Please note that this template is provided to facilitate information submission on a voluntary basis, only when the information provider finds this template appropriate. If the available information does not fit the format of this template, information can be submitted in another format, in consultation with the Secretariat.

Appendix

Template for Submission of Scientific Information

to Describe Ecologically or Biologically Significant Marine Areas

*Note: Please **DO NOT** embed tables, graphs, figures, photos, or other artwork within the text manuscript, but please send these as separate files. Captions for figures should be included at the end of the text file, however.*

Title/Name of the area:

Cayman Island Twilight Zone Expedition 2007/2008. Little Cayman Island.

Presented by (*names, affiliations, title, contact details)*

Dr. Nicolas Alvarado
NOAA Office of Ocean Exploration & Research (2020 Company, LLC.)
Oceanographer
263 13th Avenue S.
Suite 113, Rm. 303
St. Petersburg FL 33701
e-mail: Nicolas.Alvarado@noaa.gov
Tel: (727) 209-5955

(on behalf of)

Dr. Marc Slattery, Department of Pharmacognosy, and the National Institute for Undersea Science & Technology, University of Mississippi; 662-915-1053; slattery@olemiss.edu

Dr. Deborah J. Gochfeld (National Center for Natural Products Research, University of Mississippi; 662-915-6769; gochfeld@olemiss.edu

Dr. Julie B. Olson (Department of Biological Sciences, University of Alabama; 205-348-2633;jolson@bama.ua.edu

Dr. Michael P. Lesser, Department of Zoology and Center for Marine Biology, University of New Hampshire; 603-862-3442; mpl@cisunix.unh.edu

Abstract (*in less than 150 words)*

Deep reef communities have been hypothesized to act as nursery habitats and/or refugia for commercially- and ecologically-important coral reef species. This project used mixed gas technical diving and rebreathers to document the species boundary between shallow- [< 190 fsw] and deep-reef [>190 fsw] communities of the Little Cayman wall system. During the life of this grant, the interdisciplinary research team conducted a total of 358 dives, including 44 deeper than 150 fsw. We developed a sponge species diversity list, and compared and contrasted the sponge communities at the species break. In addition, we collected representative species across the depth gradient for a comparison of biochemical, stable isotope and molecular profiles, for use in assessing connectivity of deep and shallow reefs. Environmental

sensors were installed on the reef, and several experiments to further understand the biology of the deep reef sponges and corals, relative to their shallow water conspecifics, were completed.

Introduction

(To include: feature type(s) presented, geographic description, depth range, oceanography, general information data reported, availability of models)

The principal goal of this project was to increase current understanding of the transition zone between tropical coral reefs and the aphotic deep-water communities. This zone, often referred to as the Twilight Zone, has had very limited prior exploration and discovery. The few studies conducted provide little information about the extent or distribution of the transition zones, and their biodiversity and ecology. Moreover, the biotechnological potential of these deep-adapted species appears to be high, and our group assessed these capabilities.

Primary objectives:

1. Gain access to and explore the deep fore-reef communities of Little Cayman Island, with emphasis on sites representing a variety of slope angles and current patterns. The geology (e.g., substrate type, topography, slope angle), hydrography (e.g., prevailing current, water temperature) and environmental conditions (e.g., photosynthetically-active radiation, salinity) at each site will be recorded and compared.
2. Characterize the biodiversity and distribution patterns of these communities. This will be accomplished using video photo-documentation, as well as by collection of taxonomic samples. Data analysis will permit the identification of endemic species and those that are common to all sites and/or depths.
3. Assess the site-specific flora and fauna for potential biotechnological uses including biomedical drug development and fluorescent probe development. Sub-samples of our taxonomic vouchers will be bioassayed at the National Center for Natural Products Research and leads will be fractionated for identification of the responsible biomolecules. Additional sub-samples will be probed for fluorescent proteins at the University of New Hampshire, and novel genes will be excised using molecular techniques.

