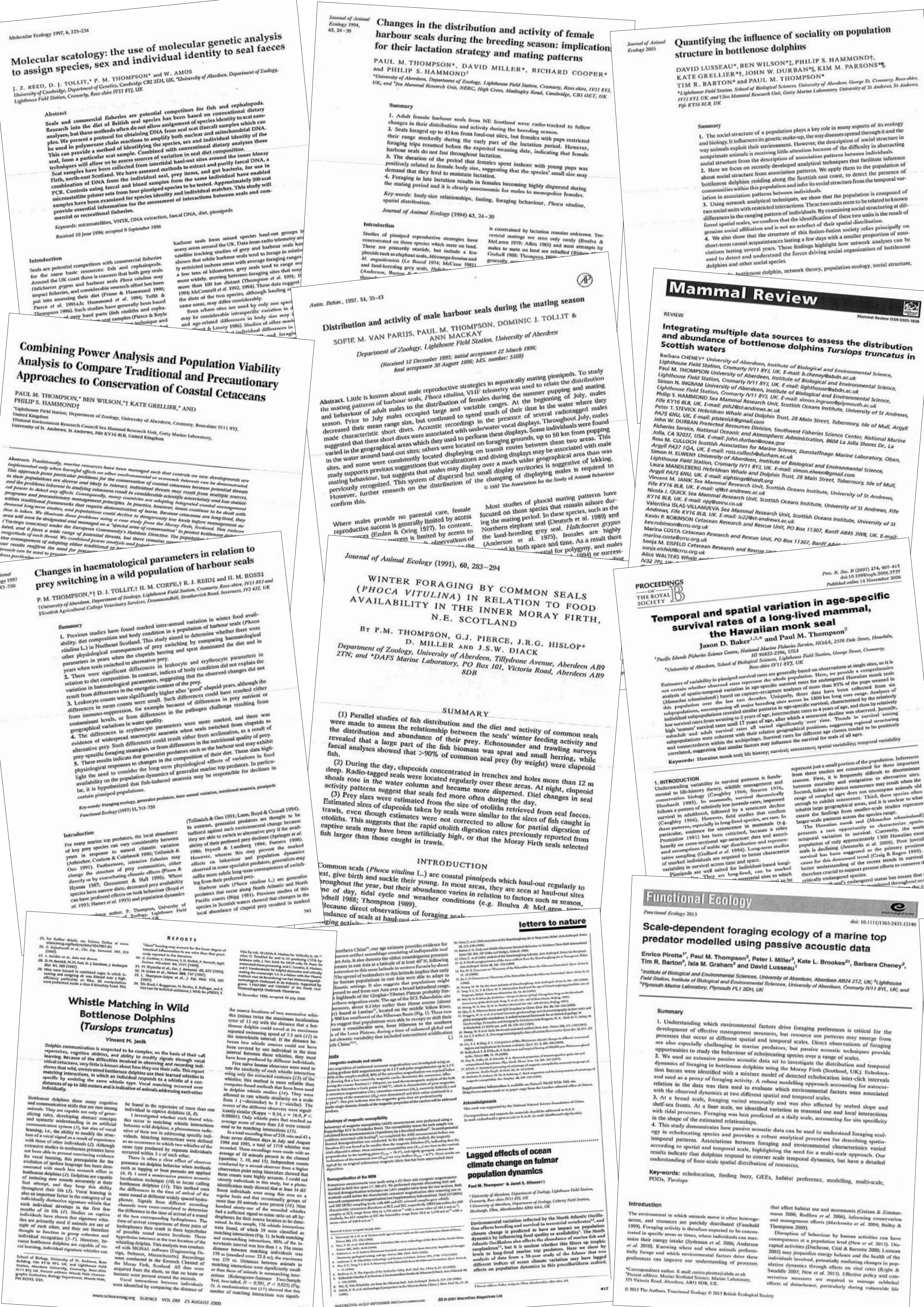
University of Aberdeen Lighthouse Field Station

25 years of teaching and research in Cromarty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Changes in the distribution and activity of female harbour seals during the breeding season: implications for their lactation strategy and mating patterns

PAUL M. THOMPSON*, DAVID MILLER*, RICHARD COOPER* and PHILIP S. HAMMOND†

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Quantifying the influence of sociality on population structure in bottlenose dolphins

DAVID LUSSEAU*, BEN WILSON*‡, PHILIP S. HAMMOND†, KATE GRELLIER*†, JOHN W. DURBAN*§, KIM M. PARSONS*¶, TIM R. BARTON* and PAUL M. THOMPSON*

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Distribution and activity of male harbour seals during the mating season

SOFIE M. VAN PARIJS, PAUL M. THOMPSON, DOMINIC J. TOLLIT & ANN MACKAY

Combining Power Analysis and Population Viability Analysis to Compare Traditional and Precautionary Approaches to Conservation of Coastal Cetaceans

PAUL M. THOMPSON,* BEN WILSON,*† KATE GRELLIER,* AND PHILIP S. HAMMOND†

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Integrating multiple data sources to assess the distribution and abundance of bottlenose dolphins *Tursiops truncatus* in Scottish waters

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Changes in haematological parameters in relation to prey switching in a wild population of harbour seals

P. M. THOMPSON,*† D. J. TOLLIT,† H. M. CORPE,† R. J. REID‡ and H. M. ROSS‡

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WINTER FORAGING BY COMMON SEALS (PHOCA VITULINA) IN RELATION TO FOOD AVAILABILITY IN THE INNER MORAY FIRTH, N.E. SCOTLAND

