

EARTHWATCH INSTITUTE FIELD REPORT

Project Title: Whales and Dolphins of Moray Firth

Principal Investigator: Dr. Kevin Robinson

Position/Affiliations: Director, Cetacean Research and Rescue Unit (CRRU)

Research Site: The outer southern Moray Firth, northeast Scotland (57°41'N, 2°00'W)

Local Management Status of the Research Site: The inner firth was officially appointed a Special Area of Conservation (SAC) in March 2005.

Scientific names of primary species being studied: *Balaenoptera acutorostrata* (minke whale), *Tursiops truncatus* (bottlenose dolphin) and *Phocoena phocoena* (harbour porpoise).

Key Research Objectives:

The underlying objectives of the charity's research efforts aim to:

- record/document the occurrence and biodiversity of the cetacean species in NE Scottish waters;
- monitor the status and welfare of coastal cetacean populations in this area of the North Sea;
- identify prime areas/habitats used by key inshore species;
- evaluate (and propose solutions to) the underlying threats faced by the species using these key areas;
- conduct detailed research into the biology, ecology and population dynamics of the principal coastal cetacean species found in this location;
- study the best methods for promoting long-term conservation of the marine environment (particularly through collaboration with partner organisations and the Local Biodiversity Action Plan process).

Historically, environmental education has also formed a central component of the CRRU's ongoing work with whales and dolphins in Scotland – the extensive public interest in the whales and dolphins of the Moray Firth providing a valuable opportunity for educating people about the detrimental anthropogenic (manmade) impacts / threats to these marine mammals and their coastal habitat. In this respect, the charity continues to undertake a rigorous educational programme, working with teachers and schools, local and national interest groups, corporate bodies, universities and students, the general public, the media and other animal welfare bodies and partners.

Data Collection and Results

a) Data collected during the past field season.

The CRRU facilitated eight Earthwatch teams between May and October 2006, with each team lasting 12 days in duration (arriving on a Sunday and leaving on a Thursday). The team dates in 2006 were: 21 May to 1 June, 4 to 15 June, 18 to 29 June, 2 to 13 July, 16 to 27 July, 30 July to 10 August, 13 to 24 August, 27 August to 7 September. A total of 51 Earthwatch participants joined the CRRU across these dates.

Between May and October 2006, a total of 135 part surveys were carried out on 64 survey days, covering a total survey distance of 2,908.5 km (table 1). 278 encounters were recorded during the survey period with four different species of cetacean: 132 harbour porpoise (*Phocoena phocoena*) encounters, 117 minke whale (*Balaenoptera acutorostrata*) encounters, 28 bottlenose dolphin (*Tursiops truncatus*) encounters and one Risso's dolphin (*Grampus griseus*) encounter (table 2). The overall percentage of time spent with the study species was approximately 32%. The distribution of the animals encountered during 2006 is shown in figure 1.

Table 1: Summarising the survey effort carried out from dedicated cetacean surveys with the help of Earthwatch volunteer teams between May and October 2006 inclusive.

2006	No. of days part surveys made	Total no. of part surveys	Total effort (km)
May	6	7	213.05
Jun	13	20	376.65
Jul	16	33	804.75
Aug	11	39	796.45
Sep	15	33	661.50
Oct	3	3	56.10
Total	64	135	2,908.50

Table 2: The total number of encounters and the cumulative number of encounter hours (including percentage time spent) with each of the study species during 2006. The total number of animals encountered is given for each species in parentheses.

Total no. of harbour porpoise encounters	Porpoise encounter hours	Total no. of Bottlenose dolphin encounters	Bottlenose encounter hours	Total no. of minke whale encounters	Minke encounter hours	Total no. of encounters with other cetacean species	Other species Encounter hours
152 (315)	15.4 (5%)	29 (406)	41.2 (13%)	118 (123)	42.2 (14%)	1 (15)	0.4 (<0.1%)

