Bleaching Resilience Index (to be finalized at the meeting)

A Bleaching Resilience Index will be developed based on the percentage of Healthy, Pale, Part Bleached, Whole Bleached and Percent Recovery at sites. These are five categories that will have a maximum of 5 points similar to the Resilience Index prepared by Arrivillaga (2009). Data from the months sites were surveyed during peak bleaching season (October, November) will be used to grade the sites for Healthy, Pale, Part Bleached and Whole Bleached, while the Percent Recovery category will be the difference in of value from overall bleaching level in Oct or Nov and the recovery month of February or March.

Healthy - Examining values for "healthy" or "no bleaching" coral colonies during a coral bleaching event between months or years can be used to identify which CBE had a greater impact on the corals at a particular site, and also how quickly corals recover. Graphs for each site monitored are presented for review.

Pale - Coral colonies that only exhibit paling and not bleaching can either be exhibiting early sign of stress, or are somewhat tolerant of higher water temperatures and thus do not bleach.

Part Bleached - Coral colonies that bleach partly are likely to continue to bleach if the stress continues and become whole bleached. At a given point in time coral that are part bleached in relation to whole bleached colonies would be more resilient.

Whole Bleached - Colonies of corals that are 90% or greater bleached are under extreme stress and not resilient to warmer temperatures associated with climate change and would receive a low score.

Pale + Part Bleached + Whole Bleached - Corals that experience some form of bleaching are under some stress. These graphs will be exact opposites of the healthy graphs.

Percent Recovery - Identification of sites resilient to coral bleaching can be measured as percent recovery.

(More to be entered here after our meeting)

DISCUSSION (*Under development will finalize after meeting June 25)*

The goals of the coral bleaching monitoring that was carried out by members of the Belize National Coral Reef Monitoring Network were to:

- Monitor impacts of climate change on coral reefs in Belize
- Identify sites which recover quickly after coral bleaching events
- Identify factors which influence level of impact
- Protect sites identified as resilient

Inherent to any study are limitations, and to overcome these limitations, recommendations are provided on how to improve future coral bleaching monitoring efforts.

Impacts of Climate Change on Coral Reefs in Belize

Recovery

Measuring Resilience from Coral Bleaching

Until now members of the Coral Network have not discussed how a site's coral bleaching levels can be used to identify resilient reef sites. Before moving forward and reviewing the results of the coral bleaching surveys and determining if the surveys can identify resilient reefs, it is essential that resilient reefs are defined. Bood (2006) defined resilience as:

a) the capacity of a system to undergo and respond to change and disturbance, whilst maintaining its functions and controls or
b) the ability to revert to original configuration subsequent to perturbations.

In the case of coral bleaching events monitored by the Coral Network, corals resilient to bleaching are measured by "a" during a bleaching event by grading the level of severity, ie. pale, part bleached or whole bleached, and "b" when measuring the % recovery rate of coral colonies at a specific site.

Recommended resilience rate:

90-100%	Very high
75-90%	High
55-75%	Good
35-55%	Low
0-35%	Very low

Factors Influencing Resilience

One objective of the Coral Watch Program was to identify factors that may influence sites to have a greater resilience to coral bleaching. Possible factors which influence an area or even a specific site within a large area can be influence by:

- Depth
- Reef Type
- Storms
- Oceanic circulation
- River Run-off
- Other _____

Channels in the reef do seem to have higher resilience, as is the case in the Caye Caulker site just outside the CCMR boundaries and also the site surveyed by Wildlife Trust near Rendezvous Caye, and other observations made while in the field.

LIMITATIONS & **RECOMMENDATIONS**

The significant data set which resulted from the nationwide monitoring of coral bleaching events in Belize has highlighted areas that show resilience to coral bleaching. Table 5 presents an overview of limitations and recommendations are outlined for consideration by members of the National Coral Reef Monitoring Network as they move forward with managing for resilience within their MPAs.

Table 5. Description of limitations on coral bleaching database and recommendations on how these limitations can be overcome.