BY P.M. THOMPSON, G.J. PIERCE, J.R.G. HISLOP* D. MILLER AND J.S.W. DIACK

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Temporal and spatial variation in age-specific survival rates of a long-lived mammal, the Hawaiian monk seal

Jason D. Baker[1,2,*] and Paul M. Thompson[2]

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Whistle Matching in Wild Bottlenose Dolphins (*Tursiops truncatus*)

Vincent M. Janik

letters to nature

Lagged effects of ocean climate change on fulmar population dynamics

Paul M. Thompson* & Janet C. Ollason†‡

Functional Ecology 2013

Scale-dependent foraging ecology of a marine top predator modelled using passive acoustic data

Enrico Pirotta[1*], Paul M. Thompson[2], Peter I. Miller[3], Kate L. Brookes[2†], Barbara Cheney[2], Tim R. Barton[2], Isla M. Graham[2] and David Lusseau[1]

Full publication list at : www.abdn.ac.uk/lighthouse/publications

The Lighthouse Field Station

Celebrating 25 years of Cromarty based teaching and research on the ecology of seals, dolphins and fulmars

Since 1990 the Lighthouse Field Station has provided a Highland base for marine biologists from the University of Aberdeen. Our research on the ecology and conservation of marine top predators has built upon field studies in Scottish waters, and underpinned work with a wide range of UK and overseas collaborators. 25 years on, our findings have been reported in over 130 scientific publications and had important impacts on the way we understand and manage our marine ecosystems.

The following pages provide an overview of how our research has developed over the years, and highlight the teaching and public engagement activities that have been integrated into our work. These achievements have only been possible with the support of many colleagues, students, collaborators, friends and funding bodies, and we'd like to take this opportunity to thank you all.

1990

A research contract from the Scottish Office Agriculture and Fisheries Department allowed the University to expand studies of harbour seal population and foraging ecology that we'd initiated in 1987. Alongside this work, we began a programme of regular photo-ID surveys for bottlenose dolphins in collaboration with the Sea Mammal Research Unit (SMRU), initially using the Zoology Department's boat *Talitrus*. This was expanded later in 1990 with funding from the Greenpeace Environmental Trust, and we secured a 3-year lease for the Lighthouse Keeper's Cottage in Cromarty as a base for this work.

1991

Much of the year was dominated by our harbour seal field studies, using our new boat *Tursiops* to capture seals at different haulout sites with a seine net for tagging and health screening. Subsequent VHF tracking studies were used to identify key foraging areas within the Moray Firth, as well as providing new data on diving behaviour and reproductive strategies. *Tursiops* also allowed us to make monthly photo-ID surveys to identify seasonal patterns in the distribution of bottlenose dolphins in the inner Moray Firth. The Lighthouse Field Station was officially opened by Tom Kelly of the Scottish Office in June.

1992

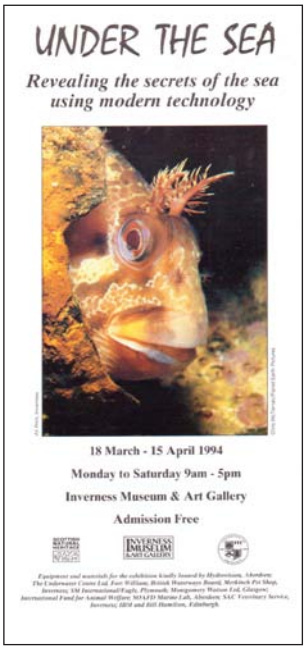
Our seal tracking was extended through comparative studies that used SMRU satellite tags to follow Moray Firth grey seals as far as Orkney and the Farne Islands. In March, we hosted our first international meeting, when 50 colleagues met in Cromarty for a European Seal Group conference. The national profile of the Moray Firth bottlenose dolphins and our research programme was raised through a leading article in BBC Wildlife. Later in the year, photo-ID surveys were extended to the outer Moray Firth through collaboration with IFAW's boat *Song of the Whale*.

1993

In March, we hosted the Annual Conference of the European Cetacean Society at the Eden Court Theatre in Inverness, attracting over 300 participants from across the world. A grant from NERC allowed us to collaborate with colleagues at the University of Cambridge to develop molecular techniques to study individual and sex differences in seal diet. A new partnership with the Whale and Dolphin Conservation Society provided additional funding for our dolphin photo-ID studies and our results supported their Adopt-a-Dolphin scheme. Honours students from Aberdeen started using the Field Station as a base for summer projects.

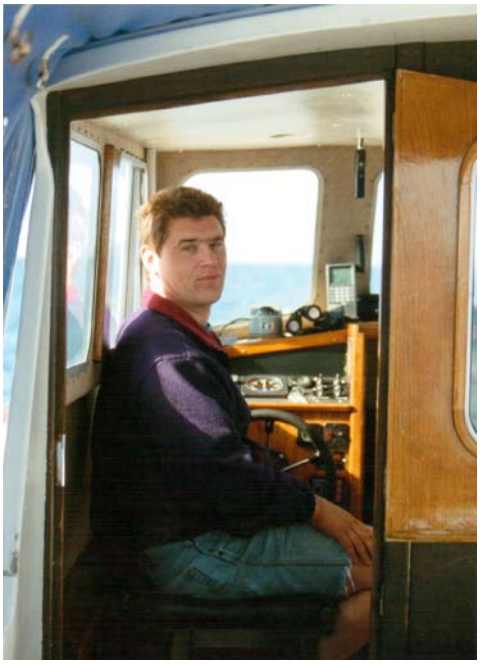
1994

Another contract from the Scottish Office Agriculture and Fisheries Department focussed our studies towards harbour seal diet. Ongoing health screening with the Scottish Agricultural College's Veterinary Investigation Centre highlighted that annual variation in prey stocks influenced seal parasite burdens and condition. Collaboration with the Scottish Agricultural College also revealed that bottlenose dolphins were the cause of the traumatic injuries found in many stranded harbour porpoises. These findings were included in two network TV programmes that focussed on our dolphin research, resulting in international press coverage.