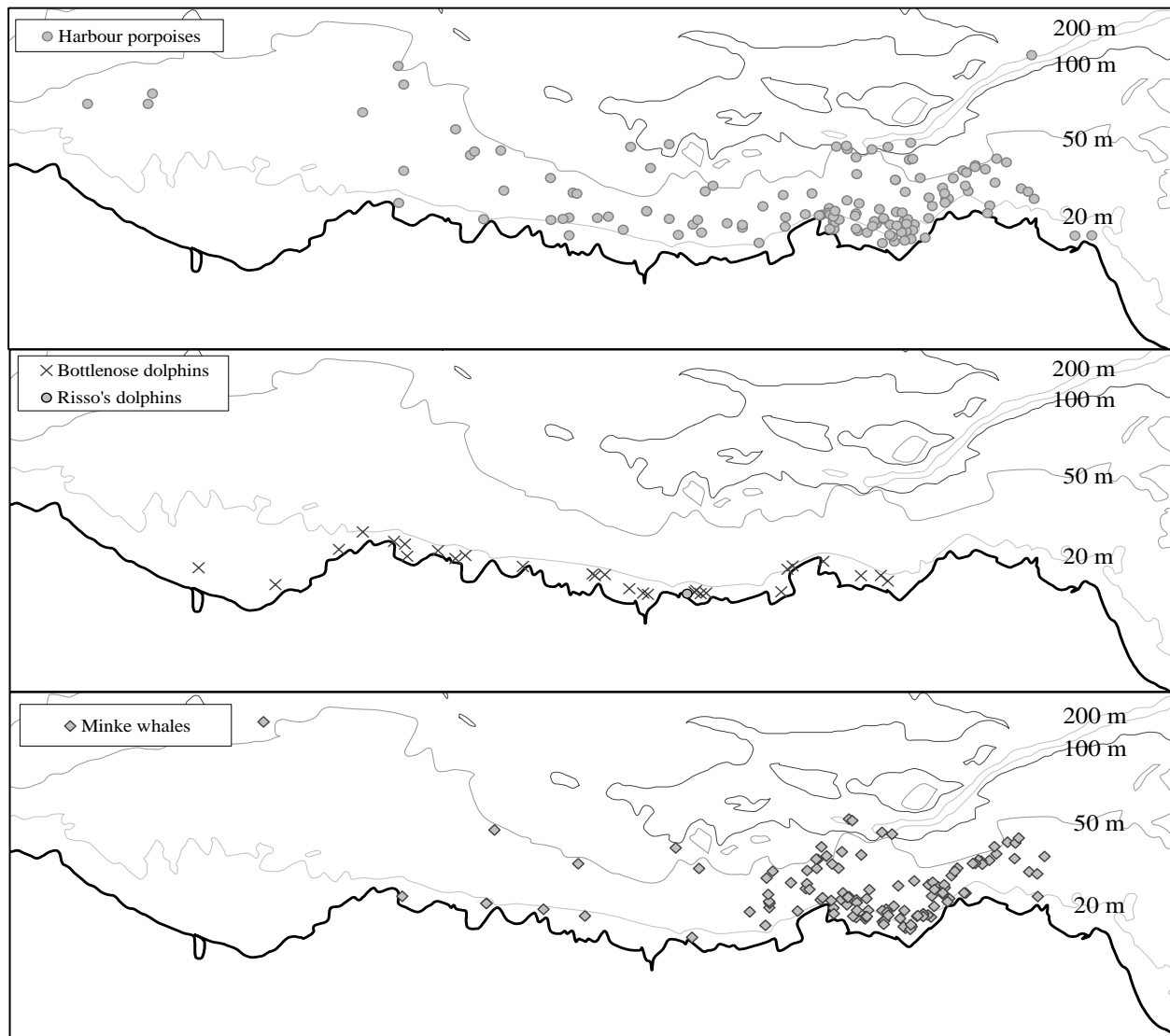


Figure 1: Maps detailing the distribution of cetacean sightings from dedicated boat surveys along the southern coastline of the outer Moray Firth between May and October 2006.

b) Progress towards achieving original objectives

Studies in 2006 took a directed approach to answering specific questions targeted at furthering our knowledge of the cetacean community in northeast Scotland's coastal waters. Further to a very productive field season, with exceptionally high sightings of the three main study species, the resulting datasets were extremely beneficial and complementary to earlier work – as well as facilitating several postgraduate studies and an undergraduate study. The scientific output arising from ongoing work included a number of submissions of publications to the *Journal of Marine Biological Association of the UK*, *Lutra* and *Remote Sensing of Environment* amongst others in progress (all highlighted in the following section), as well as several accepted paper submissions and a hosted workshop for the 21st Annual European Cetacean Society meeting in San Sebastian, Spain, in April 2007. In addition to the scientific field work objectives, further progress with the charities' educational and training programmes was also accomplished.