LIMITATION	RECOMMENDATION
Lack of Data for a Given Month Regular monitoring of sites is essential so data can be compared from month to month and to other sites. Seasons where data exists for consecutive months provide more refined details on bleaching levels and recovery.	**Establish Minimum Requirements for Data Collection** Coral Network members need to discuss the minimum requirements for monitoring a site for the data to be useful. The understanding of the bleaching occurrences throughout the year would be significantly improved if surveys were conducted through the summer months as well. However, there is no doubt that the corals are more affected in the autumn than in spring.
Scheduling Conflict & Weather Coral Network members agreed to a two week period in which to schedule the Coral Bleaching Monitoring. The scheduled time was planned around SPAG surveys and often the monitoring window was too small to account for weather influences that would have caused surveys to be cancelled due to passing of tropical storms or Northers.	**Schedule Surveys Early in Monitoring Window** Coral Network members did their best to adapt and follow through with program goals, but perhaps the monitoring window needs to be increased, and members need to schedule monitoring early in the window should weather cause delays they have time to still complete surveys within the appropriate time.
Online Database Inaccurate When the ERI took over database management they uploaded all the data into the database and repeatedly requested that members review the database to confirm that the data presented was correct. SEA was perhaps the only member that sent corrections on missing sites. The errors found are with sites missing and revisions of data in sites.	**Members to Update Online Coral Bleaching Database** Cora Network members that contribute to the Coral Bleaching database need to engage personnel to go through the online database and ensure accuracy. In the production of this report ECOMAR found many discrepancies which are included in Appendix VI.
Comparability An additional limitation of the coral bleaching database is that the data is not easily comparable to other coral bleaching surveys done throughout the tropics in the Atlantic and Pacific Oceans. When the protocol was developed members discussed entering the data into the Reef Base database but this did not occur. Recently NOAA has begun to compile coral bleaching data from throughout the Caribbean and while the ERI has assisted with completing the detailed questionnaire, the data was not collected in the same	**Consider Contributing to Regional Database** Coral Network members should review regional coral bleaching databases and consider how they can contribute the data collected in Belize to this database. If this can only be done by collecting additional data or in a revised format it should be considered so data can be compared for sites outside Belize.

format, making easy comparison difficult.	
Staff Turnover Adhering to the methodology was a requirement so that the sites remained the same (so they could be compared) and that observers were knowledgeable about species id and able to differentiate between diseased corals and bleaching corals.	**Offer Regular Review &Training** Regular training sessions should be scheduled to ensure that the coral bleaching methodology is replicated at all sites monitored. Senior staff within NGOs can offer this training to new personnel. In September 2011 a Coral Bleaching Training Workshop was held for biologists involved in coral bleaching monitoring . The two day workshop covered many tropics but priority was given to training participants to distinguish between diseased and bleaching corals through theory and practical training, and how to enter observations into the coral bleaching database and generate reports.
Funding Lack of funding influenced the number of surveys that members could complete, while staff turnover, effected reports received. The lack of sufficient surveys has a great impact on determining resiliency since it is impossible to determine the rate of recovery. The sites discussed are designated by their location in an area from northern to southern Belize.	**Regular Monitoring** If funding is not available to cover expenses then NGOs should liaise with dive operators within the community so they can monitor the sites regularly. Dive operators often visit the same sites at least once a week and during coral bleaching events sites can be monitored more frequently so peak bleaching time can be determined. Involving the local dive operators in coral bleaching surveys will also help build closer relationships between park managers and user groups, both which have the same objective – keep the reefs alive and healthy!
Site Selection Sites regularly monitored for SMPs or AGRRA were utilized in many cases. These sites were not necessarily "resilient."	**Select Sites Based on Resilience** More discussion should occur on the selection of sites. • New sites should be selected that appear to be healthy with high coral cover and fish abundance. • New sites just outside MPA boundaries should also be monitored. If "good" sites are identified then MPA managers could possibly extend boundaries to include these "resilient" sites. If "good" sites are located outside park boundaries then this may also indicate good park management.
Does not Identify Contributing Factors The coral reef database does not take into account ambient factors which may include sediment laden run off, nutrient loading, ocean/sea circulation patterns or upwelling, and genetics of coral species.	**Digitize Other Influences** The impact external influences have on a site may contribute to the resiliency levels of a particular reef site. In order to identify possible factors, water quality parameters, water circulation patterns, etc need to be digitized and mapped in GIS. This way the impact of these other influences which may contribute to a site's resiliency can be measured.
Little Use of Data Another limitation was the fact that no member of the Coral Network actually utilized the information they gathered on coral bleaching to identify resilient reefs or to incorporate into managing marine protected areas in Belize. In order to make the vast amount of	**Publish Scientific Reports** Perhaps volunteers can be engaged in the production of reports that can be published thereby sharing this database with other interested organizations.

data useful, WWF contracted ECOMAR to produce this Technical document that would present the results and solicit input from members. Since 2008, Coral Network members have been busy managing their MPAs and are involved in many monitoring projects and often lacked the resources to produce scientific reports on the coral bleaching events that have plagued Belize. Limited publication of the surveys have been completed by ECOMAR (Searle et al 2010 & 2012), TIDE (Foster and Williams 2009a and 2009b), ERI UB (Cho-Ricketts 2012), and through a data sharing agreement, NOAA incorporated the data into a report they are preparing for the Wider Caribbean region.	