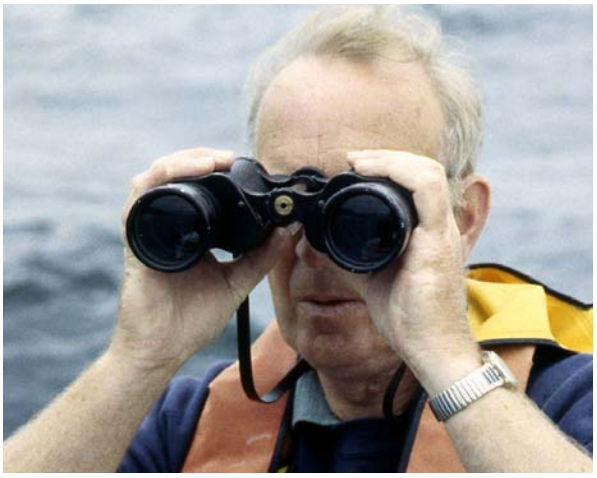
1995

Bioacoustics became an increasingly important component of our research. A new research vessel *Bella Jane* was purchased with funding from the Wills Trust to support passive acoustic studies of both seals and dolphins. In partnership with the Highland Council we built upon collaborative studies with the University of St Andrews to integrate a permanent hydrophone array into a new visitors centre overlooking Inverness and the Kessock Channel. In Cromarty, we organised the first of what became a long series of annual training workshops for Aberdeen postgraduate students and the Field Station's first PhD student graduated.



1996

A UK government contract from MAFF and DETR allowed us to continue with a summer programme of bottlenose dolphin surveys, primarily aimed at understanding the causes of the high levels of skin lesions we detected. Proposals for the Moray Firth to become a Special Area of Conservation in response to the EU Habitats Directive resulted in the first of a series of contracts from Scottish Natural Heritage to provide scientific support for SAC management and monitoring. The internet and email arrived at the Field Station, albeit only on a single shared PC. The first of our undergraduate Field Courses on Coastal Ecology was held in the Cromarty Old Brewery.



1997

There was increased use of the Field Station as a base for postgraduate studies at overseas study sites, with fieldwork conducted on fur seals and river dolphins in South America and killer whales in Norway. Within the Moray Firth our harbour seal studies focussed on land-based observations. Industry support from the Cromarty Firth Port Authority, Ross and Cromarty Enterprise, and Talisman Energy (UK) Ltd allowed us to develop land based observations and acoustic studies of bottlenose dolphin distribution and behaviour in the Cromarty Firth.

1998

This year saw the first of what became annual field trips to Orkney. A summer project on harbour seal acoustics revealed dramatic declines in adults and pups on Eynhallow. At the same time, the Field Station took over the co-ordination of the Aberdeen University study of northern fulmars that had started in 1950. Bottlenose dolphins got mixed press. Concerns over the animals using the candidate Moray Firth SAC resulted in a contract to model population viability. While collaborative studies with the Scottish Agricultural College revealed that bottlenose dolphins engaged in infanticide in addition to their previously reported aggression towards porpoises.

1999

Our involvement in the development of a management plan for the Moray Firth SAC increased interactions with industry stakeholders, resulting in regular support from Talisman Energy (UK) Ltd and Chevron Texaco. Oil and gas related studies were also conducted for the Atlantic Frontier Environmental Network in collaboration with Cornell University and the Joint Nature Conservation Committee. This project used remote acoustic loggers to study the distribution of fin whales in the Shetland-Faroes channel. In the Cromarty Firth, new studies of interactions between seals and salmon were developed with the Fisheries Research Services and the Conon District Fisheries Board.

2000

A series of collaborative papers based upon our passive acoustic studies highlighted how low cost acoustic techniques could provide insights into dolphin foraging behaviour and harbour seal mating strategies. Following pilot studies in 1999, we continued to develop harbour seal photo-ID studies in the Cromarty Firth to support studies of individual movements and survival. Further afield, postgraduate collaborations with the Bahamas Marine Mammal Surveys studied the social behaviour and ecology of bottlenose dolphins in warmer waters. The Management Group for the Moray Firth SAC was launched.