Secondary objectives:

1. Examine deep reef coral biology, including reproductive status, photosynthetic capabilities, growth rates, etc.
2. Analyze phenotypic plasticity relevant to chemical variability across sites and over the depth gradient.
3. Assess the connectivity of the deep fore-reefs to shallow reefs as it relates to disease transmission, genetic relatedness/gene flow, heat tolerance, and coral physiology.

Location

(Indicate the geographic location of the area/feature. This should include a location map. It should state if the area is within or outside national jurisdiction, or straddling both. It should also state if the area is wholly or partly in an area that is subject to a submission to the Commission on the Limits of the Continental Shelf)

The Cayman Islands (19°41’ N, 80°03’ W) rise from the Cayman Trench, located in the center of the Caribbean Sea, between Cuba and Jamaica. Upwelling of deep, nutrient-rich waters from the North Equatorial and Caribbean

currents aid in the development of shallow (2- to 20-meter depth) fringing reefs and patch reefs. Many of these reefs are associated with mangrove forests, sea grass beds, and algal plains, which are important habitat for reef-associated fishes.

Feature description of the proposed area

(This should include information about the characteristics of the feature to be proposed, e.g. in terms of physical description (water column feature, benthic feature, or both), biological communities, role in ecosystem function, and then refer to the data/information that is available to support the proposal and whether models are available in the absence of data. This needs to be supported where possible with maps, models, reference to analysis, or the level of research in the area)

The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for being the least impacted within the Cayman Islands, and for the narrow "skirt" of shallow fringing and patch reefs near shore, so the walls are often located within 0.5 kilometers (km) of the beach. They include a zone of shallow-reef species on near vertical slopes, followed by a deeper zone of unique deep-reef species of sponges and corals, as well as some gorgonians (sea fans and sea whips) and algae. Investigating these deep, light-limited, coral reef systems that include many species of hermatypic (reef-building) corals will allow us to evaluate the potential negative impacts of several factors that broadly influence the decline or recovery of Caribbean coral reef systems.

Feature condition and future outlook of the proposed area

(Description of the current condition of the area – is this static, declining, improving, what are the particular vulnerabilities? Any planned research/programmes/investigations?)

• Identified a species break at 190 FSW at the Rock Bottom Wall site on Little Cayman. This represents the upper limit of the Twilight Zone at this location.

• Compared species break data to that of the Bock Wall site, Exumas, Bahamas, where the break occurs at 240 FSW.

• Quantified biodiversity cover above and below this species break (= 10% vs 60% sponge cover, respectively) using video-transects at 100', 150', 180', 200', 250' & 300'

• Identified sponge and coral biodiversity gradient between 10m and 80m (at least 12 new species discovered)

• Collected 105 sponge samples for biotechnology efforts

• Initiated basic biological experiments with tunicates, sponges, corals and microbes to better understand shallow- vs deep-adapted species

• Collected year-long temperature profiles at RBW site, as well as preliminary nutrient characterization, and profile of coral symbionts.

Exploration often generates more questions than tangible results, and we have that situation with this project. We are now poised to ask questions related to cause and effect on deepreefs (e.g.,do abiotic conditions control the upper boundary of the twilight zone much like they do in rocky intertidal communities, etc). Over the course of the next several months we will continue to review the data in hand and develop specific biological questions/models that we will incorporate into our future deep reef research efforts. We now have a better understanding of the se unique communities in the Caribbean basin; obviously exploration of Pacific deep reefs remains an important future goal.