CONCLUSION (*To be completed after meeting)*

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II. Belize National Coral Reef Monitoring Network Members

Organization	1st Representative	Alternate Representative
Belize Audubon Society North Park Street Belize City Tel: (501) 223-5004	Shane Young Marine Protected Areas Manager marineparks@belizeaudubon.org Cel: (501) 602-1253	Eliceo Cobb Biologist eliceo_cobb@yahoo.com Cel: (501) 636-2732
Belize Fisheries Department Princess Margaret Drive Belize City TEL: (501) 224-4552	Isaias Majil Marine Protected Areas Manager isaiasmajil@yahoo.com Cel: (501) 601-1570	Inez Garcia Fisheries Assistant inz_cardenas@yahoo.com (501) 635-0191
Coastal Zone Management Authority & Institute Princess Margaret Dr Belize City Tel: (501) 223-0719	Collin Gillett Director directorczmai@gmail.com Cel: (501) 601-5001	
ECOMAR PO Box 1234 Belize City Tel: (501) 223-3022	Linda Searle Director linda@ecomarbelize.org Cel: (501) 671-3483	
Environmental Research Institute University of Belize Central Campus, Hummingbird Ave P.O Box 340, Belmopan Tel: (501) 822-2701	Leandra Cho-Ricketts, PhD Marine Science Director lricketts@ub.edu.bz Cel: (501) 623-5956	Celso Cawich Marine Biologist ccawich@ub.edu.bz Cel: (501) 601-6334
Green Reef 100 Coconut Drive San Pedro Tel: (501) 226-2833	Mito Paz Executive Director greenreef@gmail.com Cel: (501) 663-2865	
Healthy Reefs 1755 Coney Drive, 2nd Floor Belize City Tel: (501) 670-3953	Melanie McField, PhD Executive Director mcfield@healthyreefs.org Cel: (501) 610-4899	Roberto Pott Country Coordintor pott@healthyreefs.org Cel: (501) 602-4390
Siwaban Foundation Caye Caulker Tel: (501) 226-0178	Ellen McRae Executive Director siwaban@gmail.com Cel: (501) 668-3232	
Southern Environmental Association	Annelise Hagan, PhD Science Program Director	Reylando Castro Biologist

Placencia Tel: (501)523-3377	a.b.hagan@seabelize.org Cel: (501) 681-2816	reylandocastro@yahoo.com Cel: (501) 600-9000
The Nature Conservancy 1899 Constitution Drive PO Box 660, Belmopan Tel: (501) 822-0274	Julie Robinson Marine Conservation Program Manager jrobinson@tnc.org Cel: (501) 610-4903	Alejandro Martinez Belize Country Program Director alejandro_martinez@tnc.org Cel: (510) 610-0087
Toledo Institute for Development & Environment Hopeville Area Punta Gorda Town Tel: (501) 722-2274	James Foley, MSc. Science Director jfoley@tidebelize.org Cel: (501) 634-4989	Marlon Williams Junior Biologist mwilliams@tidebelize.org
Wildlife Conservation Society 1755 Coney Drive, 2nd Floor P O Box 768, Belize City Tel: (501) 223-3271	Virginia Burns Perez Technical Coordinator vburns@wcs.org	Robin Coleman, PhD Assistant Coordinator rcoleman@wcs.org Cel: (501) 670-2972
World Wildlife Fund 1061 Queen Helmet Street Belize City Tel: (501) 223-7680/7684	Nadia Bood, MSc. Belize Program Coordinator nbood@wwfca.org Cel: (501) 602-6015	
INDIVIDUALS Lisa Carne Cel: (501) 623-6122 lisasinbelize@gmail.com		

III. NATIONAL CORAL REEF MONITORING NETWORK BLEACHING MONITORING METHODOLOGY

Bar Drop Methodology Revisions

In efforts to measure the level of variability Alex Arrivillaga from TNC has consulted with Melanie McField of Healthy Reefs on the Bar Drop Method and discussed implementing minor changes to the original methodology that was used for the October 2008 bleaching surveys.

1. Where possible, have more than one surveyor record data at a given site. At each site 200 colonies are to be counted and so if there are two surveyors then each would count 100 colonies.
2. After recording 50 colonies, swim 5 meters away and begin a new transect, counting 50 more colonies. Each site should therefore have 4 "transects" of 50 colonies each. When entering the results in the excel spreadsheet identify the first and second transect of each surveyor by a letter A and B at the end of the site name.

Data collection reminders:

3. Please be consistent with names of sites.
4. Only count stony corals and fire corals. If other species are bleaching please make note of how many per transect. Abbreviated names of coral species should have the first letter capital and the others lower caps (or all capitals?).
5. Methodology states that coral colonies only greater than 10 cm must be recorded.
6. Goal is to complete 6 sites per area. At minimum 4 must be completed.
7. Please record map datum, depth (preferably in meters), and reef zone.
8. Please confirm your coordinates for each site.

Weighted-bar Swimming transect (WBST) Method for Assessing the Extent of Coral Bleaching and Disease Incidence

Melanie McField, WWF / Belize SPO (mcfield@btl.net)
Philip and Patricia Kramer, Univ. of Miami/RSMAS (pkramer@rsmas.miami.edu)

See manuscripts: McField, M.D. (1999). Coral response during and after mass bleaching in Belize. Bull. Mar. Sci. 64(1): 155-172; and Kramer, P.A. and P.R. Kramer. 2000. Ecological Status of the Mesoamerican Barrier Reef: impacts of Hurricane Mitch and 1998 coral bleaching. Final report to the World Bank.