2001

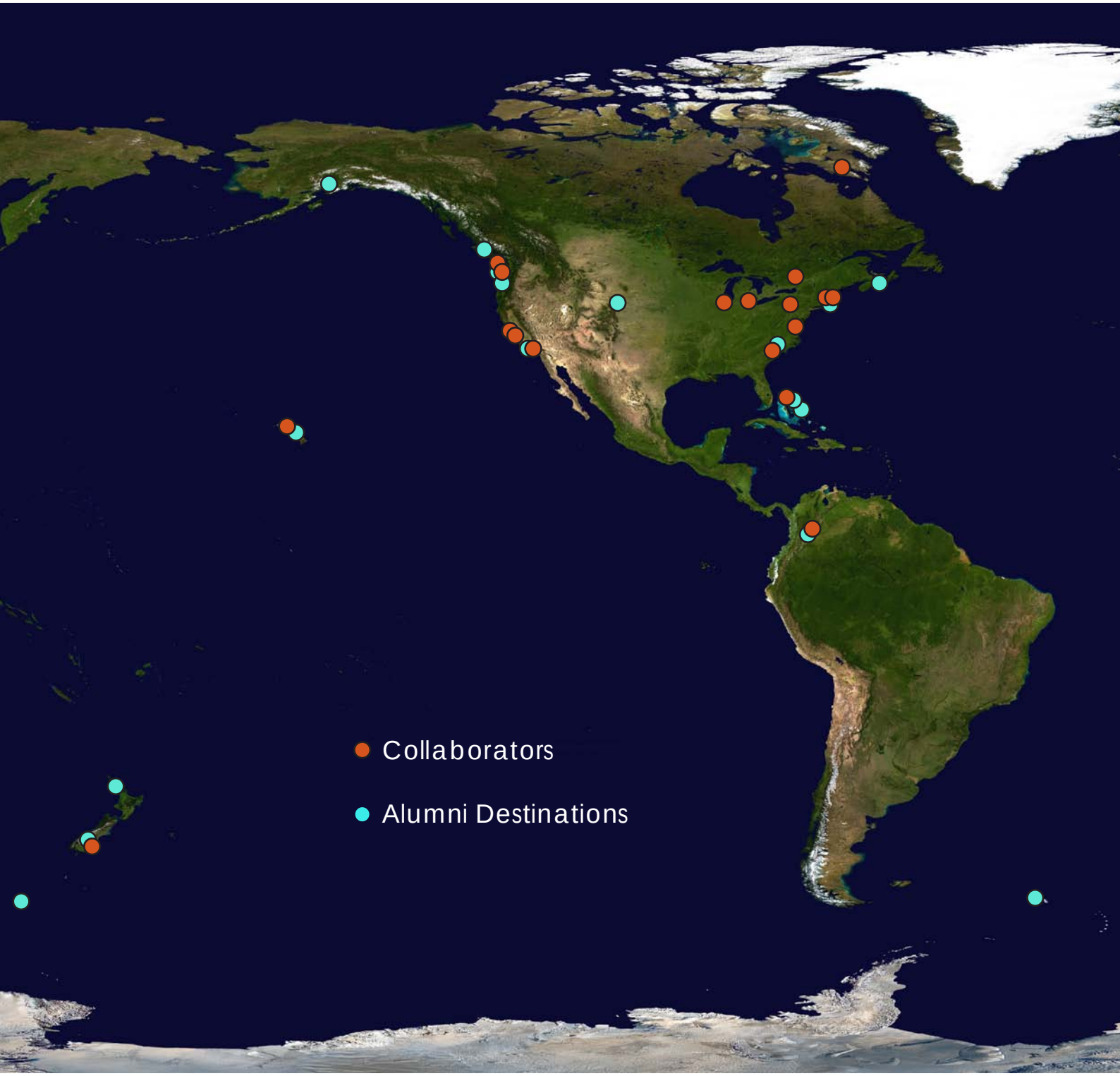
Analysis of the long-term fulmar data set revealed that climate variation influenced reproductive success in this population and underpinned a successful NERC grant to model the impacts of climate on survival. Passive acoustic surveys of sperm whale and oceanic dolphin distribution were made across the Shetland-Faroes Channel with the Fisheries Research Services Marine Laboratory. Similar techniques were used to study bottlenose dolphin distribution during the replacement of Talisman's Beatrice pipeline. *Tursiops* was retired after a grant from International Water Ltd allowed us to purchase *Rona,* extending our capabilities for undertaking coastal surveys.

2002

Support from a wide range of funders allowed us to refurbish the Old Buoy Store to provide new teaching and research facilities at the Lighthouse Field Station. Work on the Old Buoy Store grounds and new boat shed continued through the summer and was completed later in the year. The Management Plan for the Moray Firth SAC was launched. Several different aspects of the Field Station's research were featured in a BBC Radio 4 Nature Programme on "*The Moray Firth Bottlenose Dolphins*".

