Institution: University of Exeter

Unit of Assessment: Biological Sciences

Title of case study: Global Sea Turtle Conservation

1. Summary of the impact (indicative maximum 100 words)

Research on the status, distribution and ecology of sea turtles at the University of Exeter has driven national and international conservation policy, engaged millions of people worldwide and raised substantial funding for conservation. Governments including the UK, Cayman Islands, Cyprus and Gabon have used this research in making legislation and multi-million pound management decisions. Development of open-access animal tracking tools has facilitated a global network of over 135 countries, with more than 300 projects tracking thousands of animals from 118 species. The ability to adopt tracked animals online has attracted millions of visitors and raised funding for conservation projects world-wide.

2. Underpinning research (indicative maximum 500 words)

Annette Broderick and Brendan Godley joined the University of Exeter in 2003. During this period they have been funded by grants of over £1.4million (e.g., by Defra, FCO, Darwin) and have led marine turtle research (particularly in the areas of species distribution, impact upon fisheries and the development of a global satellite tracking system) in >20 countries resulting in >100 peer reviewed publications.

This research has highlighted the status and distribution of marine turtle populations at numerous sites around the world (Ascension Island, Cayman Islands, Cyprus, Gabon). Data from long-term population studies has been used in IUCN Red Listing (i.e. species at threat of extinction) and critical analysis of such global assessments and informed management decisions [1]. Increasing knowledge of spatial distribution has allowed key habitats for protection to be targeted [2] and, more recently, allowed a global test of the efficacy of marine protected areas for one species [3]. Research in Gabon (Darwin Initiative 2009-2012; NOAA 2006-2008) not only demonstrated that Gabon hosts the world's largest nesting colony for the leatherback turtle [4] but also highlighted the inadequate scope of the extant marine protected areas for protecting turtles during the nesting season [2] which not only leave the parks, but cross into neighbouring countries. Tracking after the breeding season highlighted a range of migratory strategies spanning the South Atlantic. These strategies expose turtles to some of the world's highest levels of longline fishing, in addition to areas with coastal gillnet fisheries.

Research has focused on the likely impact and mitigation of direct and indirect fisheries on marine turtle populations, and numerous publications from the group describe participatory work with governments, NGOs and fishing communities. Recommendations resulting from this research have led to legislative change and future studies. In the Cayman Islands for example, there is a legal harvest of marine turtles, and past over-exploitation has led to greatly reduced nesting populations. Research (FCO/Defra 2004-2006, Darwin Initiative 2005-2008) has shown that both breeding and nesting occurred outside a long-established closed season, and size limits were allowing rare and reproductively valuable adult turtles to be taken. In their 2007 paper [5] Godley & Broderick recommended legislative changes for the fishery.

Research utilising satellite tracking led to the development of the online Satellite Tracking Analysis Tool-STAT [6] which facilitates animal tracking and public data-sharing for workers without access to advanced spatial analysis and web design skills. This has been a huge success and has now facilitated the work of global network of over 300 projects involving >7600 animals of 118 species from a wide range of taxa.

3. References to the research (indicative maximum of six references)

Evidence of the quality of the research: this work has been published in high quality peer reviewed journals and has attracted significant external grant funding.

