Institution: University of Essex

Unit of Assessment: 5 – Biological Sciences

Title of case study: Environmentally sustainable development of the Wakatobi Marine National Park, Indonesia

1. Summary of the impact

By describing the exceptional biodiversity of the Wakatobi Marine National Park (WMNP), Essex research underpinned the Park's nomination for World Heritage Status, and its designation as a *UNESCO Man and the Biosphere (MAB) Reserve* in 2012. MAB designation was due to our development of a participatory research programme that has taken approximately 5600 international research tourists to the WMNP since 2002. This sustainable research model has contributed to the economic development of the region through the employment of more than 100 local staff per year, injecting over £1M into the local economy. This has also led to increased turnover for our UK partner, Operation Wallacea, from £250k to over £3M per annum (2002-11).

2. Underpinning research

The work of the Coral Reef Research Unit (CRRU, part of the School of Biological Sciences at Essex), has centred on the Wakatobi Marine National Park (WMNP) in Indonesia. A trans-disciplinary programme described the Park's biological, social and cultural features and demonstrated its international significance for biological and cultural diversity. The Unit's research has also focused on identifying and evaluating natural and anthropogenic threats to the Park's natural resources and its management, as well as barriers to its conservation. This work identified the need for international regulation and protection (see Clifton et al., 2010), and underpinned the Park's nomination for World Heritage Site status, and its subsequent designation as a UNESCO Biosphere Reserve.

To characterise and promote the environmental significance of the Park, Professor David Smith developed a research strategy in partnership with Operation Wallacea (OpWal), a UK-based SME. In line with this strategy, over the course of ten years between 2002 and 2012 OpWal have recruited approximately 5600 paying volunteers to visit the WMNP, who have contributed towards research. The strategy has aimed at maximising research output, public engagement, local community participation, international awareness as well as regional, national and international policy impact. This has been enabled by a thematic approach to research that has been developed since 2002. The themes have focused on:

a) ***Ecosystem Biodiversity,*** to identify the WMNP as a mega biodiversity hotspot. This was demonstrated in, for example, Bell and Smith, 2004.
b) ***Ecosystem Dynamics,*** to describe environmental regulation of system health and productivity. This was shown in, for example, Crabbe and Smith, 2005.
c) ***Ecosystem Connectivity,*** to demonstrate the importance of protecting mangrove and seagrass habitats (this was shown in, for example, Unsworth et al., 2008) and the closed nature of coral reefs of the Wakatobi as it concerns recruitment (see, for example, Salinas de León et al., 2011).
d) ***Ecosystem Management,*** to evaluate the potential for community participation in environmental protection and the success of different protective policies. This is addressed in Clifton et al., 2010.
e) ***Ecosystem Degradation,*** to demonstrate the key threats to the region and how they can be best alleviated. These were shown in, for example, Crabbe and Smith, 2005, and in Suggett and Smith, 2011.

As well as these findings being published in international journals, Smith also authored extensive reports for the Indonesian Ministry of Research and Technology (2004-12, see www.RISTEK.go.id). These have addressed a broad range of topics, including: i) the biodiversity of the Park (see Bell and Smith, 2004); ii) the immediate anthropogenic factors threatening its diversity and productivity (see Crabbe and Smith, 2005); iii) the rate of anthropogenic-induced loss of habitat (see Green et al., 2012); iv) reduction in marine resource availability (see Exton and Smith, 2013); and v) the urgent need for strict management (see Clifton et al., 2010).

In summary, having partnered with the UK SME Operation Wallacea, the research undertaken within this model was multi-faceted. It demonstrated the biological importance of the WMNP and underpinned its UNESCO *Man and the Biosphere* designation, by providing a solution to reconcile the needs for conservation with sustainable economic development of the region.

3. References to the research [can be supplied by HEI on request]

Bell, J.J. and D.J. Smith (2004) Ecology of sponge assemblages (Porifera) in the Wakatobi region, south-east Sulawesi, Indonesia: richness and abundance. *Journal of the Marine Biological Association of the UK*. 84(03), 581-591. DOI:10.1017/S0025315404009580h

Crabbe, M.J.C. and D.J. Smith (2005) Sediment impacts on growth rates of *Acropora* and *Porites* corals from fringing reefs of Sulawesi, Indonesia. *Coral Reefs*. 24(3), 437-441. DOI:10.1007/s00338-005-0004-6

Unsworth, R., P. De Leon, S. Garrard, J. Jompa, D.J. Smith and J. Bell (2008) High connectivity of Indo-Pacific seagrass fish assemblages with mangrove and coral reef habitats. *Marine Ecology Progress Series*. 353, 213-224. DOI:0.3354/meps07199

Clifton, J., R.F.K. Unsworth and D.J. Smith (Eds.) (2010) *Marine Conservation and Research in the Coral Triangle: The Wakatobi National Park.* New York: Nova Science Publishers. ISBN:978-1-61668-473-0

Suggett, D.J. and D.J. Smith (2011) Interpreting the sign of coral bleaching: friend versus foe. *Global Change Biology*. 17, 45-55. DOI:10.1111/j.1365-2486.2009.02155.x