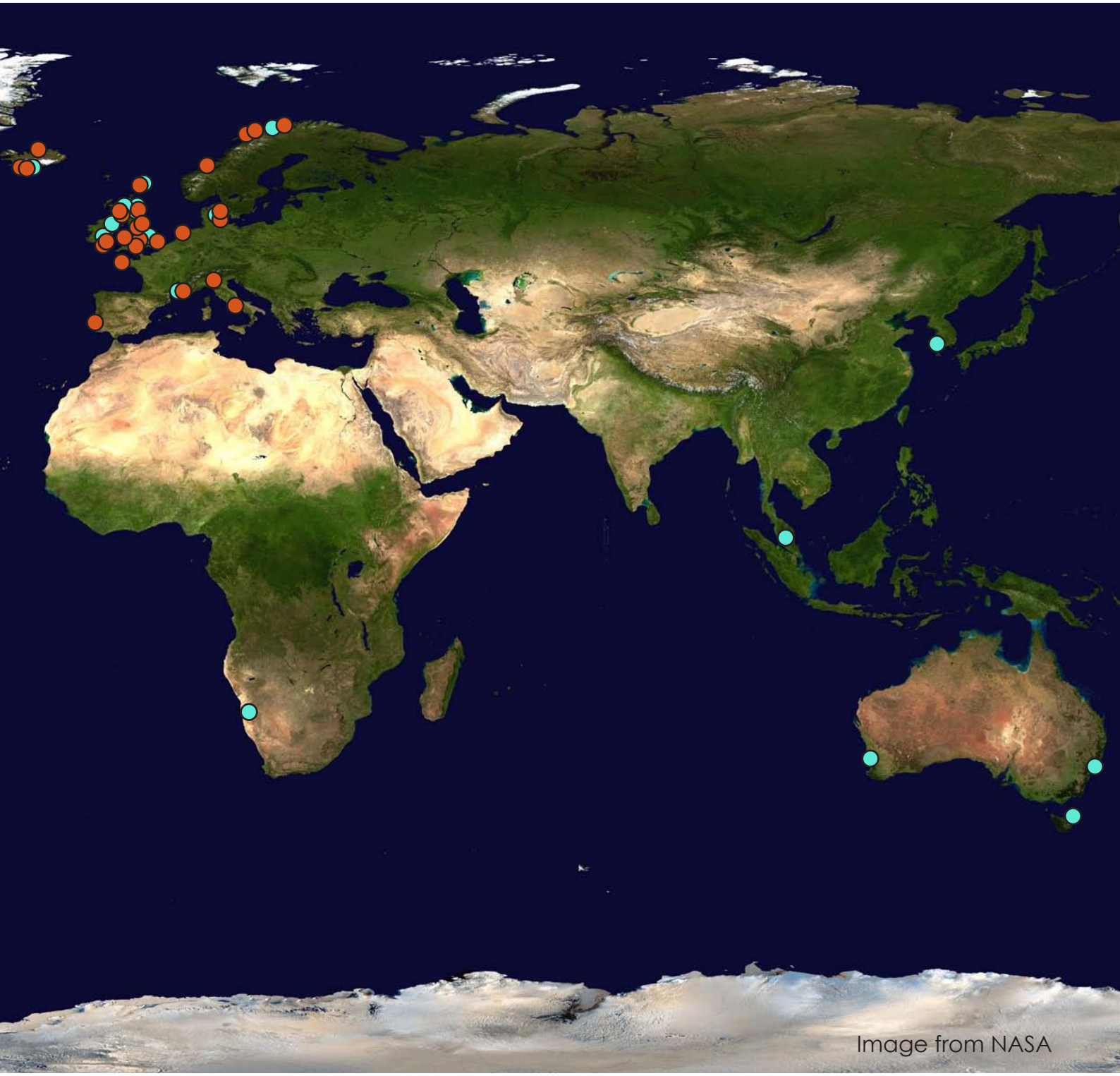
Collaborators

Andenes Whale Centre; Bahamas Marine Mammal Surveys; Bangor University; Biomathematics and Statistics Scotland; British Antarctic Survey; Canadian Wildlife Service; Centre for Ecology and Hydrology; Cetacean Research and Rescue Unit; Chicago Zoological Society; CNRS; Conon District Fisheries Board; Cornell University; David Cabot; Duke University; Foundacion Omache;



Iceland Nature Research Centre; Norwegian Institute for Natural Research; Norwegian Institute of Fisheries and Aquaculture; Norwegian Polar Institute; Ocean Networks Canada; Oceanopolis; Oregon State University; Parqe Natural da Arrabida; Plymouth Marine Laboratory; Scottish Agricultural College; Scottish Association for Marine Science; Sea Watch Foundation; Shetland Biological Records Centre; South Iceland Nature Centre; Spey District Salmon Fishery Board; Stanford University; Subacoustech Environmental Ltd;

Fresh Pond Research Institute; FRS Marine & Freshwater Laboratories; Hebridean Whale and Dolphin Trust; IFAW; Imperial London; JNCC; Kongsburg Maritime Ltd; Marine Research Institute; Marine Scotland Science; Moss Landing Marine Laboratory; National Environmental Research Institute; National Marine Fisheries Service; National Marine Mammal Laboratory; National Wildlife Research Centre, Carleton University; Natural Power Consultants; NERC Sea Mammal Research Unit; Netherlands Institute for Forestry & Nature Research; Northeast



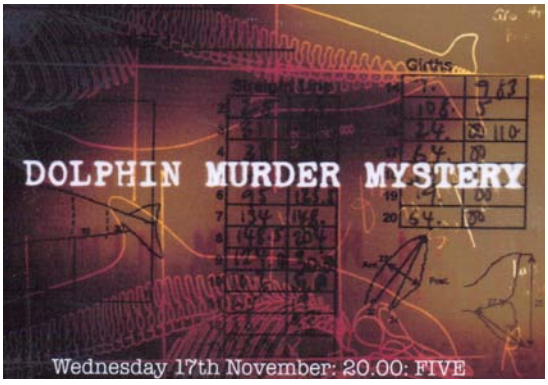
Swedish Museum of Natural History; Talisman Energy (UK) Ltd; Tethys Research Institute; Universita La Sapienza; University of Bath; University of California; University of Cambridge; University of Copenhagen; University of Cork; University of Durham; University of Edinburgh; University of Glasgow Veterinary School; University of Maryland Centre for Environmental Science; University of Michigan; University of Otago; University of Reading; University of St Andrews; University of Leeds; Whale & Dolphin Conservation; Wild Idea; WWT Consulting.

2003

The refurbished Old Buoy Store was officially opened by Charles Kennedy MP, and a series of public Open Days were held through the summer. Honours students carried out projects on fulmars on Eynhallow and dolphins in the Moray Firth, and exchange students and post-docs joined us from Denmark, Ireland, France, New Zealand and Australia. Field Station studies were also presented at international workshops in France, Gran Canaria and the US.

2004

This was the first of two summers in which we conducted a series of acoustic surveys from *Bella Jane* to study the distribution of bottlenose dolphins and harbour porpoises across the Moray Firth SAC. Scottish Natural Heritage started to contribute to our annual photo-ID surveys to monitor the condition of the SAC. Poor prey stocks resulted in the worst breeding season on record for Eynhallow fulmars and other Scottish seabirds. Channel 5 screened *Dolphin Murder Mysteries*, loosely documenting our efforts to identify what had caused traumatic injuries to harbour porpoises.