c) Summary of research results

Comprising 51% of all encounters, the harbour porpoise continued to be the most frequently sighted coastal cetacean in 2006, followed thereafter by the minke whale at 39%. However, the two most abundant species in the study area were the bottlenose dolphin and the harbour porpoise, jointly accounting for 84% of the total number of animals recorded ($n=859$). Both harbour porpoises and minke whales were encountered throughout the study area on survey routes 1 to 4 respectively, but bottlenose dolphins were only ever recorded on the innermost survey route (route 1), in shallow waters rarely exceeding 25 m depth (median depth 15.7 m, $n = 29$). Whilst minke whales and harbour porpoises were also recorded on this innermost route 1, corrections for survey effort revealed a considerably higher abundance of both species on each of the outer survey routes 2 to 4 respectively.

2006 saw a significant overall rise from 2005 in the total number of cetaceans encountered in the study area, from 187 to 300 encounters respectively. This was mainly due to a large increase in the number of minke whales and harbour porpoises in the region, likely coincidental with the regional increase in sand eel (*Ammodytes* sp.) stocks targeted by both of these species – further to the ban of the North Sea commercial fishery for sand eels from June 2005.

In addition to photographing bottlenose dolphins and minke whales for our image catalogues in 2006, we continued to collect images of basking sharks and also encountered several oceanic sunfish in our coastal field site.

Significance/Benefits of Research

• Locally

- Results are disseminated locally via newsletters, the local press/media, through public talks and local exhibitions/demonstrations. Boat owners and members of the public are also encouraged to report their sightings.
- The CRRU is active within the Moray Firth Partnership, NE Scotland Biodiversity Partnership and Local Biodiversity Action Group.
- The local involvement of supporters and training of medics for marine mammal rescue activities also forms a vital area of our local remit.

• Nationally / Internationally

- National / international collaborations and partnerships with other non-profit organisations, animal welfare bodies, universities and colleges, and public and governmental bodies (detailed further below).

Dissemination of Results

a) Have you provided details of results from your research to or within:

- **Scientific papers**

- Clark, N.M., & K.P. Robinson (in progress). Spatio-temporal trends in the fine-scale distribution of harbour porpoises in the outer southern Moray Firth, NE Scotland. *Journal of Cetacean Research & Management*.
- Culloch, R.M. & K.P. Robinson (under review). Bottlenose dolphins using coastal regions adjacent to a Special Area of Conservation (SAC) in north-east Scotland. *Journal of the Marine Biological Association of the United Kingdom* **87(2)**.
- Eisfeld, S.M. & K.P. Robinson (in progress). The group characteristics and social fidelity of bottlenose dolphins (*Tursiops truncatus*) in the outer southern Moray Firth. *Behavioral Ecology & Sociobiology*.
- Lusseau, D., S. Allen, G. Bearzi, B. Bilgre, M. Bossley, R. Constantine, K. Dudzinski, P.J. Faria, C. Fortuna, S.M. Eisfeld, J. Lewis, F. Ritter & K.P. Robinson (in progress). Culture in bottlenose dolphins (*Tursiops* sp.): an insight through surface behavioural pattern. *Nature*.
- Robinson, K.P., N. Baumgartner, N.M. Clark, R.M. Culloch, S.M. Eisfeld, G.N. Haskins, M.J. Tetley, A.R. Whaley & L. Zapponi (2007). The summer distribution and occurrence of cetaceans in the coastal waters of the outer southern Moray Firth in northeast Scotland. *Lutra* **50(1)** (in press).
- Robinson, K.P., N. Baumgartner & M.J. Tetley, (in progress). The distribution and habitat use of coastally-occurring minke whales (*Balaenoptera acutorostrata*) in northeast Scotland. *Journal of the Marine Biological Association of the United Kingdom*.
- Robinson, K.P. & M.J. Tetley (2007). Behavioural observations of foraging minke whales (*Balaenoptera acutorostrata*) in the outer Moray Firth, north-east Scotland. *Journal of the Marine Biological Association of the United Kingdom* **87(1)**: 85-86.
- Tetley, M.J., E.G. Mitchelson-Jacob & K.P. Robinson (under review). The summer distribution of coastal minke whales (*Balaenoptera acutorostrata*) in the southern Moray Firth, NE Scotland, in relation to co-occurring mesoscale oceanographic features. *Remote Sensing of Environment. Special Issue on Earth Observation for Biodiversity and Ecology* **107**.