1. **Broderick AC**, Frauenstein R, Glen F, Hays GC, Jackson AL, Pelembe T, Ruxton GD, **Godley BJ** (2006) Are green turtles globally endangered? ***Global Ecology and Biogeography*** 15:21-26
2. Witt MJ, **Broderick AC**, Coyne MS, Formia A, Ngouessono S, Parnell RJ, Sounguet GP**, Godley BJ** (2008) Satellite tracking highlights difficulties in the design of effective protected areas for critically endangered leatherback turtles *Dermochelys coriacea* during the inter-nesting period. ***Oryx*** 42:296-300
3. Scott R, Hodgson DJ, Witt MJ, Coyne MS, Adnyana W, Blumenthal JM, **Broderick AC**, Canbolat AF, Catry P, Ciccione S, Delcroix E, Hitipeuw C, Luschi P, Pet-Soede L, Pendoley K, Richardson PB, Rees AF, **Godley BJ** (2012) Global analysis of satellite tracking data highlights adult green turtles are significantly aggregated in MPAs ***Global Ecology Biogeography* 21:1053-1061**
4. Witt MJ, Bonguno EA, **Broderick AC**, Coyne MS, Formia A, Mounguengui Mounguengui GA, Moussounda C, NSafou M, Nougessono S, Parnell RJ, Sounguet G-P, Verhage S and **Godley BJ** (2011). Tracking leatherback turtles from the world's largest rookery: assessing threats across the South Atlantic. ***Proceedings of the Royal Society B* 278:2338-2347**
5. Bell C, Solomon JL, Blumenthal JM, Austin TJ, Ebanks-Petrie G., **Broderick AC, Godley BJ** (2007) Monitoring and conservation of critically reduced marine turtle nesting populations: lessons from the Cayman Islands. ***Animal Conservation*** 10: 39-47.
6. Coyne MS, **Godley BJ** (2005) Feature Article: Satellite Tracking and Analysis Tool (STAT): an integrated system for archiving, analyzing and mapping animal tracking data. ***Marine Ecology Progress Series*** 301: 1-7.

Grants:
The group's work on marine turtles is consistently well funded from a range of sources such as: Defra's Darwin Initiative, FCO/DfID Overseas Territories Environment Programme, NERC, NOAA and Total Foundation (>£1.4 million since 2004)**:**

7. **Darwin Initiative Grant** (Co-PI: **Broderick** & **Godley**) 2012-2015 *Implementing a Darwin Initiative Biodiversity Action Plan for Ascension Island* **£299,480**
8. **FCO/DfID Overseas Territories Environment Programme Grant** (PI: **Broderick**) 2011-2013 *Status of marine turtles of Ascension Island*. Amount: **£50,381.**
9. **Darwin Initiative Grant** (Co-PI: **Broderick** and **Godley**) 2009-2013. *Darwin Initiative Sustainable Artisanal Fisheries Initiative (Peru)*. Amount: **£299,995.**
10. **Darwin Initiative Grant** (Co-PI: **Godley** and **Broderick**) 2009-2012 *Darwin Initiative Marine Biodiversity Action Plan (Gabon).* Amount: **£299,997.**
11. **NERC Case Studentship** (PI: **Broderick**) 2008-2012. *Population dynamics of marine turtles under harvest.* **Amount: £ 78,000.**
12. **Total Foundation Grant** (Co-PI: **Broderick** and **Godley**) 2007-2008. *Oman Satellite Tracking.* 2007-2008 Amount: **£ 55,826.**
13. **NOAA Funded Large Pelagic Research** Centre Grant (Co-PI: **Broderick** and **Godley**) 2006-2008 *East Atlantic Marine Satellite. Tracking* Amount: £ **68,769.**

14. **Darwin Initiative Grant** (PI: **Godley**) 2005-2008 *In Ivan's Wake: A Marine Biodiversity Action Plan for Cayman Islands*. Amount: **£178,822.**

15. **FCO/DfID Overseas Territories Environment Programme Grant** (PI: **Godley**) 2004-2006 *Turtles in the UK OT's.* Amount: **£100,000**

4. Details of the impact (indicative maximum 750 words)

Informing conservation agency decisions:
Data from the group's long-term monitoring projects in the UK Overseas Territories and Cyprus have been used in both local conservation and global IUCN Red List Assessments and in support of a change to regional assessments for marine turtle species (section 5; source 1). In Cyprus, data have provided the basis for the designation of five Special Environmental Protected Areas (SEPAs) containing turtle nesting beaches. These sites have also been identified as potential Natura 2000 sites and are awaiting designation to this ecological network of protected sites by the European Union (section 5; source 2).

Research in Gabon has been influential in the rescheduling of multi-million dollar seismic surveys (section 5; source 3); published tracking data were used to create maps of risk highlighting that planned seismic work held potential for high levels of interaction with breeding turtles and moves afoot to increase the size of marine protected areas. It has also galvanized the inception of a marine fisheries observer programme funded by governments of UK and USA and the NGO WWF.

