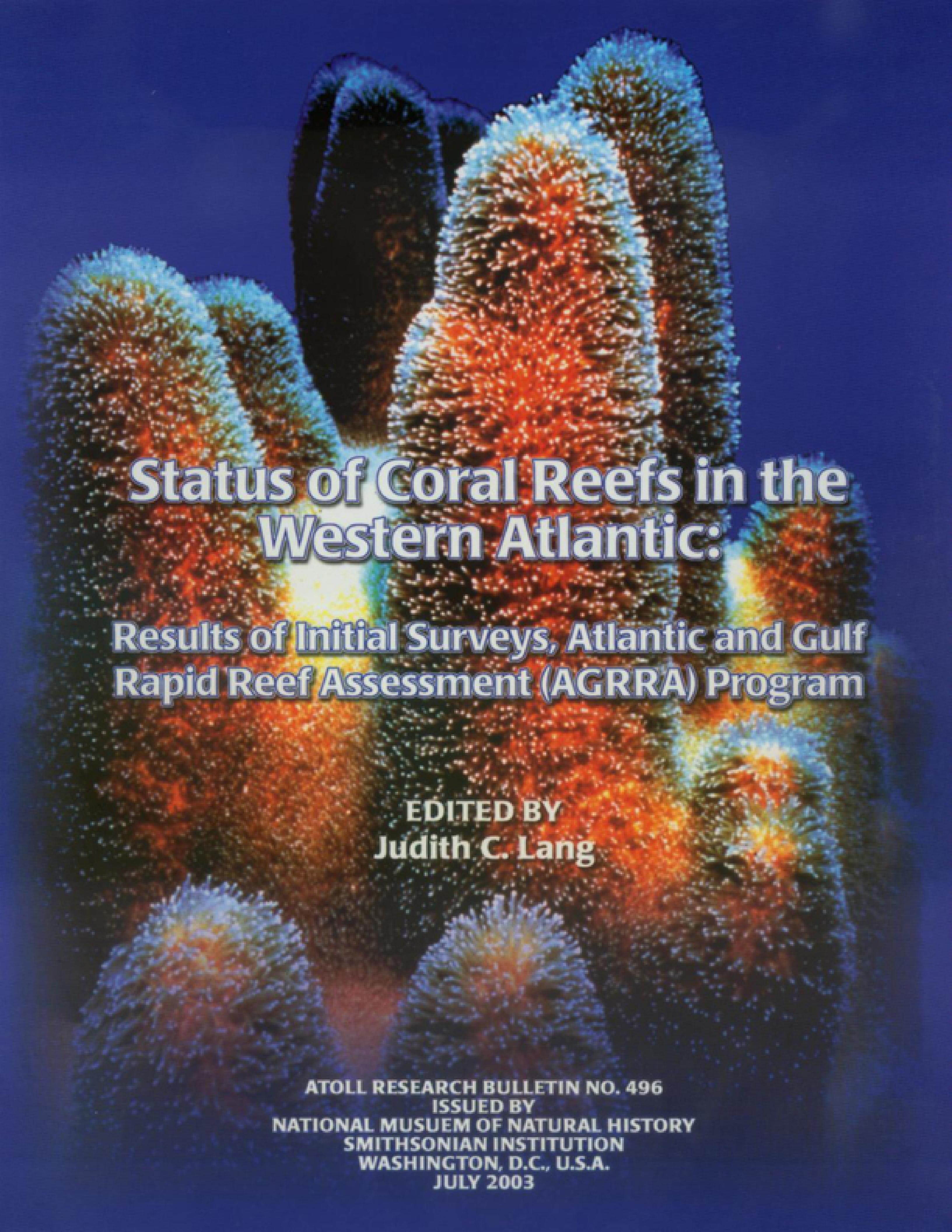

Status of Coral Reefs in the Western Atlantic:

Results of Initial Surveys, Atlantic and Gulf Rapid Reef Assessment (AGRRA) Program

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Atlantic and Gulf Rapid Reef Assessment (AGRRA)

A Joint Program of
The Rosenstiel School of Marine and Atmospheric Science, University of Miami and
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STATUS OF CORAL REEFS IN THE WESTERN ATLANTIC: RESULTS OF INITIAL SURVEYS, ATLANTIC AND GULF RAPID REEF ASSESSMENT (AGRRA) PROGRAM

NO. 496

FOREWORD

BY

ROBERT N. GINSBURG[1] and JUDITH C. LANG[2]

INTRODUCTION

The global decline in coral reefs during the last decades has provoked the most serious concerns about these remarkable ecosystems. Were they owing to a single worldwide cause, like influenza, plague or HIV in humans, the focus of efforts to understand and remedy the situation would be clear. Instead, the causes of declines as well as the nature of reefs vary significantly from region to region and within regions. Thus the urgent need is to assess the condition of reefs regionally with directly comparable quantitative observations rather than anecdotal reports.