A new assessment method has been developed to rapidly and quantitatively assess the extent of coral bleaching and mortality, and the incidence of coral disease. The "weighted-bar swimming-transect method" was developed as a bleaching assessment by McField (1999) and modified by Kramer and Kramer (2000) to include information on disease and mortality. It utilizes a one meter piece of small diameter PVC tubing filled with stones or sand and capped at both ends (or left open to fill with water). Each bar is marked with five strips of black electrical tape (or other marking) spaced 0.25 meters apart. Thus there are five marks per bar, including the two ends. The observer swims in a straight line along a compass bearing or depth contour (parallel to the reef crest axis), holding the bar perpendicular to the line of the swimming-transect. Every three kick cycles (one full push down and up for both legs is one kick cycle) the bar is dropped/placed straight down onto the substrate. The species and condition of corals (=>10 cm) lying under the marks are recorded. Condition refers to that of the entire colony and not to the individual polyps under the mark. If a mark does not fall directly on top of a coral, record the condition of the nearest coral colony to the mark which falls within a 12.5 cm radius of the mark. This distance of 12.5 cm is fairly easy to gauge since it is half the distance between any two marks. Thus the bar demarcates five adjacent but non-overlapping

circles each centered on a mark. If no coral lies within a given circle no data is recorded for that mark so sandy patches and other non-coral areas can be passed through quickly. The total number of “bar drops” and corals assessed is recorded for each site. For each “bar-drop”, anywhere from zero to five corals are assessed.

For studies of coral bleaching the conditions to recorded are as follows under the Bleach column of the datasheet (sample provided in excel file):

- PA=Pale (definite loss off pigment (lighter coloration for that species)
- PB=Part Bleached (patches of fully bleached or some white tissue on the colony - not due to other coral diseases such as white band, black band, or white plague)
- WB=Wholly Bleached (over 90% of colony with totally white-bleached tissue)

In addition the following diseases are recorded if present:

BB = Black band
WB = White band
WS = White spots, patches or pox
WP = White plague
YB = Yellow blotch (sometimes called yellow band)
RB = Red band
DS=Dark Spot disease
UK = Unknown

(these are based on Bruckner’s latest disease cards and the McCarty/Peters website http://ourworld.compuserve.com/homepages/mccarty_and_peters/coraldis.htm)

The percent of old dead and recent dead (based on the intactness of non-living corallite structure) can also be recorded (as described in AGRRA methods http://coral.aoml.noaa.gov/agra/). Coral mortality estimates provide information to help determine transient and lethal effects of bleaching, disease or other disturbances. However, this estimation adds additional time spent examining each colony and will reduce the number of colonies surveyed per dive. If bleaching/disease is the focus of the study this information could be skipped.

If mortality estimates are included, they include the estimation of the percent (%) of the coral that is "recently dead" and the % of the coral that is "old dead" as viewed from above in "plan" or "map" view. "Recently dead" is defined as any non-living parts of the coral in which the corallite structures are white and either still intact or covered over by a layer of algae or fine mud. “Old dead" is defined as any non-living parts of the coral in which the corallite structures are either gone or covered over by organisms that are not easily removed (certain algae and invertebrates).

While swimming, observers should look into the distance along the compass bearing and avoid looking down at the substrate until the bar is resting on the bottom. The “size” of each transect can be delimited by dive time, distance traveled, or number of coral condition records desired (like 100 records per transect), depending on habitat and sampling conditions. Each transect should remain within a pre-defined depth range or habitat zone. Several observers can swim parallel to each other to increase the sample size per dive at each site. Observers should remain at least ten meters apart, and cover approximately equal distances by swimming at the same speed.

This method enables observers to cover large areas of reef in either deep water, while scuba diving or in shallow water, while snorkeling. Because no transect lines are set more data are collected for the time expended and a larger area of reef can be covered. The method also increases the number of samples of rarer and smaller coral species as compared with traditional line intercept methods. Due to the previous use of this method, further use would allow comparisons within the Mesoamerican barrier reef system.

IV. CORAL BLEACHING MONITORING DATA SHARING AGREEMENT

BELIZE

An Agreement for Data Sharing among Members of the National Coral Reef Monitoring Network

This Data Sharing Agreement is made among the National Coral Reef Monitoring Network's current members which include the Belize Audubon Society, Coastal Zone Management Authority & Institute, ECOMAR (Environmental Conservation Organization), Fisheries Department, Green Reef, Healthy Reefs for Healthy People Initiative, Lisa Carne, Siwa-Ban Foundation, Southern Environmental Association, the Environmental Research Institute (University of Belize), The Nature Conservancy, Toledo Institute for Development and Environment, Wildlife Conservation Society, Wildlife Trust, and World Wildlife Fund.

