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TOO PRECIOUS TO DRILL:  
THE MARINE BIODIVERSITY OF BELIZE

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Fisheries Centre, University of British Columbia, Canada

# TOO PRECIOUS TO DRILL: THE MARINE BIODIVERSITY OF BELIZE

edited by

Maria Lourdes D. Palomares and Daniel Pauly

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## DIRECTOR'S FOREWORD

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The April 2010 Deepwater Horizon oil rig blowout in the Gulf of Mexico has sharpened attention on the oil spills occurring in many parts of the world ocean, and their potential damaging effects on marine ecosystems and the living organisms they sustain. This report focuses on the sustainability of marine fisheries of Belize in the face of potential impacts of ocean threats – in particular, oil spills. The report is timely and important in at least two ways. First, it addresses oil spills in the ocean, which occur frequently worldwide and can have significant effects on life in the ocean and the wellbeing of the people dependent on it. Second, the report focuses on a small developing country, Belize – an example of a country that does not usually receive the attention it deserves by researchers, even though the ocean and the resources it contains is the main source of existence for its citizens. Thirdly, this work is a collaboration between academic researchers, NGOs and management partners, thereby making the research output more relevant to real life problems.

This report consists of several chapters that tackle issues ranging from the ecology of the marine ecosystem of Belize right through to the economic benefits currently derived from activities dependent on the ecosystem. These include fishing, angling and whale(shark) watching. A crucial point made in the report is that while oil is a non-renewable resource, fish is renewable. This means that in comparing the benefits from drilling the marine ecosystem of Belize, it is important that in the short term, possibly larger benefits from oil drilling should not be allowed to trump benefits that, if well-managed and protected, are capable of continuing to flow through time, benefiting all generations.

The result of the work reported in this contribution, which is based on a broad collaboration between scientists, civil society members and managers, serves as a good example of how to produce policy relevant research that serves societal goals and objectives.

I commend the authors of the report for producing a significant piece of research that has a strong potential to contribute positively to policy making in Belize.

U. RASHID SUMAILA  
Director and Professor  
The Fisheries Centre, UBC

## EDITORS' PREFACE

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There is a huge amount of zoological and botanical publications on the marine biodiversity of Belize, notably because the American Museum of Natural History in New York and the Smithsonian Institution in Washington, D.C., established marine stations many years ago in Belize and used these for continuous monitoring, and for generations of graduate students to complete their theses. All these and similar materials were, however, published mainly in US and British scientific journals, with only sporadic efforts to make it accessible to the Belizean students and members of the public. Thus, those Belizeans who live with their back to the sea do not get the information that they need to turn around, and fully appreciate the beauty and wealth of the biodiversity along their shores, and its role in attracting tourists and producing seafood. This also leads to the Belizean public not fully appreciating the risk to marine biodiversity of an oil spill and the potential cost to their economy.

In view of the debate and the possibility of a national referendum on offshore oil drilling in Belize, a conference entitled 'Too Precious to Drill: the Marine Biodiversity of Belize' was organized jointly by Oceana Belize and the *Sea Around Us* project, with major funding from the Oak Foundation. This report assembles the contributions presented at this conference, and is complemented by a conference website ('Too Precious to Drill: the Marine Biodiversity of Belize' at [www.seararoundus.org](http://www.seararoundus.org), under 'Hot Topic') which assembles all the published material that was used in enhancing the content of SeaLifeBase ([www.sealifebase.org](http://www.sealifebase.org)) and FishBase ([www.fishbase.org](http://www.fishbase.org)) for Belize, two global information systems documenting nomenclature, geography, ecology and biology of marine organisms of the world, and which hopefully will become tools for familiarizing Belizean students with their marine biodiversity. Also, we hope that this report and the conference website will contribute to informing the national debate on oil drilling in Belizean waters.

We thank Ms Audrey Matura-Shepherd and her staff at Oceana Belize for their enthusiastic assistance with the preparation of this material and the event at which it was released, and the Oak Foundation for funding the event and the preparation of this report. The *Sea Around Us* project, of which this report is a product, is a scientific collaboration between the University of British Columbia and the Pew Environment Group.