This volume contains the initial reports and their synthesis of a new approach to assessing the regional condition of coral reefs in the Western Atlantic Ocean developed under the Atlantic and Gulf Rapid Reef Assessment (AGRRA) program. It features rapid, multiscale assessments by teams of five-six trained observers for reefs of the Greater Caribbean, Gulf of Mexico and South Atlantic with the same method. Thus it becomes possible to assess many reefs spread over the entire region.

The AGRRA protocols are focused on the condition of three key elements of the function and structure of reef ecosystems**:** stony corals, fish and algae. The long-term goal of this region-wide effort is to provide, for the first time, a database suitable for comparative evaluation of current reef condition. This approach is similar to that which public health officials would use to make a rapid health assessment of villagers in remote areas. Analysis of the assessments provides norms of condition for some 30 key parameters of reef condition, such as the species identity, sizes and partial mortality of reef-building corals and the biomass of ecologically and commercially significant reef fishes. As demonstrated in the Synthesis of this volume, these initial norms**,** which are like those of human health assessments (blood pressure, pulse, reflexes), can be used to compare the condition of individual reefs at different spatial scales: between reefs; groups of reefs; subregions; or for most of the twenty reef areas in this volume. Even these initial results offer valuable background information for selecting protected areas or perturbed reefs in need of monitoring.

While this volume was in preparation, additional AGGRA surveys have been carried out in several other major reef areas: Jamaica's northern and western coasts; Cuba's southern coast; the Caribbean reefs of Panamá. The completed regional

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assessment will expand and refine the initial regional interpretations presented in this volume, and produce an essential baseline with which to gauge future major changes disclosed by revisits.

SPECIAL VALUE OF THESE INITIAL RESULTS

Each of the twenty assessments in this volume is based on data from multiple sites. The areas assessed extend from the northern Bahamas to the southern-most reefs of the Caribbean and from the windward Netherlands Antilles to the Gulf of Mexico. Some areas are of special interest because of significant anthropogenic impacts (e.g., Veracruz, some Virgin Islands sites and Grand Cayman Island). Others are notable for the relative scarcity (apart from fishing) of direct human impacts (e.g., Andros in the Bahamas, Flower Garden Banks in the NW Gulf of Mexico and Los Roques, Venezuela); all are affected by adverse regional- and global-scale changes. The inclusion of the southernmost reefs in the Atlantic off Brazil extends the range of areas examined and adds a coral community and reef structure quite different from that of the Greater Caribbean. These assessments were accomplished owing to the major efforts of about a hundred reef observers and team leaders from eight different countries who volunteered to spend long days of arduous diving to collect the basic data.

The results of these first 20 AGRRA surveys demonstrate the promise of this approach for characterizing and comparing reef condition, for distinguishing between regional and local impacts, for recognizing the differences between acute and chronic stressor effects and for identifying candidate reef areas for protection or remediation. Some unanticipated but valuable dividends are the ancillary observations on the distribution of reefs, their general community structure, their geomorphology, and identification of localized threats to reefs. For example, the reef off Andros Island, some 217 km long, was so little known that our general characterization provides the most comprehensive information available on this second longest reef complex in the Western Atlantic.

Kramer (this volume) has contributed an extensive Synthesis of the separate reports. The regional means cited below are based on this standardized analysis of the initial AGRRA dataset.

Corals

Our results provide quantitative verification of the decline of elkhorn coral *(Acropora palmata)* on reefs crests in Los Roques and the Tobago Cays (St. Vincent). Furthermore, what had been dense arrays of A. *palmata* on reef crests off Providencia in the Turks and Caicos Islands and Grand Cayman (Ginsburg, personal observations) and off Abaco (Bahamas) are now largely standing dead skeletons. Living staghorn corals *(A. cervicornis)* were rare in all areas, including those in which they are known to have occurred historically. That some of the die-offs of sensitive acroporid corals occurred in relatively remote areas reinforces earlier demonstrations that the declines are regional not local (e.g., Aronson and Precht, 2001). Surprisingly, healthy thickets of living elkhorn predominated on the shallow (1-3 m) crest along the Andros (Bahamas) reef tract, however, and signs of recovery and recruitment in localized areas elsewhere in the region are encouraging.

