

Whale sharks and reef fish spawning aggregations research & conservation in Belize



Darwin Initiative for the Survival of Species Annual Report



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May 2001

1. Darwin Project Information

<i>Project title</i>	Whale sharks and reef fish spawning aggregations research and conservation in Belize
<i>Country(ies)</i>	Belize
<i>Contractor</i>	University of York
<i>Project Reference No.</i>	162/09/005
<i>Grant Value</i>	£129,220
<i>Start/Finishing dates</i>	1 April 2000-30 March 2003
<i>Reporting period</i>	1 April 2000-30 March 2001

2. Project Background

- *Briefly describe the location and circumstances of the project and the problem that the project aims to tackle.*

The project aims to investigate biology and ecology of whale sharks and their interactions with reef fish spawning aggregations on the Belize Barrier Reef. The work is undertaken on the Belize Barrier Reef with a specific focus on Gladden Spit, a reef promontory that is of local, regional and international importance. This site harbours what may be the densest and most predictable aggregation of whale sharks in the world. It also supports the last commercially viable spawning aggregations of economically important fish species in Belize. The project also seeks to identify common characteristics among migratory species that can be used to develop more effective management strategies. In doing so, it will provide tangible national benefits as well as conservation guidance for migratory species that will be of international significance. Since the project started, it has expanded to encompass several other reef promontories where reef fish spawning aggregations are or were known to exist and has established collaborations with other countries suspected to be along the whale shark's migratory routes. As a result of the research undertaken to date, a marine reserve was declared 18 May 2000, at Gladden Spit the key whale shark and snapper spawning aggregation site on the Belize Barrier Reef

3. Project Objectives

- *State the purpose and objectives (or purpose and outputs) of the project. Please include the Logical Framework for this project (as an appendix) if this formed part of the original proposal or has been developed since, and report against this.*
- (1) Increase global knowledge of the natural history of the little known whale shark, with a focus on elucidating the population dynamics and migratory behaviour of the seasonally, or annually-based Belizean population;
 - (2) Determine the costs and benefits of whale shark tourism as a local economic alternative to commercial fishing through an environmental economic analysis of whale shark tourism;

- (3) Determine the impacts of tourism and fishing on whale sharks and the optimum size of a marine reserve capable of providing protection to whale sharks at the aggregation site;
 - (4) Assist local and national organisations in the development of guidelines to protect migratory species such as the whale shark;
 - (5) Strengthen the organisational, collaborative and management capacities of local institutions responsible for managing marine reserves and migratory species.
- *Have the objectives or proposed operational plan been modified over the last year and have these changes been approved by the Darwin Secretariat?*

To date, there have been no changes in the objectives or proposed operational plan. However, we may need in the near future to run fewer field trips due to rising costs of running boats and hiring boat captains. Due to competing tourism in the area, competent boat captains have increased their rate in the past year from BZ\$150 Belize a day (US\$ 75) to \$300+/day and from \$50 to \$100+ for an assistant. To maximize effectiveness and keep within budget, we will focus the majority of the fieldwork during the peak spawning months of March through June and run a few additional field trips throughout the year, budget permitting. Field-work will run close to 12 weeks/year. These periods of fieldwork also coincide with periods of more clement weather, the remaining months sometimes proving difficult to work in due to rough seas and large storms (including hurricanes). These small operational modifications will be passed through to the Secretariat for approval.

4. Progress

- *Please provide a brief history of the project to the beginning of this reporting period. (1 para.)*

This project's research originally formed part of a project on the physical-biological characterisation of the Gulf of Honduras undertaken by The Nature Conservancy and the University of South Carolina and funded by the Mellon Foundation. With the discovery of Gladden's multiple species of reef fish spawning and the large congregation of whale sharks feeding on the spawn, University of York was involved to spearhead the whale shark research. With the start of the Darwin Project the research and dissemination of information on whale sharks increased significantly as the funds enabled more field work to take place in light of the purchase of the state-of-the-art technology for tracking and monitoring the sharks' behaviour.

