleberg**, P. M. Thompson and **A. D. Foote** Estimating killer whale predation levels on Shetland harbour seals.

Booth, C. G, C. B. Embling, P. T. Stevick, D. Gillespie, J. Gordon and P. S. Hammond. Inter-annual differences in harbour porpoise distribution on the west coast of Scotland.

Calderan, S. V., C. R. Weir, M. Unwin, R. L. Pitman, **C. Booth**, T. Photopoulos and K. Robinson. White-beaked dolphin (*Lagenorhynchus acutus*) occurrence in the Minch (Scotland, UK) during August 2007.

Foote, A. D., T. Simila, G. Vikingsson and **P. T. Stevick**. Estimates of movement and site fidelity of North Atlantic killer whales using opportunistic individual identifications.

Mandleberg, L. C., S. V. Calderan, P. T. Stevick, C. B. Embling, J. Shrimpton and C. G. Booth. Cetacean diversity in north west Scotland: an oceanographic perspective.

2008 IWC presentations

Dolman, S.J. Reid, R.J., Barley, J.P., Deaville, R., Jepson, P.D., O'Connell, M., Berrow, S., Penrose, R.S., Pinn, E., **Stevick, P.T., Calderan, S.**, Robinson, K.P., Doyle, T.K., Brownell, R.L. and Simmonds, M.P.. A preliminary note on the unprecedented strandings of 45 deep-diving odontocetes along the UK and Irish coast between January and April 2008. Document SC/60/E5 presented to the International Whaling Commission, May 2008 .

Stevick, P. T. 2008. Quantifying rates of inter-area movement using capture-recapture results: a comparison of methods. Document SC/60/SD7 presented to the International Whaling Commission, May 2008.

Papers

Submitted

Bolt H. E., P. V. Harvey, **L. Mandleberg**, P. M. Thompson and **A. D. Foote** Estimating killer whale predation levels on Shetland harbor seals. Submitted 25/2/08 to Marine Ecology Progress Series.

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

In Preparation

Calderan, S. V., Stevick, P. T., 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.

Embling et al., (authorship to be determined) Predictive models of harbour porpoise distribution & relative abundance in the Inner Hebrides, Scotland: Evaluating the effect of different survey data techniques, time and space on model robustness.

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

Foote, A. D., T. Simila, G. Vikingsson and **P. T. Stevick**. Estimates of movement and site fidelity of North Atlantic killer whales using opportunistic individual identifications. In prep for Journal of Applied Ecology.

Mandleberg, L. C., S. V. Calderan, P. T. Stevick, C. B. Embling, J. Shrimpton and C. G.

Booth. Patterns of cetacean biodiversity in west Scotland are related to oceanographic features.

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

Non-refereed publications

Footo, A. D., Víkingsson, G., Øien, N., Bloch, D., Davies, C.G., Dunn, T.E., Harvey, P., **Mandleberg, L.,** Whooley, P. and Thompson, P.M. 2007 Distribution and abundance of killer whales in the North East Atlantic. Paper SC/59/SM5 submitted to the Scientific Committee of the International Whaling Commission (invited paper).

Mandleberg, L. Bottlenose dolphins of the Hebrides: a summary report from five years of research (2001-2005).

Robinson, K. P., **P. T. Stevick** and C. D. MacLeod (eds). 2007. Proceedings of the workshop; An integrated approach to non-lethal research on minke whales in European waters. Held at the 21st Annual Conference of the European Cetacean Society, San Sebastian, Spain, 2007. ECS Special Publication Series No 47.

Stevick, P. T. 2007. Evidence for changes in minke whale prey off Scotland: Why collaboration matters. pp 42-47 in Robinson, K. P., Stevick, P. T. and MacLeod, C. D. (eds). Proceedings of the workshop; An integrated approach to non-lethal research on minke whales in European waters. Held at the 21st Annual Conference of the European Cetacean Society, San Sebastian, Spain, 2007. ECS Special Publication Series No 47.