Assessment of the area against CBD EBSA Criteria

(Discuss the area in relation to each of the CBD criteria and relate the best available science. Note that a candidate EBSA may qualify on the basis of one or more of the criteria, and that the boundaries of the EBSA need not be defined with exact precision. And modeling may be used to estimate the presence of EBSA attributes. Please note where there are significant information gaps)

<table>
<tr><td rowspan="2">CBD EBSA Criteria
(Annex I to decision IX/20)</td><td rowspan="2">Description
(Annex I to decision IX/20)</td><td colspan="4">Ranking of criterion relevance
(please mark one column with an X)</td></tr>
<tr><td>Don’t Know</td><td>Low</td><td>Some</td><td>High</td></tr>
<tr><td>Uniqueness or rarity</td><td>Area contains either (i) unique (“the only one of its kind”), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6">Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for being the least impacted within the Cayman Islands, and for the narrow “skirt” of shallow fringing and patch reefs near shore, so the walls are often located within 0.5 kilometers (km) of the beach. They include a zone of shallow-reef species on near vertical slopes, followed by a deeper zone of unique deep-reef species of sponges and corals, as well as some gorgonians (sea fans and sea whips) and algae. Investigating these deep, light-limited, coral reef systems that include many species of hermatypic (reef-building) corals will allow us to evaluate the potential negative impacts of several factors that broadly influence the decline or recovery of Caribbean coral reef systems.</td></tr>
<tr><td>Special importance for life-history stages of species</td><td>Areas that are required for a population to survive and thrive.</td><td></td><td></td><td></td><td>X</td></tr>
<tr><td colspan="6">Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

Recent interest in deep-reef communities has been sparked by an increased understanding that they represent important refuges and nursery habitats for shallow-water coral and fish populations. Thus, as shallow-water reefs suffer declines, the deep reefs might be one of the few natural options for recovery.</td></tr>
<tr><td>Importance for threatened, endangered or declining species and/or habitats</td><td>Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.</td><td></td><td></td><td>X</td><td></td></tr>
</table>

Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

Recent interest in deep-reef communities has been sparked by an increased understanding that they represent important refuges and nursery habitats for shallow-water coral and fish populations. Thus, as shallow-water reefs suffer declines, the deep reefs might be one of the few natural options for recovery.

Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.				**X**

Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for being the least impacted within the Cayman Islands, and for the narrow "skirt" of shallow fringing and patch reefs near shore, so the walls are often located within 0.5 kilometers (km) of the beach. They include a zone of shallow-reef species on near vertical slopes, followed by a deeper zone of unique deep-reef species of sponges and corals, as well as some gorgonians (sea fans and sea whips) and algae. Investigating these deep, light-limited, coral reef systems that include many species of hermatypic (reef-building) corals will allow us to evaluate the potential negative impacts of several factors that broadly influence the decline or recovery of Caribbean coral reef systems.

Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.			**X**	

Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for being the least impacted within the Cayman Islands, and for the narrow "skirt" of shallow fringing and patch reefs near shore, so the walls are often located within 0.5 kilometers (km) of the beach. They include a zone of shallow-reef species on near vertical slopes, followed by a deeper zone of unique deep-reef species of sponges and corals, as well as some gorgonians (sea fans and sea whips) and algae. Investigating these deep, light-limited, coral reef systems that include many species of hermatypic (reef-building) corals will allow us to evaluate the potential negative impacts of several factors that broadly influence the decline or recovery of Caribbean coral reef systems.

Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.			**X**	

Explanation for ranking
Scientists were contacted for a more appropriate ranking but have not responded.

The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for

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Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.				*X*
Explanation for ranking Scientists were contacted for a more appropriate ranking but have not responded. The Cayman Island reefs are considered some of the most pristine within the Caribbean due to limited human populations and impacts. They provide an opportunity to study coral reef communities (shallow and deep), with a focus on natural processes. The reefs surrounding Little Cayman are significant for being the least impacted within the Cayman Islands, and for the narrow "skirt" of shallow fringing and patch reefs near shore, so the walls are often located within 0.5 kilometers (km) of the beach. They include a zone of shallow-reef species on near vertical slopes, followed by a deeper zone of unique deep-reef species of sponges and corals, as well as some gorgonians (sea fans and sea whips) and algae. Investigating these deep, light-limited, coral reef systems that include many species of hermatypic (reef-building) corals will allow us to evaluate the potential negative impacts of several factors that broadly influence the decline or recovery of Caribbean coral reef systems.					