## ENDEMIC MARINE FISHES OF BELIZE: EVIDENCE OF ISOLATION IN A UNIQUE ECOLOGICAL REGION<sup>1</sup>

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### ABSTRACT

The Meso-American Barrier Reef (MABR) forms a physical boundary enclosing a large coastal lagoon that runs the length of the country of Belize. This creates a semi-enclosed body of water that is a mix of oceanic water and freshwater river input. Thus, the Belize lagoon ecosystem is unique in the western hemisphere and represents a distinct biogeographical province with special water quality. The majority of coral reef fishes have pelagic larvae that spend weeks in the plankton during their early development. This is a highly dispersive phase of the life history of marine fishes. As a result, most Caribbean species range throughout the Caribbean Sea. Even so, some taxa show strong local selection and restricted biogeographic distributions. In Belize, this is especially evident and probably due in large part to the physical barrier of the reef and the special quality of the marine water in the lagoon system. Recent studies of the fishes inside the MABR have discovered several new species of fishes and many of these are endemic to Belize. A preliminary estimate of endemic fishes in Belize yields a count of 12 species found only in the lagoonal area and another 8 species found on the outer barrier reef and the atolls.

### INTRODUCTION

Belize is in a corner of the Caribbean Sea that is bounded by unique oceanographic conditions and the distinctive barrier reef. The majority of fishes that occur in Belize are the same species that are found everywhere else in the Caribbean. But, there are exceptions; there are some species found only in Belize and nowhere else. These are scientifically designated as 'endemics'. The endemic marine fishes of Belize are evidence of biological isolation in a unique ecological region. The biological questions are 'what local ecology are these endemic fishes adapted to?' and 'how do these species maintain their genetic uniqueness?' Such questions are complicated and require learning the details about the fish's natural history. Many marine animals have early life histories as embryos and small larvae which drift in the plankton. These animals spawn free floating eggs and their offspring drift away. As such, these propagules are easily dispersed over vast distances creating large populations of single species. Such is the case for many of the most familiar fishes such as groupers, snappers, surgeonfishes and many other reef fishes. But, some other fishes have evolved different reproductive tactics that result in their planktonic larvae staying close to natal reefs. Some of these fishes have developed non-dispersing embryos and larvae and others have adapted their reproduction and larval dispersal to occur during times when oceanographic conditions entrain and retain the larvae near home reefs. The Belize Barrier Reef System is a semi-enclosed marine habitat. Even though it does pulse with tides and there is an influx of oceanic waters through myriad channels. The bulk of the water inside the Barrier Reef has a higher retention or residency time than it would have otherwise if that barrier reef was not present.

It is important to describe biogeographically restricted species for purposes of conservation and as key indicator species used in ecological monitoring for local effects. To date, there have been about 500 fish species found in Belize waters (see Palomares and Pauly, this volume). David Greenfield pioneered ichthyological surveys in Belize in the 1970s. Subsequently scientists from the Smithsonian museum have been the leading force in documenting Belize reef communities and describing new species (e.g. Baldwin, Faust, Lavett-Smith, Ruetzler, Tyler and others).

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<sup>1</sup> Cite as: Lobel, P.S., Lobel, L.K., 2011. Endemic marine fishes of Belize: evidence of isolation in a unique ecological region. *In*: Palomares, M.L.D., Pauly, D. (eds.), *Too Precious to Drill: the Marine Biodiversity of Belize*, pp. 48-51. Fisheries Centre Research Reports 19(6). Fisheries Centre, University of British Columbia [ISSN 1198-6727].

This report highlights the several new fish species that we have found in Belize with help and collaboration of colleagues. Big fishes are easier to find than little fishes. The new discoveries that we are making of previously unknown species in Belize waters have one key common trait. The new fishes are small and easily overlooked or mistakenly misidentified. In some cases, it required DNA data combined with color photographs of live fish to make the case distinguishing the Belize population as a distinct species.



**Cleaner Goby, *Elacatinus lobeli*** (Randall and Colon, 2009). This species is similar in color to the neon goby found in Florida, but it is genetically and morphologically distinct. It is a cleanerfish and removes ectoparasites from host fishes. It is endemic to the MABR, and is found broadly inside the MABR and on the atolls. It was named for Phillip S. Lobel who photographed and collected type specimens.



This probable new species of **Banner Goby, *Microgobius*** is found only in deep sand flats areas (>15 m) in the inter-reefal channels between mangrove islands in Belize MABR. It is very hard to see as it prefers murky water, is very skittish and avoids divers. This species is being diagnosed for description by the authors with J. Randall.



**Sponge Goby, *Elacatinus coloni*** (Randall and Lobel, 2009). This species is a sponge dweller and feeds on a polychaete sponge parasite. It is endemic and found only inside the MABR usually in tube sponges.