The averages for living stony coral cover of 18 ± 10% in shallow reefs (≤5 m) and 26 ± 13% in deeper reefs (10 ± 3m), which are based on 17 of the assessments, cannot be used as representative of the whole region for at least three reasons: a wide range of percent cover was found within and among reef areas; the means are not adjusted for the relative sizes of the different reef areas; and shallow reefs are under-represented in most areas.

Partial mortality in stony corals represents the cumulative effects of diseases, overgrowth by algae and other epibionts, predation, bleaching, physical abrasion, etc. It can be subdivided by assessors on the basis of skeletal appearance into "recent" (<~1 year) and "old" (>~1 year) mortality. As with coral cover, the regional mean of recent mortality of 4% of colony surfaces for both shallow and deep sites masks significant subregional variations. Recent mortality was well above the regional mean off Andros and in the western Caribbean (Belize, Yucatán) as a result of the cumulative effects of bleaching and diseases associated with the 1998 ENSO-related warming. The most severely affected taxa were *Agaricia tenuifolia* and species of the *Montastraea annularis* complex. Outbreaks of diseases in *M. annularis* and *M. faveolata* were additionally noted off Curaçao, the Cayman Islands, Costa Rica and some of the Virgin Islands. Of special concern is the prevalence of diseases and bleaching-related mortality in the *M. annularis* complex, a major contributor to reef framework throughout the Greater Caribbean.

Algae and Fishes

Although much attention has been given to the current prominence of macroalgae on many wider Caribbean reefs, in terms of relative abundance, turf algae generally predominated in the AGRRA assessments. In deeper sites, however, elevated values for both macroalgal relative abundance and macroalgal index (a proxy for its biomass) were found throughout the Bahamas (Abaco, Andros and San Salvador) and in María la Gorda (Cuba).

Herbivores affect the types, abundance and biomass of algae found on reefs. Herbivorous fishes [surgeonfishes (acanthurids), parrotfishes (scarids) ≥5 cm, and the damselfish *Microspathodon chrysurus*] averaged ~30/100 m^2 overall on deeper sites in the 17 areas having comparable data. Their density was not related to the relative abundance and index values of macroalgae for the region as a whole. Moreover, the long-spined urchin *(Diadema antillarum),* formerly a key herbivore, was too scarce (regionally <3/100 m^2) to have any significant effect on algal distribution patterns.

The total density of reef-associated AGRRA fishes (primarily the "AGRRA herbivores" plus commercially important predators) was nearly twice as high in shallow (85/100 m^2) as in deeper (49/100 m^2) sites for the 17 assessments mentioned above. Large-sized parrotfishes, seen mostly in the southern Caribbean, were rare. The overall mean density of large-sized groupers (serranids) and snappers (lutjanids) averaged <1/100m^2. The scarcity of large fishes is an indication that, regardless of location, legal designation, or local fishing regulations, the entire region has been overharvested at least for these species.

Quantitative historical data with which to compare the present results are lacking for reefs in most of the assessed areas. Where prior information of some form exists, it is clear that only the relatively remote Flower Garden Banks have remained essentially unchanged in recent decades. Everywhere else (San Salvador in the Bahamas, Cayman Islands, Costa Rica, Los Roques, U.S. Virgin Islands, Yucatán) their condition has deteriorated.

Kramer (this volume) shows how 13 of the 30 individual norms of condition can be used to establish a preliminary biotic health index for the 17 deeper assessments having comparable data. The four considered "better" (above average) are two in offshore locations (Flower Garden Banks and Los Roques), and two that are adjacent to small human populations (Bonaire and the windward Netherlands Antilles). In contrast, the six that were grouped in the "worse" (below average) category include sites in two sparsely populated biosphere reserves (Sian Ka'an, México, and Guanahacabibes, Cuba), two of the Bahamian islands (Andros, Abaco), and a stressed reef in Costa Rica's Cahuita National Park. Given these spatial patterns, no single type of threat, at any scale from localized anthropogenic inputs through regional overfishing and diseases to ENSO events and climate change, seems sufficient to explain the details of presumed or documented declines on reefs that have been assessed to date by the AGRRA protocols.

DEVELOPMENT OF THE AGRRA PROGRAM

The AGRRA program developed from insight gained from the 1993 Colloquium and Forum on Global Aspects of Coral Reefs. This meeting, attended by some 120 scientists from 20 different countries, was an early attempt to consider the condition of reefs on a global scale. A major conclusion of the meeting highlighted the insufficiency of available information: "The database for evaluating the condition of the world's reefs is quite inadequate on all counts," (Ginsburg and Glynn**,** 1994).