Sharing experiences and information applying other criteria (Optional)

Other Criteria	**Description**	**Ranking of criterion relevance** (please mark one column with an X)			
		Don't Know	**Low**	**Some**	**High**
Add relevant criteria					
Explanation for ranking					

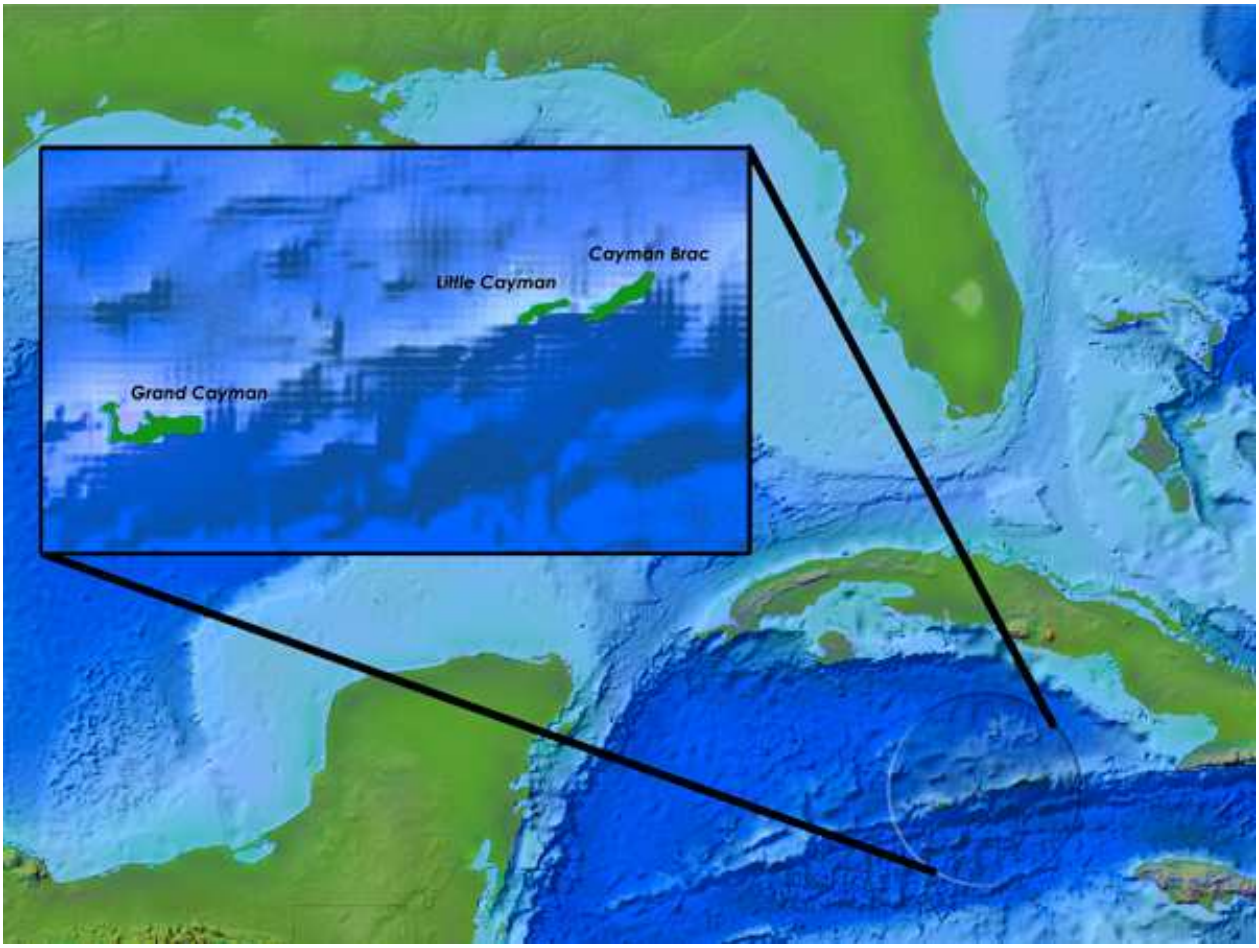
References

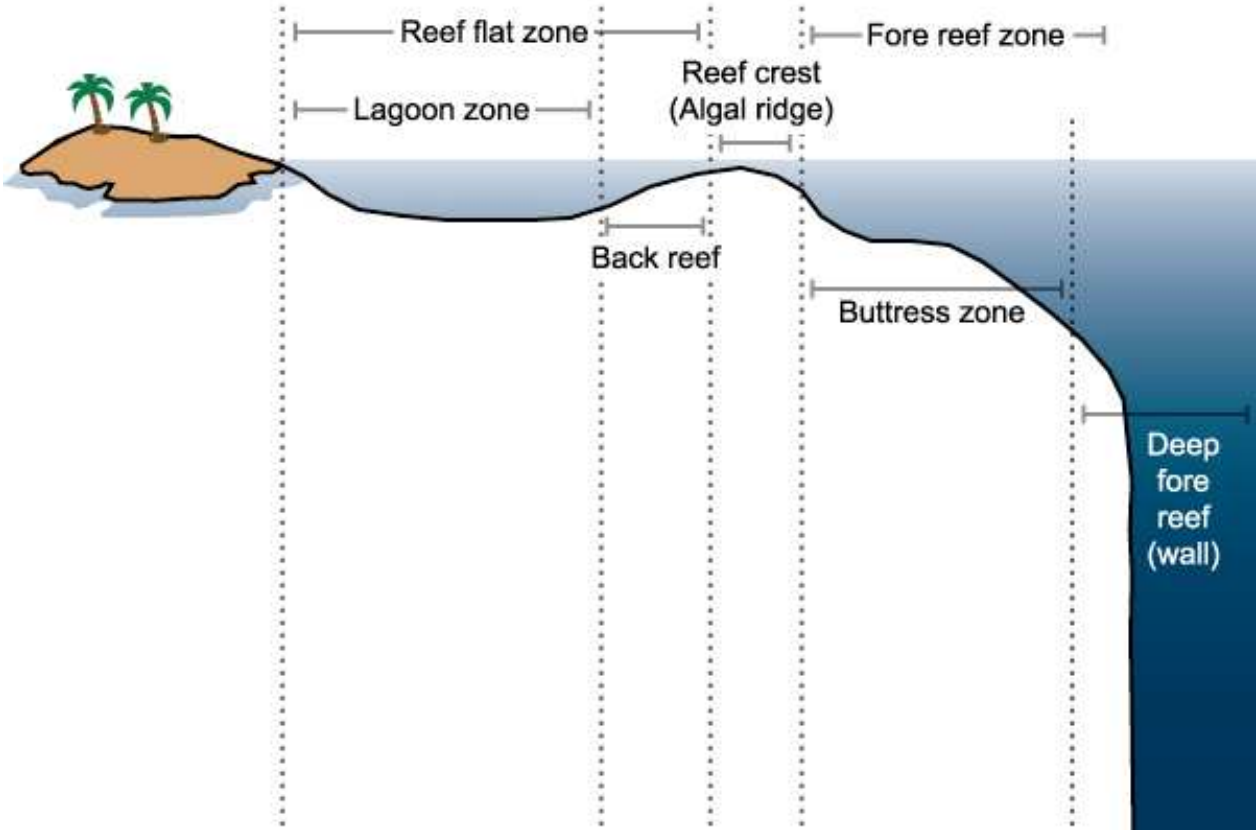
(e.g. relevant documents and publications, including URL where available; relevant data sets, including where these are located; information pertaining to relevant audio/visual material, video, models, etc.)

http://oceanexplorer.noaa.gov/explorations/07twilightzone/welcome.html

NOAA OER Grants Online Final Report Award NA060AR4600184

Maps and Figures


Cayman Brac
Little Cayman
Grand Cayman


Reef flat zone
Fore reef zone
Reef crest
(Algal ridge)
Lagoon zone
Back reef
Buttress zone
Deep
fore
reef
(wall)

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