- *Summarise progress over the last year against the agreed baseline timetable for the period. Explain differences including any slippage or additional outputs and activities.*

Project progress this past year has far exceeded expectations both according to the original objectives and operational baseline. Outreach has increased with the inclusion of additional people in the research schedule than originally scheduled. The development of a network of collaborators throughout Belize and the Caribbean is another accomplishment this year that will significantly enhance the profile and conservation possibilities for whale sharks on a regional basis. The research has been disseminated at 5 international conferences and one local workshop. Darwin further co-sponsored Belize's first and second dive conservation course, Belize's first national grouper spawning aggregation assessment, and the first whale shark tourism

and conservation course – all activities that were not included in the original plan but have been crucial to raising the profile of whale sharks and spawning aggregations in Belize and beyond.

- *Provide an account of the project's research, training, and/or technical work during the last year. This should include discussion on selection criteria for participants, research and training methodologies as well as results. Please summarise techniques and results and, if necessary, provide more detailed information in appendices (this may include cross-references to attached publications)*

Research forms the fundamental drive for this project and underpins several of the conservation initiatives related to spawning aggregations and whale sharks. We have made significant steps forward in understanding whale shark foraging behaviour at the Gladden Spit area and are slowly uncovering some of their migratory behaviour as more data becomes available from the instruments.

We successfully tested and deployed all the state of the art geolocating satellite pop-off tags paid for by the project. This was the first time these had ever been used in the world. They provided data new to science on the foraging behaviour of the sharks with respect to their diving patterns. Coupled with the acoustic tags and underwater instruments funded by a grant from the UK Natural Environment Research Council, we were able to ascertain the degree of site fidelity of sharks not only to Gladden but also to several other reef promontories in Belize.

We have perfected the tagging technique for the marker ID tags deployed over the past few years and have collected excellent sightings data from our collaborating partners (NGO scientists, tour-guides, fishers) and have now identified some of the migratory routes taken by the sharks in Belize and to neighbouring countries – thus strongly supporting the need for an international network of collaborators.

Training is an important component of the project and the research to foster ownership over the marine resources and promote sustainability of research over the long term. We stress hands-on training and therefore training usually took place in the field as fieldwork was being conducted and then aspects of the research delegated to those who showed aptitude at specific tasks. The on-site training/workshops that were previously scheduled for June and September have been held from March-June during the peak field-work periods. Several more formal settings for training took place including the two dive conservation courses and the whale shark tourism and conservation guide course. We trained students and colleagues in tagging techniques, tag preparation, acoustic monitoring, tracking data reporting and analysis, instrument mooring and servicing, tourism survey implementation and review of data, fisheries landings and catch per unit effort data recording, entry and analysis. We also trained in fish spawning aggregation censusing and monitoring techniques, plankton sampling and fish larval raising and associated data recording, underwater video and still camera use.

Unfortunately, the pool of available participants is not very large in Belize due to the small population (275,000). Belize has few trained marine biologists so students in biology or natural resources were chosen by the project coordinator for the student posts via submission and review of CVs, cover letters and references – all

requirements for the work. Criteria for participant selection depending on the post applied for including: years working in the marine field, other competences

- *Discuss any significant difficulties encountered during the year.*

No significant difficulties have been encountered this past year.

- *Has the design of the project been enhanced over the last year, e.g. refining methods, indicators for measuring achievements, exit strategies?*

No.

- *Present a timetable (workplan) for the next reporting period.*

Activity	Month (April 2001-March 2002)											
	A	M	J	J	A	S	O	N	D	J	F	M
Field work	X	X	X			X	X		X	X		X
Outreach & information dissemination	X	X	X	X	X	X	X	X	X	X	X	X
Training (students, NGO)	X	X						X				
Collection of fisheries data	X	X				X	X					
Tourist/fisher surveys	X	X	X									X
Community consultation	X								X			
Workshop on migratory species												X
National seminar to disseminate findings												X
Second year evaluation												X

5. Partnerships

- *Describe collaboration between UK and host country partner(s) over the last year. Are there difficulties or unforeseen problems or advantages of these relationships?*
- *Has the project been able to collaborate with similar projects in the host country or establish new links with / between local or international organisations involved in biodiversity conservation?*

The success of this project is founded on the partnerships it has created and fostered over the past few years with organizations and individuals working with marine conservation in Belize, the Caribbean region and worldwide.