Also, presentations accepted for the forthcoming 21st Annual Conference of the European Cetacean Society, Donostia, San Sebastian, Spain, 22-25 April 2007:

- Baumgartner, N., K.P. Robinson & G.J. Pierce. Preliminary photo-identification analysis of individual minke whales on the east coast of Scotland.
- Haskins, G.N. & K.P. Robinson. Visually detectable attributes of spinal malformations in free-ranging bottlenose dolphin calves in northeast Scotland.
- Zapponi, L. & K.P. Robinson (2007). Social attitudes to marine conservation in NE Scotland: Public perceptions and cetaceans in the Moray Firth.

• **Presentations**

- *Can changes in habitat stability affect the behavioural ecology of cetaceans? Foraging strategies of minke whales under different environments.* Talk for workshop on “Climate Change & Cetaceans in Coastal Ecosystems” by Michael Tetley, 20th Annual Conference of the European Cetacean Society, Gdynia, Poland, April 2006. Audience of 50 scientists.

- *Whales and dolphins of the Moray Firth (23-24 May 2006)* – a series of presentations and whale rescue demonstrations by CRRU/Earthwatch team at a BP Green Forum event, Aberdeen Thistle Hotel. Attended by 70 offshore and onshore green team members, environmental advisors and senior managers.
- *Whale rescue demonstrations (8-9 July 2006)* – series of “hands-on” public demonstrations by the CRRU team at the Scottish Traditional Boat Festival in Portsoy, Aberdeenshire. Estimated participation approx. 300 people over 4 demonstrations.
- *The diving ecology of minke whales in the Moray Firth (1 Sep 2006)* – presentation given by Nina Baumgartner to the Cetacean Working Group at the University of Aberdeen (Dept Zoology) discussing the first year findings of her MPhil study. Specialist audience of approximately 30 scientists.
- *Sharks, Seals & Cetaceans at Risk in Our Seas (23 Nov 2006)* – Earthwatch lecture given by Dr. Kevin Robinson at the Royal Geographical Society, London. 400+ audience present.
- *An integrated approach to non-lethal research on minke whales in European waters (21 April 2007)* – a workshop proposed and co-organised by Dr. Kevin Robinson for the forthcoming 21st Annual Conference of the European Cetacean Society to be held in San Sebastian, Spain. Specialist audience of approximately 25 scientists.
- *Fine-scale studies of coastal minke whales in northeast Scotland*. Talk by Dr. Kevin Robinson to be presented at the 21st Annual Conference of the European Cetacean Society, Donostia, San Sebastian, Spain, 22-25 April 2007.
- **Popular articles or films**
 - Connexions (June/July edition) – circular of the North Sea Strategic Performance Unit, BP. Article page 8 entitled “North Sea environmentalists have a whale of a time at the Green Forum”.
 - Coast Magazine – CRRU/Earthwatch feature article pp. 84-87 “Into the blue” by Alex Reece.
 - TwoFour Broadcast (www.twofourbroadcast.com) (in progress – April 2007) – Lifestyle documentary to be filmed in Gardenstown. The CRRU will be carrying out a simulated whale rescue with three celebrities.
- **Books, chapters, illustrations**
 - Rake, M. (2007). *Patterns of cetacean strandings in NE Scotland (1992 to 2006): How do incidental strandings relate to live animal surveys?* BSc thesis, University of Southampton. 78pp.
 - Underhill, K. (2006). *Boat traffic effects on the diving behaviour of bottlenose dolphins (Tursiops truncatus) in Sardinia, Italy*. MSc thesis, University of Wales, Bangor. 60pp.
 - Zapponi, L. (2006). *Human and wildlife co-existence in the marine environment – A case study in the Moray Firth*. MSc thesis, University of Nottingham. 70pp.
 - Robinson, K.P., P.T. Stevick & C.D. MacLeod (2007). Proceedings of the workshop on An integrated approach to non-lethal research on minke whales in European waters. European Cetacean Society Newsletter, Special Issue, in preparation.

Volunteer Tasks and Accomplishments

- a) How did the volunteers contribute ideas, skills, expertise and motivations beyond that which you anticipated?