Stevick, P. T. 2008. The changing status and distribution of whales. Proceedings of the conference on Whaling and the Hebrides. Islands Book Trust

Mass Media coverage 2008

Table 4. Media coverage for HWDT up to July 2008

Medium	Date	Publication	Title
Magazine	Jan-08	Easyjet inflight magazine	Monitor Whales and Dolphins in Scotland
Newspaper	Feb-08	Press & Journal	Plea over dolphins and whales washed up on beaches
Newspaper	Feb-08	Am Muileach – local paper	Stranded dolphins on west coast beaches
Newspaper	21/02/08	The Oban Times	Dolphin and whale spotter wanted
Newspaper	28/02/08	Daily Mail	This whale washed up dead on a Scottish beach. In it's stomach...the remains of 23 plastic bags
Newspaper	Mar-08	Round & About – local	World book day offer
Newspaper	16/04/08	The Press and Journal	Naval Sonar activity suspected of causing high number of rare whale strandings
Radio	24/04/08	BBC Radio 4	Open Country
Newspaper	May-08	Am Muileach – local paper	Rare Whales Stranded in the Hebrides
Newspaper	09/05/08	Ullapool News	Beach clean highlights rubbish issue
Newspaper	June-08	Am Muileach – local paper	The seal that came in from the cold
Newspaper	June-08	Ullapool News	Watch out for whales and dolphins
Magazine	July-08	The Sea	Watch Whales in the Hebrides
Magazine	Spring-08	WWF	The Sundance Kids
Magazine	Spring-08	WWF	Record year for Killer Whales
Magazine	Spring-08	Clyde Breakers	Argyll & Bute beach Forum Birthday Event
Magazine	Summer-08	WWF	A Permanent Feature?

PUBLIC OUTREACH

Public workshops, talks and events:

Over the last three 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. These have been located throughout Argyll and the Atlantic Island area and also occasionally in a wider area. In total since April 2005 about 50 workshops, talks and events have been delivered. The following table outlines those delivered between October 2007 and July 2008.

Table 5. Public events attended by HWDT, October 2007 to July 2008

Event	Description	Date	Location
Clyde SSMEI Forum	Forum for Clyde Scottish Sustainable Marine Environment Initiative	November 2007	Glasgow
SAC – Firth of Lorn and Loch Creran meeting	Special Area of Conservation stakeholders meeting	January 2008	Oban
Open Boat	Local business information event	24 th October 2007	Tobermory
Beach forum	Presentation and workshops, Marine Litter CD-ROM launch	23 rd October 2007	Oban
Talk	Meeting of Glasgow University Zoological Society	24 th January 2008	Glasgow
Talk	Presentation by Clare Embling on PhD work	14 th February 2008	Tobermory
Celebratory event	RSPB Nadair project, provider of beach workshop for children	28 th March 2008	SAMS, Oban
Talk	Talk for holiday visitors	5 th May 2008	Craignure, Mull
Open boat	Aboard <i>Silurian</i>	14 th May 2008	Port Ellen
Wildlife week	Local wildlife events	May 2008	Tobermory
National Whale and Dolphin Watch	Cetacean watch for general public	23 rd June 2008	Ardnamurchan lighthouse
Opening event	Stall and workshop provider	3 rd July 2008	Tobermory
Eigg playscheme	Workshop on the beach for 23 young people	8 th July 2008	Isle of Eigg
Beach workshop	For general public	15 th July 2008	Tobermory
Highland Games	Stall and interpretation	24 th July 2008	Tobermory
Highland Games	Stall and interpretation	26 th July 2008	Fort William
Highland Games	Stall and interpretation	30 th July 2008	Arisaig



Beach workshop © HWDT

Following the successful introduction of Open Evenings on *Silurian* last year, a similar event was included in the May education visit to Islay. This allowed about 60 parents, children and interested members of the general public to learn about the work of the Trust and local marine life by joining staff aboard.

HWDT has delivered the first two in a summer series of beach workshops. These have been planned for this summer following successful developments in this area last year. Workshops will be based around Mull and targeted at both young visitors and locals alike to educate and inspire children about the local beach environment and its life.

Over the last three years HWDT has travelled extensively in Argyll to run stalls at community shows and games to provide both information (such as leaflets and newsletters) and raise awareness of the marine environment. We have also targeted young people by running competitions and providing information which was appropriate for this audience. Over the years thousands of people have been involved and these events have proved valuable in increasing interest and awareness of cetaceans and raising the profile of HWDT's work within local communities.

Newsletter

Table 6. Wave and Wavelet publication dates

Dates:	Wavelet editions:	Wave editions:
April 2005 – March 2006	Spring	Spring
March 2006 – April 2007	Summer, Winter	Summer, Winter
April 2007 – March 2008	Summer, Autumn, Winter	Summer, Autumn, Winter
April 2008 – July 2008	Spring	Spring
	Total editions: 7	Total editions: 7

HWDT has continued to publish our adult members' magazine, Wave and junior edition, Wavelet, on a regular basis to provide readers with an update of our work, local marine and cetacean issues and other topics of interest. This members' magazine reaches a wider audience via our shop, at events and is offered to all schools which participate in our programmes. Each edition of Wave is distributed to around 1000 people and each edition of Wavelet about 500 and so more than 10,000 copies in total have been distributed within the three year period.