**Atoll Goby, *Elacatinus* nov. sp.** (Lobel and Kaufman, *in prep.*). On their first scuba dive at Lighthouse Atoll, Lobel and Kaufman discovered this new species! This was the weekend before the February 2010 MMAS meetings (Belize City). We returned to the atoll after the meetings and collected the type specimens. It has blue stripes similar to *E. lobeli* but this new fish is distinct by having a white-ish nose spot and is only found at deeper depths (>30 m).



The 'Maya hamlet' is a new species of *Hypoplectrus* found only in Belize. The manuscript describing this species is in press (Lobel, 2011).



The **Social wrasse**, *Halichoeres socialis* Randall and Lobel, 2003. Male and female (in back). This new Belize fish species was discovered during the Lobels' first field trip to Belize in 1993. Continued study of its biology and biogeographic distribution is an annual project conducted by students in Professor P.S. Lobel's coral reef ecology field course, Boston University Marine Program.

A preliminary listing of marine fishes with distributions mainly within the MABR system including the outer reef and atolls is presented in Table 1. A few of these species (e.g., *E. lori*, *T. clarkii*, *T. briggsi*) possibly range as far as the Bay Islands, Honduras, which are nearby the southern margin of the MABR. More research is needed to better define the biogeography of these species.

#### ACKNOWLEDGEMENTS

This report summarizes research accomplished under annual permits from the Department of Fisheries, Belize, 1997-2010. Research was supported by Conservation International Marine Management Area Science program, Boston University, The Legacy Program USA, The Ross and Edwards families of Lighthouse Atoll, The former Friends of Nature, and the Southern Environmental Association. Much of the field work was based from the Wee Wee Cay Marine Laboratory. We are appreciative that this work needed the help of friends and colleagues to succeed: Horace and Sharon Andrews, Mary and Paul Shave, Shelly and Clifford Robinson, Udell Foreman, David Greenfield, Jack Randall, Pat Colin, Will Heyman, Eli Romero, Les Kaufman, Margo Stiles, Lindsay Garbut and many others, many thanks.

All photographs by Phillip S. Lobel (copyrighted, all rights retained).

**Table 1.** Preliminary listing of marine fishes with distributions mainly within the MABR system including the outer reef and atolls. Species whose distribution is so far known only from the lagoons inside of the MABR are noted with an asterisk (\*).

Family	Genus and species	Reference
Batrachoididae	<i>Sanopus greenfieldorum</i> *	Collette 1983
	<i>Triathalassothia gloverensis</i>	Greenfield and Greenfield 1973
	<i>Opsanus dichrostomus</i> *	Collette 2001
	<i>Sanopus astrifer</i>	Robins and Starck 1965
Chaenopsidae	<i>Acanthemblemaria paula</i> *	Johnson and Brothers 1989
	<i>Emblemariopsis ruetzleri</i> *	Tyler and Tyler 1997
	<i>Emblemariopsis diana</i> *	Tyler and Hastings 2004
Gobiesocidae	<i>Tomicodon lavettsmithi</i> *	Williams and Tyler 2003
	<i>Tomicodon clarkei</i>	Williams and Tyler 2003
	<i>Tomicodon briggsi</i>	Williams and Tyler 2003
Gobidae	<i>Elacatinus coloni</i> *	Randall and Lobel 2009
	<i>Elacatinus lobeli</i>	Randall and Colin 2009
	<i>Elacatinus lori</i>	Colin 2002
	<i>Elacatinus</i> sp nov	Lobel and Kaufman ms
	<i>Microgobius</i> sp nov *	Lobel, Lobel and Randall ms
Blennidae	<i>Psilotris amblyrhynchus</i>	Smith and Baldwin 1999
	<i>Starksia weigii</i> *	Baldwin <i>et al.</i> 2011
Serranidae	<i>Starksia sangreyae</i> *	Baldwin <i>et al.</i> 2011
	<i>Hypoplectrus</i> sp nov *	Lobel <i>et al.</i> 2009, Lobel in press
Labridae	<i>Halichoeres socialis</i> *	Randall and Lobel 2003



New species of invertebrate found in Belize, December 2010. P. Lobel found this undescribed phoronid worm in the muddy bottom habitat in deep channels between cays in the lagoon. In February 2011, Lobel returned with Prof. G. Giribet (Harvard) and collected specimens. The description of this new species is in preparation. The worm has a burrow in the sand and it will extend itself about 5 cm above the surface, but retracts when disturbed. It is one of only about 12 species of this kind of phoronid worldwide and one of the few tropical ones.

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