2006 was the first year the CRRU has worked with Earthwatch volunteers and the experience was a very enriching one on both sides. Each volunteer brought with them a range of valuable skills, know-how and experience, and we were particularly enthused to welcome a number of veteran Earthwatch volunteers to our Scottish project, whose knowledge and background were an inspiration to all who shared their privileged company. We also received a number of corporate volunteers who were able to contribute invaluable business and management experience. Teachers, lawyers, IT folk, students and businessmen and women alike were all able to contribute a variety of useful and applied skills and expertise to assist our estimable project. One couple even took on a personal winter project to develop our database and mapping software applications – and they have done an amazing job. Others have gone on to assist us with desktop publishing and website developments, these obligations extending well beyond their initial 12 day induction with us – all great stuff!

- b) How have volunteers helped you to achieve your research or educational objectives? Please give specific and quantitative measures of the volunteers' contribution to your data collection.

If it wasn't for the volunteers, our research simply wouldn't be able to go ahead. The volunteers provide us with the energy, funding, manpower and skills base to carry out this work. The teams spend long hours in the field across the summer and autumn months – often in very hot or cold conditions – carrying out visual observations and data collection from boats, recording behaviour and photography, and inputting all the extensive data collected into files and computer databases and spreadsheets. Teamwork is extremely important for the research to run smoothly, and our Earthwatch volunteers seem to excel at this. The participants also assist in repairing and maintaining our two research vessels, contribute their ideas and theories to our research work, share the cooking, cleaning and essential ship and land-based tasks, actively take part in our educational programme and public relations work, and constitute the essential 24 hour cover needed to provide a unique, round-the-clock marine animal rescue team.

Project Development

- a), b) and c) Challenges, additional methods and forthcoming development of our research

Recent results suggest that the spatial and temporal occurrence of cetaceans in the outer southern Moray Firth study area is both variable and complex. Spatial data indicate that some species may restrict their movements and activities to particular areas and depths, whilst others are more widespread and responsive in their distribution. And continued warming of the local waters is predicted to result in continued changes within this cetacean community, with probable additions and expected increases in existing warmer-water cetaceans, such as Risso's and common dolphins, and the disappearance or change in the relative and absolute abundances of others, such as pilot whales and killer whales. In this respect, further monitoring of this cetacean community is considered to be particularly important for present and future conservation strategies.

Ongoing spatio-temporal analyses of the "priority" coastal species identified in the study area will allow us to focus conservation measures in relation to human activities in this area (e.g. by-catch reduction, disturbance by shipping, tourism etc); to identify times and areas of special significance in the life cycle, such as breeding periods and nursery areas; and to measure the effectiveness of current management and action plans, assisting in their future development. Further work aims to achieve additional coverage of the outer Moray Firth region, integrating broader scale survey data and directing more detailed work in focal areas of particular interest or

concern. Such a multi-scale approach should ultimately lead to the identification of oceanographic, biological and anthropogenic determinants that underlie the distinctive patterns of distribution seen in this coastal North Sea area, and these objectives are believed to be fundamental to local management directives for the protection of this and other coastal cetacean communities in UK and European waters.

Educational Opportunities

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

- **Local communities**

Yes

- **Students**

Yes

- **Early career scientists**

Yes

- **Other groups**

Yes

b) Please tell us the ways your research helps these groups better understand the conservation of a sustainable environment.

The CRRU forms an integral part of the community in the village of Gardenstown and the borough of Banffshire beyond, and the extensive work of the charity is fully integrated into the area's economic and social structure and development. Educating primary school children about their role in the natural environment so that they grow up to be environmentally-conscious adults remains an important directive for school visits and educational activities. When students work with the charity, whether as volunteers, during placements or on short courses, they experience this integration within the community first hand, and learn the direct importance of conservation within small Scottish coastal communities.

An important first step towards developing effective conservation strategies has been to assess the level of public knowledge and awareness of the environmental issues at hand in the local marine environment. This has been determined using interview and survey methods, incorporating residents, tourists, stakeholders and policy makers to assess public attitudes and perceptions to marine conservation.

Highlighting the economic benefits of marine conservation, through sustainable ecotourism, is also an important means of generating support for conservation projects such as those carried out by the CRRU. Investigating the socio-economic benefits of marine conservation therefore remains a vital area in ensuring public acceptance and support for the CRRU's marine conservation work.

c) Has your project helped lead to the completion of Masters' theses, or other educational research findings?

The CRRU accommodates a diversity of university projects for students across the summer months supported by the Earthwatch funding dynamic. In 2006, Dr Robinson supervised two MSc and a BSc project, detailed in the publications above, and a further two PhD placements in progress.