Wave and Wavelet

Website

The website remains a key method of communicating to a geographically widespread audience. We have continued to prioritise updating the content and functionality of our website in order to maximise its effectiveness. The web log has been updated again daily this season to provide a wide audience with information about both our monitoring and education trips on *Silurian*. News items on our homepage have been regularly renewed to provide latest sightings, report findings and raise awareness of forthcoming events.

On the Kids Site eleven new activities have been added to the 'Make and Do' pages. The website-generated 'ask us' questions have continued to keep the Education Team busy – between October 2007 and July 2008 we received 77 enquiries. Downloadable teaching resources have been made available online since January 2007 and on average 150 people per month have visited this area of our site since then, of which just over half visited the Primary level resources.

Visits to the website have remained high:

Table 7. Website use 2006 - 2008

Period covered	Number of months	Total numbers of users	Average number of users per month
April 2006 – September 2006	6	247, 032	41, 172
October 2006 – March 2007	6	287, 640	47, 940
April 2007 – September 2007	6	325, 497	54, 250
October 2007 – March 2008	6	287, 898	47, 983
April 2008 – June 2008	3	196, 977	65, 659

These data refer to total sessions served i.e. individual user visits (the number of visitors to the site) and do *not* refer to hits. We are currently making substantial changes to our website to ensure that it provides the most up to date information possible and to make use of ever progressing technical changes. With continued improvement to our site we look forward to a further increase in the number of users.

EDUCATION



School visit, 2008 © HWDT

School visits

In the last three years the education programme has gone from strength to strength in terms of quality of service, efficiency and value. 1, 456 students from 46 different schools have benefitted from our formal education programmes either on *Silurian*, in the classroom or on the beach. All schools have been visited in the Atlantic Islands area with many mainland additions. 43% of these schools have received two or more visits in this period which has added value and allowed for more in depth coverage of content and very positive relationships to develop between HWDT and these schools. (see Table 8)

Table 8. Multiple Visits to Schools

Establishment	Visit 1	Visit 2	Visit 3
High schools:			
Oban	2005, Boat	2006, Boat	
Tobermory	2006, School	2007, Boat	2008, School
Tiree	2007, Boat	2007, School	
Islay	2005, Boat	2006, Boat	2007, Boat
Campbeltown	2007, School		
Lochgilphead	2006, School		
Tarbert	2007, School		

Establishment	Visit 1	Visit 2	Visit 3
Primary Schools:			
Arinagour, Coll	2007, Boat	2008, School	
Bowmore, Islay	2005, ABREEF	2007, Boat	2008, Boat
Bunessan, Mull	2006, Boat	2007, Boat	
Dervaig, Mull	2005, Boat	2006, Beach	

Gigha	2005, Boat	2006, School	
Iona	2006, Boat	2007, Boat	
Keills, Islay	2005, ABREEF	2006, Boat	
Kilchattan, Colonsay	2006, Boat	2007, School	
Lismore	2006, Boat		
Lochdonhead, Mull	2007, School	2007, Beach	
Luing	2005, Boat	2007, School	
Port Charlotte, Islay	2005, ABREEF	2006, Boat	
Port Ellen, Islay	2005, ABREEF	2007, Boat	2008, Boat
Salen, Mull	2007, Boat	2008, Beach	
Small Isles, Jura	2005, Boat	2007, Boat	2008, Boat
Tiree	2007, Boat	2007, School	
Tobermory, Mull	2005, Boat	2007, School	2008, School
Ulva, Mull	2005, Boat	2006, Boat	

Feedback has confirmed that well qualified staff deliver a high quality product using materials and practices which have been refined over the last few years. Schools value the unique work we do, our expertise and the high staff to student ratios offered. HWDT has continued to offer input to schools in remote areas despite the considerable time and costs involved to visit and children, and staff in these areas have been very receptive to HWDT's 'outside' programmes. Outdoor learning has remained a priority and has been found to be powerful and beneficial to those students involved. *Silurian* provides a unique teaching environment which allows for direct hands-on learning about the marine environment.

As the Nadair programme comes to an end, we have been looking at ways to increase the sustainability of the programme. We have been researching and piloting the use of a small charge, in-line with other organisations delivering educational programmes.

School visits between October 2007 and July 2008 have included a range of school based visits and outdoor learning workshops both on the beach and on *Silurian* and has involved nearly 250 students. Pre-visit information has been improved and standardised to ensure all group leaders and parents are well informed of HWDT and the education work they are to participate in and leaders are fully aware in advance of the hazards, risks and control measures adopted.