INTRODUCTION

The National Coral Reef Monitoring Network is comprised of various government agencies responsible for marine protected areas, co-management NGOs that have daily oversight of marine protected areas, other NGOs involved in coral reef conservation, independent individuals that conduct research on coral reefs in Belize, and international NGOs that provide support to coral reef management and academic institutions that conduct research, monitoring and training.

Since late 1994, the Fisheries Department has been overseeing a National Coral Reef Monitoring Program which has been expanded to address new and developing concerns over the last decade, such as bleaching and disease. Presently, coral reef monitoring includes monthly assessments for bleaching and disease, biannual monitoring looking at community change and health using the Synoptic Monitoring Protocol and periodic assessments using the AGRRA protocol.

There are several organizations involved in coral reef monitoring countrywide that make up the network and include the following organizations listed below.

The Belize Audubon Society (BAS) is a non-profit, non-governmental, membership organization dedicated to the sustainable management of Belize's natural resources in order to maintain a balance between people and the environment. BAS is responsible for the management of Half Moon Caye and Blue Hole Natural Monuments on Lighthouse Reef Atoll.

The Coastal Zone Management Authority & Institute (CZMAI) is a semi-autonomous statutory body responsible for research, monitoring and formulation of policy to support the allocation, sustainable use and planned development of Belize's coastal and marine resources, established under the Ministry of Agriculture and Fisheries.

ECOMAR (Environmental Conservation Organization) is a non-profit, non-governmental organization promoting "Conservation through Education" and focuses on the marine environment. One method used to achieve this goal is to involve all levels of society in marine conservation including visitors, guides and fishermen. Current projects include Coral Watch Belize, Lionfish Wanted Dead or Alive, Reef Rally Marine Life Assessment and the Robinson Point Turtle Project.

The Environmental Research Institute (ERI) of the University of Belize is a scientific institute established to build research capacity in Belize and work to ensure that decision-making is based on accurate knowledge for the effective management, sustainable use and conservation of natural resources. UB manages and owns a field station at Calabash Caye, Turneffe and through the ERI monitoring and research programs, focus is placed on research that supports management of the Turneffe Atoll including coral reef monitoring.

The Fisheries Department is the government agency legally responsible for fisheries management, management of marine reserves and the issuing of marine research permits. The Fisheries Department is the National Coral Reef Monitoring Network chair.

Green Reef Environmental Institute is a private, non-profit organization dedicated to the promotion of sustainable use and conservation of Belize's marine and coastal resources.

Healthy Reefs for Healthy People Initiative (HRI) is an international, multi-institutional effort that tracks the health of the Mesoamerican Reef, the human choices that shape it and the progress in ensuring its long-term integrity. HRI is working to improve the understanding of reef health and provide a platform to increase the collective conservation impact in the Mesoamerican Reef.

The Siwaban Foundation (SbF) is a small nonprofit working to accomplish research, conservation and education in Belize's marine habitats, principally at Caye Caulker. Since 1990 we worked to fight for establishment of multi-habitat protection for Caye Caulker's reefs, seagrass, mangroves and littoral forest. We are active members of FAMRACC, the Co-Management CBO of Caye Caulker Marine and Forest Reserves, including design and leadership in FAMRACC's restoration project (2007-8). We have coordinated Tour Guide Training at Caye Caulker.

Southern Environmental Association (SEA), formerly Friends of Nature and TASTE, is a non-profit, non-governmental organization that represents the coastal communities of Hopkins, Sittee River, Seine Bight, Placencia, Independence, Monkey River, Punta Negra and Punta Gorda, and aims to protect their natural resources by developing their human resources. SEA has co-management agreements with the Fisheries Dept. to manage the Gladden Spit & Silk Cayes Marine Reserve and the Sapodilla Caye Marine Reserve and with the Forest Department for Laughing Bird Caye National Park. .

The Nature Conservancy (TNC) is a non-profit organization, qualified under Section 501(c)(3) of the United States Internal Revenue Code and organized for the purposes of preserving plants and animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. TNC is presently supporting the activities of partners in protected areas management, monitoring, sustainable fisheries and sustainable tourism efforts in the Mesoamerican Reef.

Toledo Institute for Development and Environment (TIDE) is a non-profit, non-governmental organization established as a grassroots initiative to address the needs of the Toledo District. TIDE has a co-management agreement with the Fisheries Department and Forest Department and is responsible for the management of the Port Honduras Marine Reserve, Paynes Creek National Park and private lands.

Wildlife Conservation Society (WCS) is a non-profit international conservation organization qualified under Section 501(c)(3) of the United States Internal Revenue Code and also registered in Belize committed to saving wildlife and wild lands around the world. WCS is supporting a wide range of marine ecosystem monitoring activities in Belize.