Salinas de León, P., A. Costales Carrera, S. Zeljkovic, D.J. Smith and J.J. Bell (2011) Scleractinian settlement patterns to natural cleared reef substrata and artificial settlement panels on an Indonesian coral reef. *Estuarine, Coastal and Shelf Science*. 93(1), 80-85. DOI:10.1016/j.ecss.2011.02.016

Green, B.C., D.J. Smith and G.J.C. Underwood (2012) Habitat connectivity and spatial complexity differentially affect mangrove and salt marsh fish assemblages. *Marine Ecology Progress Series*. 466, 177-192. DOI:10.3354/meps09791

Exton, D.A. and D.J. Smith (2013) Coral Reef Fisheries and the Role of Communities in their Management. In: J.S. Intilli (Ed.), *Fishery Management*. New York: Nova Science Publishers. ISBN: 978-1-61209-682-7

4. Details of the impact

The research undertaken within Smith's programme was used to underpin the Wakatobi Marine National Park's application for World Heritage status. Although this status was not confirmed within the REF2014 impact period, the UNESCO application did result in designation as a *Man and the Biosphere* (MAB) Reserve in 2012 [see corroborating source 1, a letter from the Regent of the Wakatobi]. This has triggered major on-going changes to the management and conservation policies within the Park, and significant economic and societal impacts have also been realised. The Park was designated as a Reserve for two main reasons: first, the international importance of the region – as demonstrated in publications produced by Smith and his team; and second, because Smith actively stimulated a participatory approach for research and conservation. UNESCO recognised these activities as demonstrating that the Wakatobi Marine National Park is a region that is "experimenting with and learning about sustainable development" and is at the forefront of programmes "to test different approaches to integrated management of […] coastal and marine resources and biodiversity" [see corroborating source 2, an article authored by UNESCO Media Services].

The participatory approach used by Smith since 2002, in partnership with Operation Wallacea (OpWal), has also resulted in significant societal impact through members of the public becoming involved and gaining valuable experience from field-based conservation research expeditions. This research-tourism model has also accumulated impact over the past 10 years by supporting OpWal's recruitment of these paying volunteers. It is conservatively estimated that around 2500 volunteers have visited the Wakatobi in the REF2014 Impact period, each staying for an average of six weeks [see corroborating source 3, a letter from OpWal's Wakatobi Marine Station Manager]. Growing levels of recruitment have resulted in OpWal increasing its turnover from £250k in 2002 to more than £3M in 2011. The company attributes its increased recruitment to its ability to market itself as a more credible science and conservation research organisation. This is due to the large volume of research published in collaboration with Smith and his team [see corroborating source 4, a letter from OpWal's Director]. Since the development of the research-tourism model, Smith's participatory research strategy, and the recognition that scientific journal publications are a marketable commodity, OpWal has expanded its research portfolio to recruit volunteers to 25 sites around the world and has offices in 10 countries [see corroborating source 3].

The commercial and research success of the partnership's activities in the Wakatobi has led to £1.4M being injected into the local community since 2004 via employment and other field expenditure [see corroborating source 4], and the establishment of a new Indonesian NGO in 2008, which provides support for local and national government activities in the region [see corroborating source 5, a letter from the Director of Lembaga Alam Mitra Wakatobi, the new Indonesian NGO]. In recognition of this success the local and central government of Indonesia have also invested £200k into the region to establish a new research and education centre of excellence under the directorship of Professor Smith [see corroborating sources 4, 6] which was formed in 2010. This new development is designed to capitalise on the scientific tradition of the area to further attract international researchers and organisations to the Park so that the Wakatobi may be further developed for the purposes of marine research and education within the 'Coral Triangle' region.

In summary, Smith's thematic participatory research programme and resulting scientific publications have led to policy, societal and economic impact, both in the UK and in Indonesia. The recognition by UNESCO of the Park's unique research and conservation profile, as well as its approaches towards integrated participatory management, demonstrates policy-based impact. The

research-tourism strategy and engagement of paying volunteers in high-quality conservation science (including authored publication) has delivered significant societal impact by providing direct research and conservation experience to approximately 2500 paying volunteers since 2008. Finally, the unique research-tourism business model – and the development of research publications as a direct marketable commodity – has led to significant economic impact in the UK, the economic development of local communities in Indonesia, and to increased long-term economic potential of the Wakatobi through the newly established centre of excellence.

5. Sources to corroborate the impact [All sources saved on file with HEI, available on request]

[1] Letter from the Regent of the Wakatobi, sent to the HEI in November 2011

[2] UNESCO, 2012. *20 new Biosphere Reserves added to UNESCO's Man and the Biosphere (MAB) Programme* [online] Available at: http://www.unesco.org/new/en/media-services/single-view/news/20_new_biosphere_reserves_added_to_unescos_man_and_the_biosphere_mab_programme/ [Accessed 11 October 2013]

[3] Hoga Marine Station Manager, Wakatobi, Operation Wallacea

[4] Director, Operation Wallacea

[5] Director, Lembaga Alam Mitra Wakatobi

[6] Letter from the Regent of the Wakatobi, sent to the HEI in December 2008