2005

Our research extended further into the outer Moray Firth through the EU DOWNVIND Project, developing monitoring approaches to support the installation of the Beatrice Offshore Demonstrator Wind Turbines. Offshore projects tracking seabirds with radar were complemented by inshore studies validating the use of T-PODs to detect dolphin and porpoise echolocation clicks using passive acoustics. BBC coverage of our other work for a Radio 4 *Living World on The Fulmars of Eynhallow* and BBC1 *Coasts* were included in Christmas *Pick of the Year* TV and Radio programmes.

2006

Bottlenose dolphin photo-ID studies were extended around the whole Scottish coast through a collaborative contract from the Scottish Executive Environment and Rural Affairs Department (SEERAD) and Scottish Natural Heritage. *Uisge* was purchased to support studies outside the Moray Firth and additional west coast fieldwork was carried out with SAMS and the Hebridean Whale and Dolphin Trust from *Silurian*. Pilot tracking studies of fulmars provided evidence of extensive feeding movements before the breeding season. Pile-driving noise was measured during the installation of the Beatrice Demonstrators and the Field Station purchased a vintage Massey-Ferguson tractor.

2007

Offshore passive acoustic monitoring using PODs continued through the final stages of the Beatrice turbine installation. Increasing numbers of breeding harbour seals in Loch Fleet opened up new opportunities for photo-ID based studies of phenology and demography. The SEERAD bottlenose dolphin project developed a sightings reporting network to target photo-ID studies that detected wide-scale movements on the west coast of Scotland. Similar approaches were used to study killer whales around the Scottish coast and another student's PhD focussed on killer whales in the North Pacific.

2008

Fieldwork on Scottish killer whales was expanded through a Carnegie Trust collaborative grant with the University of St Andrews and *Uisge* was relocated to Shetland for photo-ID and acoustic studies. With funding from the Scottish Government, large samples of miniature geo-location loggers were deployed on Eynhallow fulmars, underpinning two subsequent PhD projects. Concerns over the impacts of further oil and gas exploration resulted in Scottish Government funded passive acoustic monitoring studies in the outer Moray Firth. Dolphin photo-ID protocols were adapted to incorporate routine laser metric measurements of body size and growth.

2009

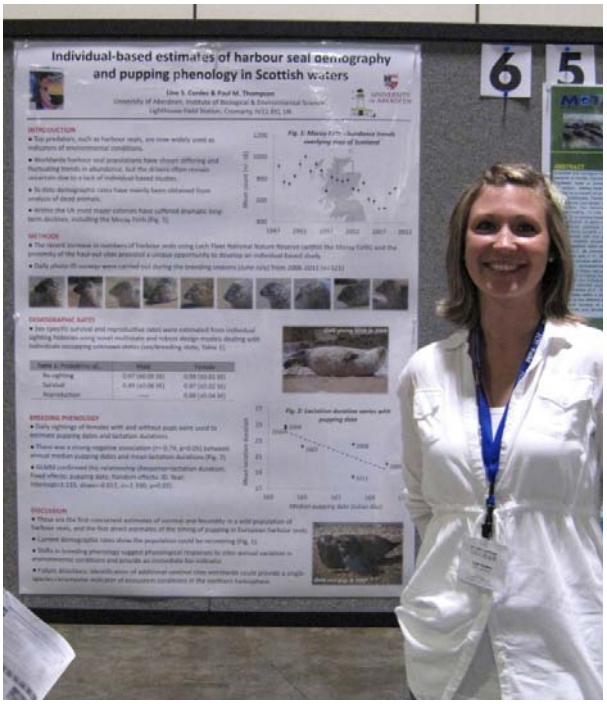
Studies were developed to assess and monitor the impact of seismic surveys with funding from DECC, Oil & Gas UK, Scottish Government and COWRIE. Visual boat based surveys were made in the outer Moray Firth from chartered fishing vessels, and recently developed CPODs were used to establish an extensive passive acoustic monitoring array across the area. Fieldwork on Eynhallow produced our first fine-scale GPS tracks of fulmar foraging trips and we tracked five of the known Loch Fleet harbour seals over the summer using SMRU GPS mobile phone tags. The University purchased the Lighthouse Tower and the Keeper's Cottage roof was replaced.

2010

An intensive programme of aerial surveys was used to estimate the density of harbour porpoise in two offshore study blocks, providing baseline for assessing the impacts of seismic survey noise. Parallel CPOD deployments and trials using digital aerial surveys provided data for a later comparison of methods for surveying offshore development sites. These studies were extended under contract to the Moray Firth offshore wind developers to provide baseline for their consent applications. Our annual programme of summer dolphin photo-ID surveys continued, with the latest data indicating that the number of individuals using the Moray Firth SAC was stable.

2011

Comparative studies of fulmars were extended through both GPS tracking of birds breeding on St Kilda and collaborative fieldwork with Irish and Icelandic researchers to deploy geo-location loggers and collect feathers for isotopic analysis. We conducted extensive passive acoustic and digital aerial surveys to assess the responses of harbour porpoises to seismic oil and gas exploration surveys in September. Collaborative work with Kongsberg measured received noise levels at different distances from the seismic vessel. The Keeper's Cottage was given a major refurbishment to upgrade the Field Station's office facilities.