The project works hard at promoting a team approach to research on the Belize Barrier Reef. The key partners in Belize include Government through the Department of Fisheries and the Coastal Zone Management Authority, in the private sector/tourism the local tour operators and the Belize Tourist Board and Belize Tourism Industry Association members. This project's day-to-day success is due to its collaborations with local fishers, tourguides, and the local non-government organizations (NGOs) Toledo Institute for Development and Environment, GreenReef, Friends of Laughing Bird Caye (FOLBC), Belize Audubon, The Nature Conservancy (who first spearheaded the research at the site and plays a major role in

conservation and institutional strengthening of local partners), and Lighthawk – a US-based NGO that promotes conservation through aerial monitoring. This project further benefits from collaborations with students and professors from the University of Belize and the University of South Carolina.

On the whole, relations with country partners have been good over the past year. Some difficulties in collaborating with the local partner FOLBC have been primarily due to their lack of institutional strength, organization, available staff and an office. The Nature Conservancy is spearheading the institutional strengthening of FOLBC and they now have an office and a staff. This bodes well for stronger collaborations in the next years and sustainable management of Gladden's resources should they succeed in becoming co-managers of the site (with the Fisheries Department).

In the past year, we created a network of collaborators with researchers and government organizations from countries located along the whale shark's probable migratory routes. New partners include the Mexican fisheries and marine reserves authority (SEMARNAP) in the Yucatan peninsula of Mexico, the UK's Coral Caye Conservation in the Bay Islands of Honduras, The Department of Oceanography of Cuba and the US/Texas's Flower Gardens Banks National Marine Sanctuary in the Gulf of Mexico.

Due to the apparent large-scale migratory nature of whale sharks, the increasing threats to the species from unsustainable fishing practices in the Pacific, and the scarcity of researchers working on the species, we have further established collaborations along the lines of informational exchanges with whale shark researchers working in Ningaloo National Park (Western Australia), Komodo National Park (Indonesia), in the Philippines (WWF), the Seychelles (MCSS-NGO), and Baja California (Mexico) through the Hubbs Sea World Research Institute.

The objective of all these partnerships is to promote the exchange of information on whale sharks in particular and fish spawning aggregations in general to identify, develop and promote the mechanisms for their conservation at the national, regional and global levels.

6. Impact and Sustainability

- *Discuss the profile of the project within the country and what efforts have been made during the year to promote the work. What evidence is there for increasing interest and capacity for biodiversity resulting from the project? Are satisfactory exit strategies for the project in place?*

The project maintains a low profile (by necessity, due to sensitivities from the Belize based Nature Conservancy with which we collaborate). However, it is growing through its accomplishments and local partnerships rather than through publicity. This suits Belize and the work well. High profile foreign-funded initiatives often attract resentment and become a target for anti-conservationist rhetoric. This is particularly true currently in light of suspicion of the conservation-community as related to the country's development objectives.

Interest in whale sharks and spawning aggregations is increasing exponentially as we have worked hard to involve many partners in the research and results have been

presented locally through talks, discussions with community members, and at several international conferences. As a result, we are receiving requests to provide information for television documentaries, articles, recommendations for conservation policy. The most notable achievement to date has been the declaration of the Gladden Spit Marine Reserve. Based on the research we began in 1998 and continue with Darwin Funding, Gladden has been deemed internationally significant for its snapper spawning aggregations and unique phenomena whereby the whale sharks come in from afar to eat the spawn. We are working with our local collaborator Friends of Laughing Bird Caye to provide them with the tools and resources needed to successfully manage this site. FOLBC is currently seeking an MOU with the Department of Fisheries to co-manage this new marine reserve, a relatively novel approach in Belize to managing national resources which will promote greater local buy-in and sustainability of management of resources, and an excellent exit strategy for the project once this is finished.

We are further seeing a surge in local ownership over different aspects of the research. GreenReef, a local NGO, spearheaded the first national grouper census. Several teams were deployed along the reef to count groupers during their seasonal spawning aggregation. Results will be used to formulate national policy on fishing on spawning aggregations. GreenReef in particular is a strong advocate for conservation of whale sharks and spawning aggregations in Belize and has written articles on whale sharks and the research, and its staff participates in many of the field expeditions. University of Belize students are now confident enough to give radio interviews about the whale shark research and through word of mouth are generating a swelling interest in Belize's marine resources. As a result Belize Government is considering making the whale shark a protected species within its Exclusive Economic Zone and is reviewing its policy of fishing on spawning aggregations in marine reserve areas in particular.