Informing policy debate and influencing policy change
In the UK Overseas Territories (OTs) the University of Exeter group have worked with governments across the region (Anguilla, British Virgin Islands, Cayman Islands, Montserrat, Turks and Caicos Islands) to create a baseline to inform local conservation policy and the UK Government's position with regard to key biodiversity agreements such as the Convention on International Trade in Endangered Species of wild fauna and flora and the Convention for Migratory Species (section 5; source 4)**.** This resulted in a major report commissioned by Defra/FCO (section 5; source 5), subsequent associated peer reviewed articles (eg Bell et al 2007 Section 3) and a National Biodiversity Action Plan for the Cayman Islands (http://www.doe.ky/nbap/ See section 5; source 6) and Letter and an Action Plan for the Coastal Biodiversity of Anegada, British Virgin Islands (section 5; source7).

Recommendations to the Cayman Islands Government (section 5; source 5) were adopted by the Cayman Islands Department of the Environment (section 5; source 6) and in 2008 legislation was amended to extend the closed season and include a maximum size limit as recommended by our group (section 5; source 8). These measures have undoubtedly contributed to the upward trend now seen in this population (communication from Scientific Research officer, department of the environment Cayman Islands government).

In Anguilla recommendations resulted in an extension to an existing moratorium prohibiting harvest until long-term studies support changes to legislation and in the Turks and Caicos Islands, in conjunction with the Marine Conservation Society (UK), research by the group has been used in a draft management plan to introduce a closed season and maximum size limit for harvest.

Increasing capacity for conservation
The establishment of STAT (Satellite Tracking Analysis Tool) has empowered workers without access to GIS, many in developing nations, with advanced spatial analysis, oceanographic expertise and web design skills. This has been a huge success and has now facilitated the work of a global network of 300 projects involving >7600 animals of 118 species from a wide range of taxa. The public facing pages of STAT (www.seaturtle.org/tracking) have been visited over 16 million times since 2004. This has allowed tracked animals to be adopted online, provided data to schools for use in lessons and has seen >£200,000 raised for conservation. The paper describing this tool

(Coyne and Godley 2005) has been cited as the methodology of an ever-increasing number of studies (160+ cites Oct 2013).
In addition, Broderick and Godley have supervised over 20 international post-graduate students (including 6 from the UKOTs for whom full scholarships were secured from DfID/FCO), many from developing nations, where building capacity for biodiversity conservation is critical.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. Letter from the IUCN Marine Turtle Specialist Group Co Chair. Director of Marine Research foundation, Malaysia.

2. Fuller,WJ, Seffer J, Ozden O, Karabulut Dogan O, Sefferova V, Stritih J, Kara C. (2009) Nicosia. Management Plan for Alagadi SEPA. Project Europe Aid/125695/C/SER/CY/7, Technical assistance for management and protection of potential Natura 2000 sites in the northern part of Cyprus, pp 49.

3. Letter from Director of National Parks, Gabon

4. Letter from Joint Nature Conservation Committee (JNCC) and Head of UK Convention on International Trade in Endangered Species (CITES) delegation

5. Godley BJ, Broderick AC, Campbell LM, Ranger S, Richardson PB (2004) An assessment of the status and exploitation of marine turtles in the UK overseas territories in the wider Caribbean. *Report to the Department of Environment, Food and Rural Affairs and the Foreign and Commonwealth Office*. 253pp.

6. Letter from Director of the Cayman Islands Department of Environment.

7. McGowan A, AC.Broderick, C.Clubbe, S.Gore, BJ Godley, M.Hamilton, B.Lettsome, J.Smith-Abbott, NK Woodfield. 2006. Darwin Initiative Action Plan for the Coastal Biodiversity of Anegada, British Virgin Islands. 13 pp. Available online at: www.seaturtle.org/mtrg/projects/anegada/

8. Marine Conservation (Turtle Protection) Regulations (2008 Revision), Cayman Islands Government (pdf)