2012

The Field Station hosted a Sublime arts residency in collaboration with IOTA. Supported by Creative Scotland, Highland Council, Inverness Common Good Fund and HIE, the works were first presented during a week of arts and science events in Cromarty and subsequently in Inverness Cathedral. GPS tracking recorded a male fulmar's record-breaking 6200 km 15 day round trip to the mid-Atlantic Ridge. Working with researchers at the University of Bath our underwater noise recordings from the Cromarty Firth provided some of the first UK data on shipping noise for the Marine Strategy Framework Directive.

2013

Continued photo-ID studies of bottlenose dolphins recorded the project's first known 4th generation calf. Collaborative studies with other research groups provided data to estimate the abundance of bottlenose dolphins in Scottish waters. Studies of the responses of bottlenose dolphins and harbour porpoises to disturbance from harbour developments and shipping were funded through the DECC Strategic Environmental Assessment and MASTS. The ongoing Loch Fleet harbour seal photo-ID study allowed us to use individual based data to investigate changes in pupping phenology.

2014

Our individual based studies were integrated into a strategic Marine Mammal Monitoring Programme to assess the population consequences of disturbance from Moray Firth windfarm developments. Pre-construction monitoring was initiated with partnership funding from BOWL, MORL, Marine Scotland, The Crown Estate and HIE. Collaborative studies with St Andrews University used UAVs to estimate seal condition and we deployed GPS mobile phone tags to collect baseline movement data for harbour seals from our Loch Fleet study population. The year ended with the submission of the Field Station's 20th PhD thesis.

2015

Additional harbour seal tracking revealed links between the Moray Firth and breeding sites in Orkney, with one female we'd caught in Loch Fleet visiting Eynhallow while we were checking fulmar nests on the island. Collaboration with the Norwegian Polar Institute extended our work on the winter distribution of fulmars through a multi-species comparison of seabirds at sites from Scotland to the arctic. Photogrammetric methods for estimating dolphin body condition were successfully trialled. Inter-disciplinary approaches such as this will underpin further studies of the ecological consequences of environmental change, and support measures to mitigate these impacts.

Thankyou...

to the following organisations and individuals for their support.

Association for the Study of Animal Behaviour; Atlantic Frontier Environmental Network; Beatrice Offshore Wind Ltd; BP Amoco; British Ecological Society; British Council; Caledonian Society of Sheffield; Carnegie Trust; Chevron-Texaco; COLCIENCIAS; Countryside Council for Wales; Creative Scotland; Cromarty Firth Port Authority; Cromarty Arts Trust; Daily Mail Newspapers; Department of Energy & Climate Change; Department for Environment Transport and the Regions; Department for Environment Food and Rural Affairs; Earthkind;

Earthwatch; EDPR; European Union; Fisheries Research Service; Friends of the Environment; Greencard Trust; Greenpeace Environmental Trust; Hebridean Whale and Dolphin Trust; HDH Wills Trust; Highland Regional Council; Highlands & Islands Enterprise; Imagining Natural Scotland; International Water Ltd; International Fund for Animal Welfare; IOTA; J&D Wotton; Leverhulme Trust; Mammals Trust UK; Ministry of Agriculture Fisheries & Food;

Marine Scotland; Marine Alliance for Science & Technology Scotland; MarCRF; Moray Offshore Renewables Ltd; National Marine Fisheries Service; Natural Environment Research Council; Natural Sciences and Engineering Research Council of Canada; Nuffield Foundation; US Office of Naval Research; Oil & Gas UK; RAF Kinloss; Repsol; Ross & Cromarty Enterprise; Royal Society; Scottish Association for Marine Studies; Scottish Funding Council;

Scottish Executive Environment and Rural Affairs Department; Scottish Natural Heritage; Scottish Government; Shell UK; Shetland Wildlife Fund; Scottish Office Agriculture Environment and Fisheries Department; Scottish Water Solutions; Scottish & Southern Energy; Spey District Salmon Fisheries Board; Talisman Energy (UK) Ltd; The Crown Estate; University of Aberdeen Development Trust; Whale & Dolphin Conservation Society.