Wildlife Trust (WT) is a non-profit 501(c)(3) tax exempt charity of the US, and a registered NGO in Belize. It is an international organization of scientists dedicated to the conservation of biodiversity. In 2005, WT established coral reef research coordinating with the Mesoamerican Barrier Reef Systems Project (MBRS) and using their established

protocols. WT has focused on coral and reef fish surveys the Central Barrier Reef, expanding its efforts to monitor coastal ecosystem health from the central lagoon systems to the reef.

World Wildlife Fund (WWF) is a non-profit organization qualified under Section 501 (c)(3) of the United States Internal Revenue Code and organized for the purposes of the conservation of nature. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by: conserving biodiversity, ensuring that the use of renewable resources is sustainable and promoting the reduction of pollution and wasteful consumption. To achieve this mission, WWF: 1) works in partnership with governments, local communities, local NGOs international agencies, and business and industry, identifying realistic solutions to the world's most pressing environmental problems; 2) reinforces its program of field projects with policy work specifically designed to address the root causes of environmental degradation; and 3) uses a rational and science-based approach to conservation, which focuses on key issues and priorities. WWF's thematic programs address key biomes (forest, freshwater, and marine), global threats (climate change and toxics), as well as priority endangered species. WWF has been supporting the coral reef monitoring work of several local NGOs.

RECITALS

Whereas the Parties are all members of the National Coral Reef Monitoring Network and wish to set out their agreements as to the use of information generated under the coral reef monitoring activities undertaken by members of the group. Data to be shared includes data that results from monitoring projects that are undertaken by the group as a whole. If members would like to share other data from monitoring projects that are not done collectively as the group, this is optional, but not a requirement of this agreement.

DEFINITIONS

"Raw Data" refers to the data compiled on the data sheets.

"Formatted Data" refers to the raw data that has been entered into the Excel spreadsheet mutually agreed on by the Parties.

"Processed Data" refers to any data sets derived from formatted data.

"Data" refers to raw, formatted or processed data.

"Data Administrator" refers to the Fisheries Department who will maintain an archive of all Raw Data.

"Data Manager" refers to the agency responsible for compiling and distributing the Formatted Data to the Parties, and for keeping written records of all data distribution. Initially ECOMAR will be the Data Manager, and when the Environmental Resource Institute (ERI) at the University of Belize comes online in 2009, responsibility will be transferred to the ERI.

"Data Ownership" refers to the intellectual property rights of each Party.

"Party" refers to a member of the National Coral Reef Monitoring Network who has signed this agreement.

"Parties" refers to more than one member of the National Coral Reef Monitoring Network who has signed this agreement.

"Person" shall be construed as broadly as possible and shall include any individual, limited liability company, corporation, partnership, trust, joint venture, unincorporated organization, government, government agency, government authority, or any other entity.

"Third Party" is defined as any person, organization etc. that is not a member of the National Coral Reef Monitoring Network. This includes any non-local program, chapter or section of an international NGO or governmental organization.

"National Coral Reef Monitoring Network" or "Coral Network" or "Network" is defined as the group of organizations or individuals that are signatories to this Agreement.

CONDITIONS

1.0 The "Data" are to be used for research, conservation, and management purposes only.

2.0 The Data are accessible electronically and can be used by the Parties, under the following conditions:

2.1 These Data will not be transferred to any other Third Party without the written consent of all the Parties to this Agreement.

2.2 Written consent must be obtained from the Party owning the Data before one Party can use another Party's Data in any publication (includes peer-reviewed publications, thesis work, education modules).

2.3 Any Party is entitled to use the Data it owns in any way it sees fit, without the consent of the other Parties.

2.4 Parties are entitled to collaborate to use their data jointly, and agree among themselves protocol for data sharing, authorship, and acknowledgments.

2.5 Clear acknowledgement of each Party must be given when using Parties' Data in any public lectures, articles, reports, etc.

2.6 Copies of all reports or publications derived from these Data must be provided to all Parties.

2.7 The names and logos of the Parties are trademarks; as such, they may not be used on reports and publications without the prior express written consent of the respective Parties.

2.8 Acknowledgement of the Network should be made as follows: "Data provided by the Belize National Coral Reef Monitoring Network"

3.0 Before any Data are collected, the Party must be in possession of a valid research license, or authorization to collect data, from the Fisheries Department. A condition of the license includes the requirement for copies of all data to be submitted to the Fisheries Department, according to the Fisheries Regulations.

4.0 Data Access Protocols for Third Parties

Data access may be requested from scientists, managers, students, or other individuals with a *bona fide* purpose. Data access will not be granted for open-ended, exploratory investigations, or for any use that would make data freely accessible to the public. In order to ensure that research being planned or currently conducted

by contributors is not compromised or unnecessarily duplicated, and that proper authorship or acknowledgment of all major data contributors occurs, any request for data must be submitted to the Network in the form of a brief proposal. The proposal need not be lengthy, but it should at a minimum contain sufficient information on the following:

- Name of the requesting institution(s) and of the Principal Investigator;
- Outline of the proposed work, including questions being addressed, hypotheses tested or anticipated management application;
- Anticipated data requirements;
- Anticipated products of the work (e.g. scientific paper, student thesis, environmental assessment (EA), environmental impact statement (EIS), management plans, reports, derived datasets);
- Estimated time frame to completion of the study (not to exceed two years, at which time a report is due. It is understood that peer-reviewed and thesis publications may require a longer time frame and so a progress report indicating the outcome of the study may be filed while awaiting publication).

