

Final Report to NOAA for
AGRRA Database Improvements for Research and Management,
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Introduction

Since 1997 the Atlantic and Gulf Rapid Reef Assessment (AGRRA) Program has provided “snapshot” characterizations of a number of structurally or functionally important, benthic and fish indicators on tropical western Atlantic coral reefs. Its protocols are based on logistically simple, non-fixed, transect-based visual surveys for reasons of speed and economy. Originally designed and implemented as a research tool primarily by university faculty and graduate students, the AGRRA approach has been widely adopted or adapted by governmental, NGO, and field educational organizations variously active in The Bahamas, Belize, Brazil, Cuba, Curaçao, Dominica, Grenada, Little Cayman, Honduras, Jamaica, México, Turks and Caicos Islands, etc.

Processed data from AGRRA-sponsored expeditions have been posted online at the AGRRA web site for several years (www.agrra.org) and are updated at intervals as new surveys or indicator products are made available, and as errors or omissions in the data are corrected¹. Initial releases consisted of an Access database and Excel files respectively summarizing the algal, stony coral and fish indicators by transect, site, and zones within batches (a batch being all sites surveyed during an AGRRA expedition).

AGRRA Methodology Review and Revisions

AGRRA Methodology Version 3 was adopted in 2000 after a series of initial fine turnings of the original protocols (Kramer and Lang, 2003). Linear intercept measurements were added in 2005, allowing coverage estimates of algal groups (rather than simply relative abundance as in earlier surveys), each stony coral ≥ 10 cm, and Σ other sessile invertebrates. Although since used extensively by The Nature Conservancy (TNC) and its NGO partners, these additions have proven to be difficult for non-professionals to execute (Lang and Marks, personal experiences in Belize, Barbados and St. Vincent). In the meantime, new approaches to sampling design and sample site selection developed for use in the Florida Reef Resilience Program were partially adapted in 2006 to respond to the intermediate-term effects of mass bleaching in the Eastern Caribbean (www.agrra.org/BLAGRRA/index.htm; Eakin et al., in prep.).

Changes to the Benthos Protocol: It was during discussions with Steve Smith in May 2007 that we first appreciated the inherent limitations of line transects (*i.e.*, that undersampling of small corals precludes population density, size distribution and size-specific condition analyses) and were encouraged to restructure the benthic protocol around belt transects. The concept of partitioning the benthic tasks into two components (as had been done in the BLAGGRA surveys), one based on point-counts for cover for the less highly trained divers, and the second on individual coral assessments, was also discussed.

After this meeting we undertook a literature review and extensive email interchange with colleagues² to determine a rationale, and select the categories, for inclusion in the point-count

¹ See: [AGRRA_V1.5-README 10-2007.doc](#)

² Principal among whom were Les Kaufman, Sara Lewis, Maggy Nugues, Val Paul, Keryea Soong, and most especially Bob Steneck

coverage protocol.³ In keeping with AGRRA's original focus on functional relationships, organisms were grouped according to their known (or currently presumed) interactions with stony corals. Along with the switch to belts, some changes were made in the stony coral assessment to match current US-based procedures (*e.g.*, counting the number of tissue isolates, P. Kramer, pers. comm.) or the more recent BLAGGRA approach (*e.g.*, partitioning of recent mortality). The resulting overhaul of the benthos protocols is far more radical, and has required correspondingly far more time to prepare, than originally envisioned.

Changes to the Fish Protocol: Densities of the fishes (commercially important species exploited by humans and ecologically significant herbivores) recorded in AGRRA surveys are low in many sites. Hence, the fish survey divers often finished before the benthos divers, *i.e.*, they were being relatively underutilized. Meanwhile, the current paucity of fish and spiny lobster predators is suspected to favor corallivorous invertebrates like *Hermodice carunculata* and *Coralliophila* spp. and the damselfishes that establish algal gardens in live corals, as well as facilitate the recruitment of any *Diadema antillarum* larvae. After consulting colleagues and FishBase, the AGRRA fish list was expanded to include non-exploited predators that consume corallivores and *Diadema*. Moreover, measurement of maximum reef relief was transferred from the benthos to the fish protocol to allow a better match with the topography in which the AGRRA fishes are surveyed.

Changes to Site Selection. The site selection section of the protocol was completely rewritten to accommodate the recommendations of Ault and Smith (2007) in which minimum sample sizes are derived from estimated reef areas as calculated by TNC using the geomorphic reef classification of the Millennium maps⁴.

Field Testing and Revisions: Numerous minor modifications were made to the new survey protocols during a 12-day research-level expedition off Andros, Bahamas, in October 2007. After receiving comments from colleagues on the revised draft of Version 5.0, an introduction explaining reasons for the changes was added, along with instructions for *minimum-* versus *complete-*level surveys for each component of the protocol. Fish Memory Cues were updated to include the new AGRRA species. Also revised were the coral crib sheet and underwater datasheets. This final pre-release version⁵ is currently undergoing review before posting online at the AGRRA web site and sending an announcement of its availability to the coral-list.