School visit, 2008 © HWDT

Table 9. School Visits October 2007 to July 2008

School	Island/Mainland	Number of Children	Dates visited	Location of Visit
Kilchattan Primary, Colonsay	Island	10	15 th November 2007	School
Tiree Primary	Island	39	11 th and 12 th December 2007	School
Tiree High School	Island	12	12 th December 2007	School
Arinagour Primary, Coll	Island	21	4 th March 2008	School
Tobermory Rainbows	Island	7	11 th February 2008	School
Tobermory Primary	Island	16	13 th February 2008	School
Tayvallich Primary	Mainland	18	12 th May 2008	Boat
Port Ellen Primary, Islay	Island	24	13 th May 2008	Boat
Bowmore Primary, Islay	Island	42	14 th and 15 th May 2008	Boat
Small Isles Primary, Islay	Island	15	16 th May 2008	Boat
Salen Primary, Mull	Island	19	3 rd June 2008	Beach
Tobermory	Island	31	10 th June 2008	School

Primary				
Total number: 13		Total number: 243		

Courses:

Over the three years we have extended and developed our outreach and education activities in the areas of university level education, teacher training, the education of interested adults and educating people whose work is associated with conservation.

Since March 2006 we have run eight Marine Mammal Courses for adults to learn about marine mammal research including lectures and one day of training and monitoring on *Silurian*. The course has been refined and developed to be very successful with good uptake of places, focused content and a wide range of participants including those with a general interest to those whose work involves conservation (for example, Wildlife Trusts, and SNH). Feedback has been positive, especially for recent courses which have benefited from HWDT's growing experience of course delivery.

Another training development has been the three days of field-based courses run for the University Marine Biological Station, Millport (part of the University of London), teaching students practical vessel-based cetacean research skills on *Silurian*.

Plans are also developing for a programme of courses for Argyll College, part of the University of Highlands and Islands network which will continue development of this area of HWDT's work.

Table 10. HWDT Courses October 2007 to July 2008

Title:	Dates:	Land or boat based:
WISE (accreditation scheme for wildlife boat operators)	March, 2008	Boat
SMRU MRes field work modules	31 st March – 10 th April 2008	Boat
Marine Mammal Course	11 th – 13 th April 2008 25 th – 27 th April 2008	Land and boat
University Marine Biological Station, Millport. Part of the University of London	12 th – 14 th July 2008	Boat

Resource development

The Education Team has created resources to effectively interpret the marine environment and educate a diversity of people including teachers and the general public. HWDT's new interpretative banners and leaflets have been used to good effect at events, talks, and in our Visitors Centre.

To raise awareness of the issue of marine litter the Education Team created a CD-ROM resource in September 2007 for high school teachers. The CD was distributed to all high schools in Argyll and Bute, Highland Region, North Ayrshire, South Ayrshire, Orkney, Shetland, Western Isles, and Inverclyde as well as to some coastal High Schools in Dumfries and Galloway. Copies were sent to all Biology and Geography High School teacher training colleges in Scotland, many of the marine rangers in Scotland, marine and environmental education centres throughout the UK and other organisations including the RSPB, WWF, JMT, SNH, FSC and MCS.

Other resources developed for primary and secondary level teachers have been published online. These cover a range of curriculum linked topics including food chains and webs, population distributions, and research methods, for example. Recent growing interest in Eco-schools has encouraged HWDT to include a set of resources online to help teachers deliver the Biodiversity topic.

Internal documentation and cataloguing work now means that HWDT has materials for use on the beach, in school and on *Silurian* available, putting us in a very good position to develop our programmes further in the future.

Other work

Office-based volunteers have always been important to HWDT's education and research teams. Since October 2007 the education team has hosted three volunteers who have worked on specific projects including the development of teaching resources, in science, art, and cleaning a cetacean skeleton for classroom use. HWDT has benefitted from the skills and time offered by these volunteers who completed effectively the project outcomes.

In the last three year period HWDT has consolidated its work. Policy and strategy documents are now in place to support our work in the future. The education strategy forms a key part of the 5 year business plan which is currently being revised. Health and safety procedures and practices are firmly established.

By the end of the 2008 season, HWDT will have six years of data collected from *Silurian*, a significant body of information with which long-term trends or changes in activity can begin to be assessed. This is a vital resource in these times of environmental and climate change. During this time we have also been visiting schools and delivering an educational programme in islands and remote areas, fostering an increased understanding and feeling of responsibility for the marine environment amongst local people. Indeed, the strength of our monitoring and education project its continuity and longevity, and it is of great importance to the future conservation status of Hebridean cetacean populations that our survey and education work continue long after the cessation of Nadair 2.