Proposals can be received by the Fisheries Department or Data Manager and will be reviewed by Network members with knowledge of the type of work being proposed and/or an ownership role with the data. Proposals will also be sent for review to those organizations that contributed substantial portions of the data being requested. The review will be focused on ensuring that duplication of effort is minimized, that proposed analyses seem appropriate, and that potential coauthors are identified. In some cases, the reviewers may suggest that, instead of authorship, acknowledgement of Network as a whole and/or certain institutions/persons be included in any published document.

GENERAL

1. Each Party agrees to submit copies of its Raw Data to the Fisheries Department. As Data Administrator, the Fisheries Department will maintain an archive of all Raw Data.

2. Each Party is responsible for formatting its own Data, and submitting these Formatted Data to the Data Manager.

3. The Data Manager is responsible for compiling and distributing a summary compilation of the Formatted Data to the Parties, and for keeping written records of all Data distribution.

4. Although all efforts will be made to ensure accuracy, the Parties do not accept responsibility for errors in the Data.

5. This Agreement shall be in effect for a period of three years from the date of the last signature. Any Party who wishes to withdraw from this Agreement must give 60 days prior written notice to the other Parties. Parties, including those who have withdrawn, are bound to the terms of the agreement in perpetuity.

6. As new members join the National Coral Reef Monitoring Network they may become signatories to this Data Sharing Agreement.

Signed:

_____ _____

Representative Signature *Date*
Belize Audubon Society

_____ _____

Representative Signature *Date*

Coastal Zone Management Authority & Institute

_____ _____

Representative Signature *Date*

ECOMAR (Environmental Conservation Organization)

_____ _____

Representative Signature *Date*

Environmental Research Institute (University of Belize)

_____ _____

Representative Signature *Date*

Fisheries Department

_____ _____

Representative Signature *Date*

Green Reef

_____ _____

Representative Signature *Date*

Healthy Reefs for Healthy People Initiative

_____ _____

Lisa Carne *Date*

_____ _____

Representative Signature *Date*

SIWA-BAN

_____ _____

Representative Signature *Date*

Southern Environmental Alliance

_____ _____

Representative Signature *Date*

The Nature Conservancy

_____ _____

Representative Signature *Date*

Toledo Institute for Development and Environment

_____ _____

Representative Signature *Date*

Wildlife Conservation Society

_____ _____

Representative Signature *Date*

Wildlife Trust

_____ _____

Representative Signature *Date*

World Wildlife Fund

VIII. Bleaching Monitoring Site Details

Region	Site	Datum	Latitude	Longitude	Depth (m)	Zone	Contac
South Water Caye	1105 South Water Caye	WGS 84	16.73652000	-88.14851000			BFD
South Water Caye	1194 SOUTH WATER CAYE	WGS 84	16.76494000	-88.07610000			BFD
Bluefield Range	Alligator Caye back reef	WGS 84	17.19847926	-88.05583684	S	BR	Wildlife Tr
Bluefield Range	Alligator Caye fore reef	WGS 84	17.19470520	-88.05164046	D	FR	Wildlife Tr
Lighthouse Reef	Aquarium	WGS 84	17.22588900	-87.60452800	D		BAS
Bacalar Chico	Bacalar Chico BO1	WGS 84	18.16904800	-87.83382200	1 to 5	BR	BFD
Bacalar Chico	Bacalar Chico RP	WGS 84	18.12504900	-87.82415200	1 to 5	BR	BFD
Bacalar Chico	BZBCCD02		18.10831	-87.8465			BFD
Bacalar Chico	BZBCCD03		18.12727	-87.81513			BFD
Bacalar Chico	BZBCCB01		18.16878	-87.834			BFD
Bacalar Chico	BZBCCB03		18.1125	-87.84692			BFD
Sapodilla Cayes	BL 1019	WGS 84	16.10412000	-88.32987000	3		SEA
Gladden Spit	BL 1032	WGS 84	16.41850000	-88.04130000	12		SEA
Gladden Spit	BL1041	WGS 84	16.55800000	-88.05070000	3		SEA
Sapodilla Cayes	BL3003	WGS 84	16.14100000	-88.26057000	3		SEA
Turneffe Islands	Blackbird 1213	WGS 84	17.36581000	-87.79700000			UBER
Bluefield Range	Bluefield Range back reef	WGS 84	17.21192532	-88.05115469	S	BR	Wildlife Tr
Bluefield Range	Bluefield Range fore reef	WGS 84	17.20739544	-88.04976556	D	FR	Wildlife Tr
Placencia	Bugle	WGS 84	16.49030000	-88.32360000	1 to 3		LC
Placencia	Buoy E	WGS 84	16.47495000	-88.17442000	14		LC
Placencia	Buoy H	WGS 84	16.42823000	-88.20559000	12 to 14		LC
Caye Caulker	Caye Caulker North Channel back reef	WGS 84	17.80043600	-87.99647300	4.6	BR	BFD
Caye Caulker	Caye Caulker North Channel fore reef	WGS 84	17.78957700	-87.99210200	13.7	FR	BFD
Caye Caulker	Caye Caulker South Channel back reef	WGS 84	17.72450600	-88.00966100	3.7	BR	BFD
Caye Caulker	Caye Caulker South Channel fore reef	WGS 84	17.72202700	-88.00306500	9.14	FR	BFD
Port Honduras	East Snake Caye 1	WGS 84	16.20778000	-88.50805000	4.8		TIDE
Port Honduras	East Snake Caye 2	WGS 84	16.20988000	-88.50607000	2		TIDE
Placencia	FALSE	WGS 84	16.60340000	-88.33420000	1 to 2		LC
South Gallows	First Patch	WGS 84	17.45673100	-88.03688100	1 to 2	BR	ECOMA
Port Honduras	Frenchman Caye	WGS 84	16.18109000	-88.63640000	4.8		TIDE
Glovers Reef	Glovers (1047)	WGS 84	16.77047000	-87.87164000			BFD
Glovers Reef	Glovers (1104)	WGS 84	16.77047000	-87.87164000			BFD
Glovers Reef	duplicate of 1047?	WGS 84	16.75118000	-87.82139000			BFD
Glovers Reef	Glovers (1107)	WGS 84	16.78407000	-87.84454000			BFD