Indicators and Reef-Health Indices

Indicators: Our plans to use the existing coral data to generate more size- and species-specific health indicators were dropped after realizing the extent to which small corals, and species of small corals, are underrepresented in line transects (Ault and Smith, 2007). However, a summary of the distribution and condition of the large (\geq the equivalent of 1 m wide x 1 m tall) corals in the AGRRA survey sites was presented at the March, 2008, Ocean Sciences Meeting in Orlando, FL.

Reef-health indices: Lesa Meng and Jason Helyer's attempt to pilot a multimetric Index of Biotic Integrity for coral reefs with data from 192 of the AGRRA sites appears to have been abandoned by the EPA after the sudden and untimely death of Dr. Meng in 2006.

³ See: AGRRA V5-Background.doc for organizational concepts and key references.

⁴ Millennium Coral Reef Mapping Project (<http://imars.usf.edu/corals>)

⁵ See: Final Draft AGRRA Methodology v. 5.0

Our initial approach to a simpler method of summarizing reef health began by ranking 733 sites that had been surveyed between 1998 and 2004 and stratified by zone with an easily calculated, benthic condition index based on three coral and two algal indicators. Initial comparisons within each zone seemed promising and were the basis of an abstract accepted for oral presentation at the 11th ICRS in July 2008. However, direct comparisons among zones proved impossible due to zone-specific differences in several scaling features that were needed to give each indicator an equal weight in the ranking system. To resolve this problem, we are substituting a system based on grades similar to those currently used in the Chesapeake Bay, US National Estuary, and SE Queensland, Australia, programs.⁶ At the same time Melanie McField of the Healthy Reefs Initiative requested assistance with assigning data ranges for a grade-based, Integrated Reef Health Index (IRHI) for the Mesoamerican region. For this effort she is using the AGRRA V.4 data collected in 2006 by NGOs that has not yet been released for inclusion in the AGRRA database. We have since expended much effort in examining the two datasets to harmonize areas of overlap, and in discussing limits with colleagues. Due to inherent difficulties in defining “ecologically reasonable” grade ranges for coral, algae and fish bioindicators, the AGRRA version of IRHI is still in preparation.

AGRRA Database Improvements

Additions to the database. New fields of information in the public AGRRA database include Spalding et al.’s (2007) biogeographic classification of the Tropical Atlantic, Sullivan and Bustamante’s (1999) classification of insular and continental shelves, and the habitat descriptions for the early AGRRA surveys (data in Lang, 2003). Elizabeth Selig has classified each AGRRA site as to whether or not it is included in an MPA, but requested this information not be released until she has finished writing the papers arising from her recently completed Ph.D. research.

Additions to the website. ArcView GIS shapefiles for the sites and for the derived summary products were added to the AGRRA web site in 2007. Unfortunately we have since come to realize that an open-source GIS application would far better serve the needs of peoples in Caribbean, as relatively few have easy access to the ArcView software.

A major addition to the accessibility of the AGRRA data is the successful completion of the Parameterized Online Reporting Tool (PORT). This application, which is accessed from the homepage of the AGRRA website, allows users to select from various pre-defined product types that may then be customized to the users’ needs⁷. To accomplish this goal, the AGRRA fish and benthic databases, once only available in MS Access, were first converted to an online form. PORT allows users to create personalized reports based on their filtering criteria and parameters without having to know anything about the structure of the databases or the SQL language used to interface with, and extract data from, the databases. The output of these reports is made available as simple HTML tables that may be viewed/printed from the user’s browser, as MS Excel spreadsheets that may be used as a basis for further calculations, or as plain text (.csv) files that may be easily imported into statistical or GIS software applications.

⁶ Chesapeake Bay Habitat Health Report Card: 2006 at www.eco-check.org/reportcard/chesapeake;
The National Estuary Program Coastal Condition Report-Fact Sheet at
<http://www.epa.gov/owow/oceans/nepccr/nepccr-factsheet.pdf>;
Report Card 2006 for the waterways and catchments of South East Queensland at
http://www.ehmp.org/filelibrary/1-reportcard2006-web_0001.pdf

⁷See AGRRA-PORT Atlantic & Gulf Rapid Reef Assessment Parameterized Online Reporting Tool Version 1.1 28-Mar-2008 for details; also available online at www.agrra.org.

References

- Ault, JS and SG Smith. 2007. *Statistical Sampling Design Analysis of the AGRRA Caribbean Coral (Benthos) Database*. A White Paper for the NOAA Coral Reef Grant Program.
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Documents accompanying this report

AGRRA V5-Background.doc or organizational concepts and key references.

AGRRA-PORT Atlantic & Gulf Rapid Reef Assessment Parameterized Online Reporting Tool Version 1.1 28-Mar-2008

AGRRA_V1.5-README 10-2007.doc

Final Draft AGRRA Methodology v. 5.0