Deep-Sea Research II
Tracking a northern fulmar from a Scottish nesting site to the Charlie-Gibbs Fracture Zone: Evidence of linkage between coastal breeding seabirds and Mid-Atlantic Ridge feeding sites
Ewan W.J. Edwards, Lucy R. Quinn, Ewan D. Wakefield, Peter I. Miller, Paul M. Thompson
Prey selection by harbour seals, Phoca vitulina, in relation to variations in prey abundance
Dominic J. Tollit, Simon P.R. Greenstreet, and Paul M. Thompson
Environmental Impact Assessment Review
Framework for assessing impacts of pile-driving noise from offshore wind farm construction on a harbour seal population
Paul M. Thompson, Gordon D. Hastie, Jeremy Nedwell, Richard Barham, Kate L. Brookes, Line S. Cordes, Helen Bailey, Nancy McLean
The Veterinary Record, June 29, 1996
Brucella species infection in North Sea seal and cetacean populations
H. M. Ross, K. L. Jahans, A. P. MacMillan, R. J. Reid, P. M. Thompson, G. Foster
Animal Conservation
Estimating spatial, temporal and individual variability in dolphin cumulative exposure to boat traffic using spatially explicit capture–recapture methods
E. Pirotta, P. M. Thompson, B. Cheney, C. R. Donovan & D. Lusseau
ORIGINAL PAPER
Spatial and social connectivity of fish-eating "Resident" killer whales (Orcinus orca) in the northern North Pacific
Holly Fearnbach · John W. Durban · David K. Ellifrit · Janice M. Waite · Craig O. Matkin · Chris R. Lunsford · Megan J. Peterson · Jay Barlow · Paul R. Wade
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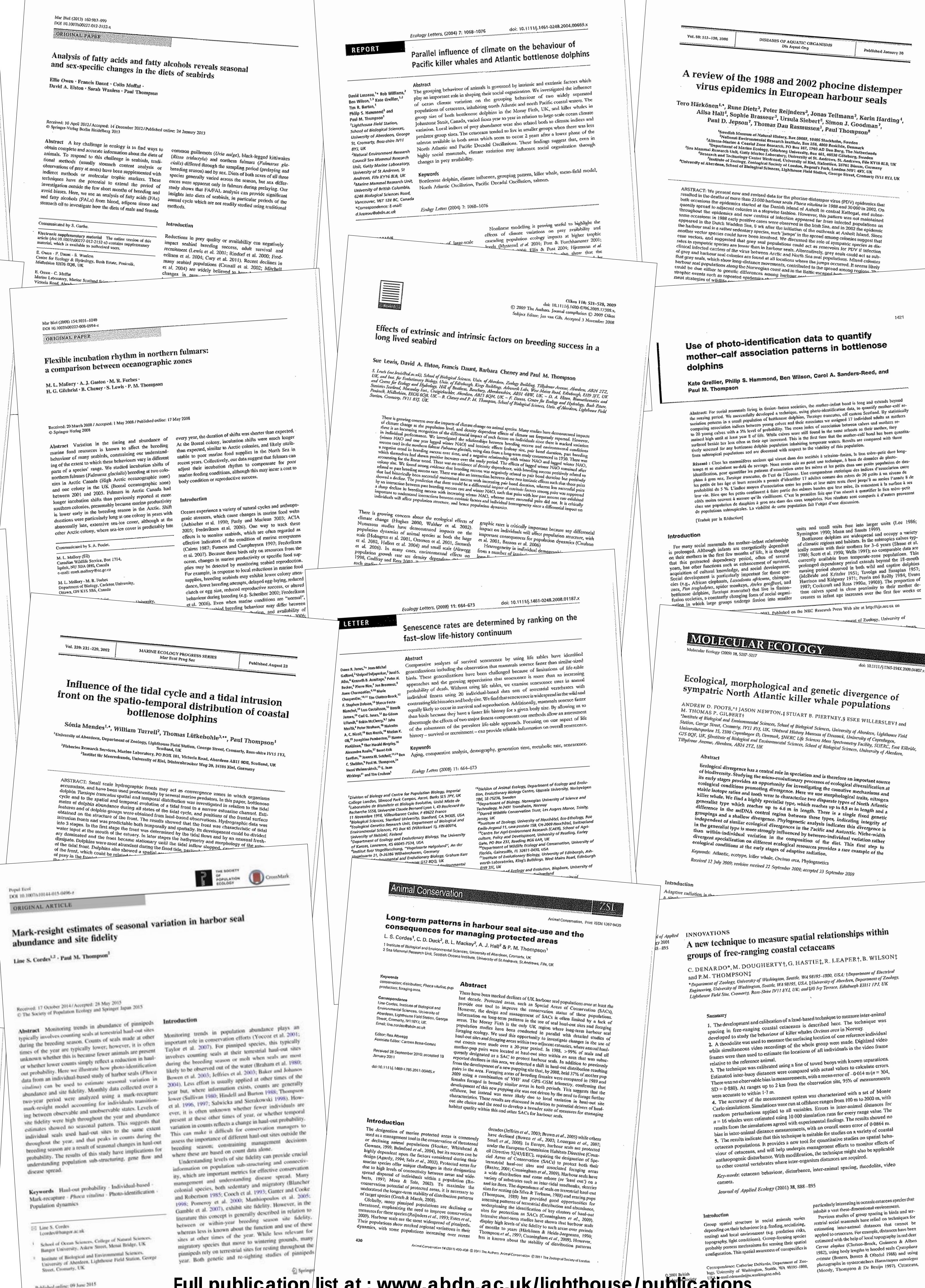
Long-term trends in the use of a protected area by small cetaceans in relation to changes in population status
Barbara Cheney, Ross Corkrey, John W. Durban, Kate Grellier, Philip S. Hammond, Valentina Islas-Villanueva, Vincent M. Janik, Susan M. Lusseau, Kim M. Parsons, Nicola J. Quick, Ben Wilson, Paul M. Thompson
EVALUATION OF CLOSED CAPTURE–RECAPTURE METHODS TO ESTIMATE ABUNDANCE OF HAWAIIAN MONK SEALS
Jason D. Baker
AQUATIC CONSERVATION: MARINE AND FRESHWATER ECOSYSTEMS
Using T-PODs to assess variations in the occurrence of coastal bottlenose dolphins and harbour porpoises
Helen Bailey, Gemma Clay, Elizabeth A. Coates, David Lusseau, Bridget Senior and Paul M. Thompson
The Royal Society
Evidence for infanticide in bottlenose dolphins: an explanation for violent interactions with harbour porpoises?
I. A. P. Patterson, R. J. Reid, B. Wilson, K. Grellier, H. M. Ross and P. M. Thompson
Patterns in the vocalizations of male harbor seals
Sofie M. Van Parijs, Peter J. Corkeron, James Harvey, Sean A. Hayes, David K. Mellinger, Philippe A. Rouget, Paul M. Thompson, Magnus Wahlberg, Kit M. Kovacs
PROCEEDINGS OF THE ROYAL SOCIETY B
Genetic isolation of a now extinct population of bottlenose dolphins (Tursiops truncatus)
Courtney Nichols, Jerry Herman, Oscar E. Gaggiotti, Keith M. Dobney, Kim Parsons and A. Rus Hoelzel



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