South Gallows	JR Wall	WGS 84	17.45596100	-88.03358300	7 to 8	FR	ECOMA
Placencia	Larks	WGS 84	16.52146000	-88.28640000	1 to 3		LC
Sapodilla Cayes	LAST DAY	WGS 84	16.15974630	-88.24740285	3		SEA
Placencia	LBCshallow	WGS 84	16.44530000	-88.19472000	1 to 2		LC
Lighthouse Reef	Lob. 20	WGS 84	17.45816700	-87.50241700	S		BAS
Lighthouse Reef	Lob. 21	WGS 84	17.34507600	-87.51319300	S		BAS
Lighthouse Reef	Lob. 22	WGS 84	17.31832100	-87.53013300	S		BAS
Gladden Spit	BL MBRS6	WGS 84	16.52821471	-87.97324255	13		SEA
Gladden Spit	Middle Silk Caye	WGS 84	16.45134417	-88.04170314	3		SEA
Port Honduras	Middle Snake Caye	WGS 84	16.20336400	-88.55108000	3.3		TIDE
Sapodilla Cayes	Northeast	WGS 84	16.13995797	-88.24484755	13		SEA
Turneffe Islands	Northwestern 2220	WGS 84	17.54819000	-87.82104000			UBER
South Gallows	Point O Reef	WGS 84	17.43542800	-88.03630000	1 to 2	BR	ECOMA
Sapodilla Cayes	SEAL'S DEEP	WGS 84	16.15528300	-88.33502899	10		SEA
Sapodilla Cayes	SEAL'S SHALLOW	WGS 84	16.15528300	-88.33502899	3		SEA
South Gallows	Shark Chute	WGS 84	17.46042500	-88.03407500	7 to 8	FR	ECOMA
Gladden Spit	Silk Cayes Wall	WGS 84	16.45473138	-88.00893761	17		SEA
Port Honduras	South Snake Caye	WGS 84	16.18097200	-88.56440000	3.6		TIDE
South Water Caye	South Water Caye Deep	WGS 84	16.81300000	-88.07800000			BFD
Sapodilla Cayes	TOM OWENS	WGS 84	16.17887792	-88.23549490			SEA
Sapodilla Cayes	Vigilance	WGS 84	16.11973096	-88.27374424	3		SEA
Turneffe Islands	WTS WP4	WGS 84	17.38588000	-87.93502000			UBER
Turneffe Islands	WTS WP1	WGS 84	17.34290000	-87.95188000			UBER
South Water Caye	WEE WEE CAYE PATCH	WGS 84	16.76000000	-88.14000000			UBER
Port Honduras	West Snake Caye	WGS 84	16.19058400	-88.56977100	4.5		TIDE
Gladden Spit	Whale Shark Zone	WGS 84	16.51472321	-87.98214184	3		SEA
Hol Chan	BZHCCB01						BFD
Hol Chan	BZHCCB02						BFD
Hol Chan	BZHCCD01						BFD
Hol Chan	BZHCCD02						BFD

INSIDE BACK COVER

BACK COVER