The Darwin Project is one of several players in a large project (Including the Nature Conservancy that initially spearheaded work at Gladden) that has had a significant impact on how people perceive and understand whale sharks and reef fish spawning aggregations. The impact has been relatively large and has consequently attracted interest from a range of sectors. Also, the UK Darwin Initiative has become better known with US collaborators due to this partnership. In the past year, three articles were published in UK papers including the Sunday Telegraph, and 4 in Belizean papers. A BBC-radio interview highlighted the work in the spring of 2000, and we are wrapping up a two-year National Geographic filming effort on the whale shark and spawning aggregation work on the reef (started before the Darwin Project began). A new whale shark tourism and conservation course video co-sponsored by the PADI Aware Foundation will be broadly shown and distributed to participants and collaborators. Several magazines are profiling our research and are slated to come out during the year. The project will receive additional coverage through the Sustainable Seas Expedition project spearheaded by Dr. Sylvia Earle that will visit in May 2001. Among a range of objectives this initiative seeks to characterize the migratory routes of large pelagic fishes from Belize to North Carolina, passing via the Yucatan, Cuba, the Gulf of Mexico, Florida and the Carolinas.

It is hoped this project leaves with its local partners full ownership and involvement in marine conservation and research in general and in whale sharks and spawning aggregations in particular. Many local partners have been trained in the methodology

and analyses used to measure and monitor populations of these species of interest and how this can be translated into conservation policy. By fostering exchanges with outside researchers and conservation organizations (Indonesia, Bermuda, Mexico) the project has also broadened the outlook of its local partners and helped establish a support network of contacts, donors and like-minded conservationists.

7. Outputs, Outcomes and Dissemination

- Please expand and complete Table 1. **Quantify** project outputs over the last year using the coding and format from the Darwin Initiative Standard Output Measures (see website for details) and give a brief description. Please list and report on appropriate Code Nos. only. The level of detail required is specified in the Guidance notes on Output Definitions which accompanies the List of Standard Output Measures.

Table 1. Project Outputs (According to Standard Output Measures)

<i>Code No.</i>	<i>Quantity</i>	<i>Description</i>
3 B	25	25 graduated from 2 diver conservation courses with open water diving certificates – providing incentives for moving away from unsustainable fishing practices
4 A	9	Training in field research (plankton sampling and analysis, whale shark tagging and recording, fish counts/censuses, survey methodologies, fisheries data collection and analysis)
6A	46	16 trained in the whale shark tourism and conservation course, soon to be a requirement by law for tour operators wishing to conduct whale shark tours 30 tour-guides, fishers, NGO collaborators, Government scientists trained in field techniques.
6B	8wks	3 day workshop for WS tourism and conservation course Remainder is In-the field training in a range of field techniques and data reporting and analysis.
7	3	WS tourism and conservation course manual TNC's Reef fish spawning aggregation information
8	44	UK staff in host country
11A	1	Paper published in Marine Ecology Progress Series
14 A	5	Disseminated findings of Darwin research at 1 formal workshop and 4 field workshops
14D	5	Presented Darwin results at 4 international conferences, in one as a poster
15 A	1	The Belize Times article
15 B	3	Articles in the Placencia Breeze and the San Pedro Sun
15 C	1	The Sunday Telegraph article
15 D	3	York papers and University of York Magazine
16A	1	1st Darwin Newsletter in Belize
16B	250	Circulation in host country
16C	60	Circulation abroad
17 A	3	Networks of fishers, tour guides, NGOs
17 B	1	Network of researchers working on sharks in possible migratory route of whale sharks and Worldwide.

18 A	1	A ½ hour special on fishers and whale sharks in which Darwin staff was a partner although funded by TNC
19D	1	BBC interview on whale sharks in York

- Explain differences in actual outputs against those agreed in the initial ‘Project Implementation Timetable’ and the ‘Project Outputs Schedule’, i.e. what outputs were not achieved or only partly achieved? Were additional outputs achieved?