Partnerships

- a) List partnerships or collaborations with other organisations that you have developed or maintained in the past season.
- Collaboration on a SEERAD funded project reviewing the distribution of bottlenose dolphins around the Scottish coast in association with the Universities of Aberdeen and St. Andrews.
 - Participation in a collaborative worldwide study on culture in bottlenose dolphins, examining insights gained from surface behavioural patterns.
 - An examination of the shifting patterns of minke whale distributions in Scottish waters and the possible effects of climate change, in cooperation with Dr. Colin MacLeod (Dept of Zoology, University of Aberdeen) and the Hebridean Whale and Dolphin Trust.
 - Further collaboration with the Veterinary Division of the Scottish Agricultural College on studies incorporating incidental strandings records, biopsies from dead cetaceans for dietary analysis and clinical findings supporting visual observations at sea.
 - PhD studentships currently in progress and being co-supervised in collaboration with the Universities of Aberdeen and Wales, Bangor.
 - Active members of the UK Marine Animal Rescue Coalition (MARC), providing specialist training and advice for other marine mammal rescue organisations in the UK and elsewhere in the world (in 2006: Jamaica, Malta, US and Thailand).

List of collaborators in 2006/07:

- Universities: Aberdeen, Bangor, Nottingham, Southampton, St. Andrews and Leeds
- UK NGOs: Hebridean Whale & Dolphin Trust, The Wildlife Trusts, Marine Conservation Society, Sea Watch Foundation, Whale and Dolphin Conservation Society
- International NGO's: Care for the Wild International, ORES Foundation for Marine Environment Research (Canada), Wildlife Rescue Centre (Thailand), Project Rugvin (Holland) Tethys (Italy), Cascadia Research Collective (USA)
- Others: Scottish Agricultural College, HM Coastguard, British Divers Marine Life Rescue, Scottish SPCA, Scottish Natural Heritage.

b) How have these organisations contributed to your project objectives?

Academically – through placements, exchanges and collaborations that are reflected in the CRRU multidisciplinary publication lists

Welfare – through enhanced collaborations and support with marine animal rescue work and campaign work with greater effectual results. Also with increased funding.

Campaign – providing greater support and platforms to use CRRU findings to promote greater lobbying for policy.

Acknowledgements

First of all, innumerable and humble thanks to all our wonderful Earthwatch guests in 2006: UK - Angie, Jennie, Alex, Sue, Ruth, Robin & Karrie, Louise, Natalie, Simon, John, Sally, Michelle, Gillian, Julia, John & Jenny Ridley; USA - Michael, Sara, Kate, Jennifer, Dave, Eileen, MJ, Brandis, Anita, Debbie, Jan, Suzanne, Molly, Rini, Sharron, Yael, Ed & Jille, Marilyn, Hill & Miriam, Elane; India - Ramesh, Maldini, Amit & Gitanjali; Bangladesh - Sumi; United Arab Emirates - AJ; Indonesia - Fitri; France - Sophie; Austria - Karin; Germany - Petra, Torsten; and China - Amy. Thank you too for ALL your wonderful feedback and kind words...

Also, HUGE thanks also to everyone at the Earthwatch Institute, especially (from the UK team): Natalie and Jen (present and former Programme Managers) for endless support and encouragement with the project; Steve, Jennie and Phillip (Development Team) for all their work and assistance with funding applications; Zoe and team (PR) for support with press releases etc; and not forgetting the recruitment, liaison and website development teams in Oxford and Boston respectively for their ongoing hard work and help.

Further immeasurable thanks to: Care for the Wild International for ongoing financial support; to the Brooke family from Bosham and the Sail4Whales team on "Never Look Back" for their incredible fundraising efforts; to our colleagues at the Universities of Aberdeen and Wales, Bangor for support with research projects and publications; to the boat mechanics and fitters at Seaway Marine and MacKay Marine; to Bodies of Banff for all their support with everything photographic; to Chris at NE Dive and the guys at Aberdeen Watersports; to the Laird of Gardenstown, Mark Ellington, for ongoing support and friendship - and especially for bringing Prince Charles to visit us; John at Puffin Cruises, Dean from North 58 and Davey from Gemini Explorer for keeping us updated on our "flipped friends" across the summer; to all our members and supporters; to David Findlay at Whitehills Marina and Michael Watt at Gardenstown harbour for berthings and support with boats; Peter Sharphouse from Submertec for use of the Spyball in July; and to all our friends and family for pretending to understand and supporting our bewildering life choices.