Not achieved: None

Additional outputs achieved:

- New network and collaborations established with researchers and agencies in Yucatan, Texas and Cuba and Honduras (Whale Shark migration route)
- Dissemination of results at five international conferences
- Co-funded with TNC and Greenreef and participated in the first national grouper spawning aggregation census
- Co-funded with TNC two Dive conservation courses
- Co-funded with PADI Aware Foundation the first national whale shark tourism and conservation course
- Additional students trained and involved in research

- In Table 2, provide full details of all publications and material produced over the last year that can be publicly accessed, e.g. title, name of publisher, contact details, cost. Details will be recorded on the Darwin Monitoring Website Publications database which is currently being compiled. Mark (*) all publications and other material that you have included with this report

Table 2: Publications

Type *	Detail	Publishers	Available from	Cost £
(e.g. journals, manual, CDs)	(title, author, year)	(name, city)	(e.g. contact address, website)	
Journal	Whale sharks feed on snapper spawn in Belize, Heyman, W, Graham, R, Kjerfve B, R.E. Johannes 2001	Marine Ecology Progress Series	rtg@btl.net	?
Manual	Whale shark tourism and conservation course manual	R. Graham	rtg@btl.net	25
Article	Placencia’s First Conservation Diving Course (April 2000)	Placencia Breeze	Placencia Tourism Center - +501 6 23294	
Article	Conservation of whale sharks in Belize and beyond... (May 2000 – Graham)	Placencia Breeze	Placencia Tourism Center - +501 6 23294	
Article	April 16, 2000 – Scientists seek secrets of the whale shark	The Sunday Telegraph		
Article	Sunday May 28, 2000 – Scientists seek secrets of the whale shark	The Belize Times		
Article	June 16, 2000 – Scientists	Discovery		

Article	<i>tackle the world's biggest fish July 2000– Annual report on project to Department of Fisheries (Heyman, Graham, Kjerfve)</i>	News TNC/USC/U of York -	rtg@btl.net	
Article & press release	<i>April/May 2000 – Whale shark protected in unique conservation project</i>	University of York Magazine		
Article	<i>March 9 2000 – Fight to save giant “Hoovers”.</i>	York Evening Press		
Article	<i>March 13, 2000 – University mission to save the whale shark</i>	Yorkshire Post		
Article	<i>April 19, 2001 – Reef Brief– Whale sharks (Jill Hepp – collaborator) on the web under San Pedro Sun</i>	San Pedro Sun		
Article	<i>April 2001 – Belize’s first whale shark tour-guiding course (FOLBC – collaborator)</i>	Placencia Breeze		
Brochures	<i>Whale shark facts/Whale shark research, Whale shark tourism guidelines – Laminated information sheets on whale shark biology/research/guidelines distributed to collaborators, local tour-guides, fishers, international research visitors and donors</i>	R. Graham	rtg@btl.net	12 for set
Brochure	<i>Whale shark brochure – general information on whale shark biology, research and tourism regulations for broad distribution to tourists in Belize</i>	R. Graham	rtg@btl.net	Postage only
Newsletter	<i>UK Darwin Initiative Newsletter, No.1- Spring 2001 – broad distribution</i>	R. Graham	rtg@btl.net	Postage only
Fisheries Report	<i>Heyman, D, Kjerfve B, Graham, R</i>	Belize Fisheries	will@btl.net or rtg@btl.net	Postage only

- *Provide details of dissemination activities in the host country during the year. Will these activities be continued by the host country when the project finishes, and how will this be funded and implemented?*
- Local articles on whale sharks and spawning aggregations were published in the spring of 2000 and Spring of 2001 in time for the peak whale shark season.

collaborators, through TV, Radio and involvement of a broad range of people in the research, much more is known now in Belize and abroad about whale sharks and reef fish spawning aggregations, the uniqueness of the Gladden Spit phenomenon and the need for its conservation. Several other countries have contacted us for assistance with their whale shark and reef fish spawning aggregation work.

- *Are there lessons that you learned from this years work and can you build this learning into future plans?*

There are no harsh lessons to be learned from this past year. We work with many local counterparts and involve many organizations and individuals, making everyone an owner of the research and the process, and ultimately the resources. This project provides information to marine decision-makers and marine resource users in a non-threatening manner. We also place great emphasis on teamwork and incorporation of local or traditional knowledge into the research and conservation work we do. This leads to greater interest and collaboration from community-based fishers and tour guides. We will continue on this same tack for the duration of the project.

10. Author(s) / Date

Dr. Callum Roberts
Rachel Graham 5th July 2001