This conclusion was especially relevant to reefs of the Western Atlantic and Gulf of Mexico. Despite the extensive research on this region's reefs beginning in the early 1900s, large areas had received little or no attention from reef scientists. [A notable exception is the ongoing international Caribbean Coastal Marine Productivity (CARICOMP) program, a pioneering effort to monitor reefs, sea grass communities and mangroves at a series of fixed localities around the region (Kjerfve, 1998).] However, it had already been clear for about a decade that reef-building corals, most notably the branching elkhorn and staghorn acroporid corals, were in serious decline at numerous sites in the Greater Caribbean. What was not clear in many areas was which other stony corals were affected.

An initial effort to develop a standard method of assessing reef condition was focused solely on the reef-building coral community and followed the approach of Juan Manuel Diáz and his colleagues (Diáz et al., 1995) to record partial mortality of stony corals. The results demonstrated that a census of corals by species, size, and partial mortality could be done rapidly and provide useful comparisons of the condition of patch reef corals in south Florida (Ginsburg et al., 1996; Ginsburg et al., 2001).

The idea of a region-wide survey of Caribbean reefs was first discussed informally at the 1996 Reef Symposium in Panamá. A major refocusing came later in 1996-1997 when Robert Steneck and Judy Lang proposed adding observations on algal functional groups, fish densities, herbivory, recruitment and the distinction between recent and old partial mortality, and then field-tested the protocols in three different geographic locations. Philip Kramer and Patricia Richards Kramer organized the first extensive field test of this expanded method in the Bahamas along the Andros reef tract in August 1997. It included quantitative fish assessments, following suggestions from Peter Sale, and roving diver surveys that were both conducted by Ken Marks.

The positive results of all these trial applications encouraged us to post the protocols on the Internet and organize an international workshop that was held in Miami in June 1998. Eighty-one scientists from 19 different countries of the Greater Caribbean, Brazil, Canada, the United Kingdom, Austria and the Philippines participated in the five-day session to review and refine the prototype AGRRA protocols and plan their region-wide application. All the participants contributed to the development of the final product through lengthy discussions of the methods and a field trip to test the proposed revisions. The product of this workshop was Version 2 of the AGRRA protocols (see Appendix One, this volume) and most of the reports in this volume were based on that version.

TRAINING AND APPLICATION OF THE PROTOCOL

It was evident from the field trials before and during the 1998 workshop that training was necessary to ensure the consistent application of the AGRRA protocols. Accordingly, Philip Kramer and Patricia Richards Kramer with Christy Pattengill-Semmens and Andrew Bruckner organized the first training workshop in Bonaire. Held in February 1999, for 11 participants, its success encouraged us to conduct a second workshop for reef scientists from Central America in Akumal, Quintana Roo in May, 1999. Philip Kramer, Patricia Richards Kramer, Andrew Bruckner and Elizabeth Fisher helped to conduct this five-day bilingual session. The 25 participants came from México (13), Belize (5), Honduras (3), Cuba (2), Costa Rica (1) and Colombia (1).

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Research helped support the compilation of this volume. American Airlines provided in-kind support for travel**.** The Bonaire Marine Park and the Centro Ecológico Akumal, México made facilities available for the training workshops. The authors in this volume acknowledge additional support for their individual assessments.

Contributors

Most the individual assessments reported in this volume required many long days of scuba diving and/or snorkeling, usually from small boats operating from shoreside bases, by participants who were all volunteers. Each assessment team consisted normally of six divers, four of whom made transects to evaluate corals and algae, and two who collected information on fish through belt transects and a roving diver census (for a description, see Appendix One, this volume). At the end of each day, team members then had to spend further hours transferring their results to a standard spreadsheet. Their commitment and hard work provided the basic data on which each report is based and for the Synthesis chapter. The leaders of these assessments naturally became the authors and coauthors of these reports. Their patience with, and responses to, the prolonged editorial and database construction process is much appreciated.

The Synthesis chapter was made possible only through the use of an Access database. A major effort was required to insure the consistency of the data entered in the database. Philip Kramer spent days correcting the initial entries through correspondence with observers. We are fortunate indeed that Kenneth Marks set up and maintained the database in such a way that queries could be answered in short order. Assembling this regional database was only possible owing to the generous sharing of basic data by the team leaders.

We are grateful to all those who helped with the formatting and copy editing: Steven Lutz, Eric Levorsen, Kimberly Rosen, Sara Fain, Barbie Bischof, Amit Hazra, and Karlissa Callwood at the Rosenstiel School of Marine and Atmospheric Science (RSMAS); Kay Clark-Bourne and Ian Macintyre at the Smithsonian Institution. We particularly wish to thank Patricia Richards Kramer for her constructive reviews and tireless assistance during the final preparation of the manuscripts and Eduardo Martinez for his many last-minute editorial corrections.

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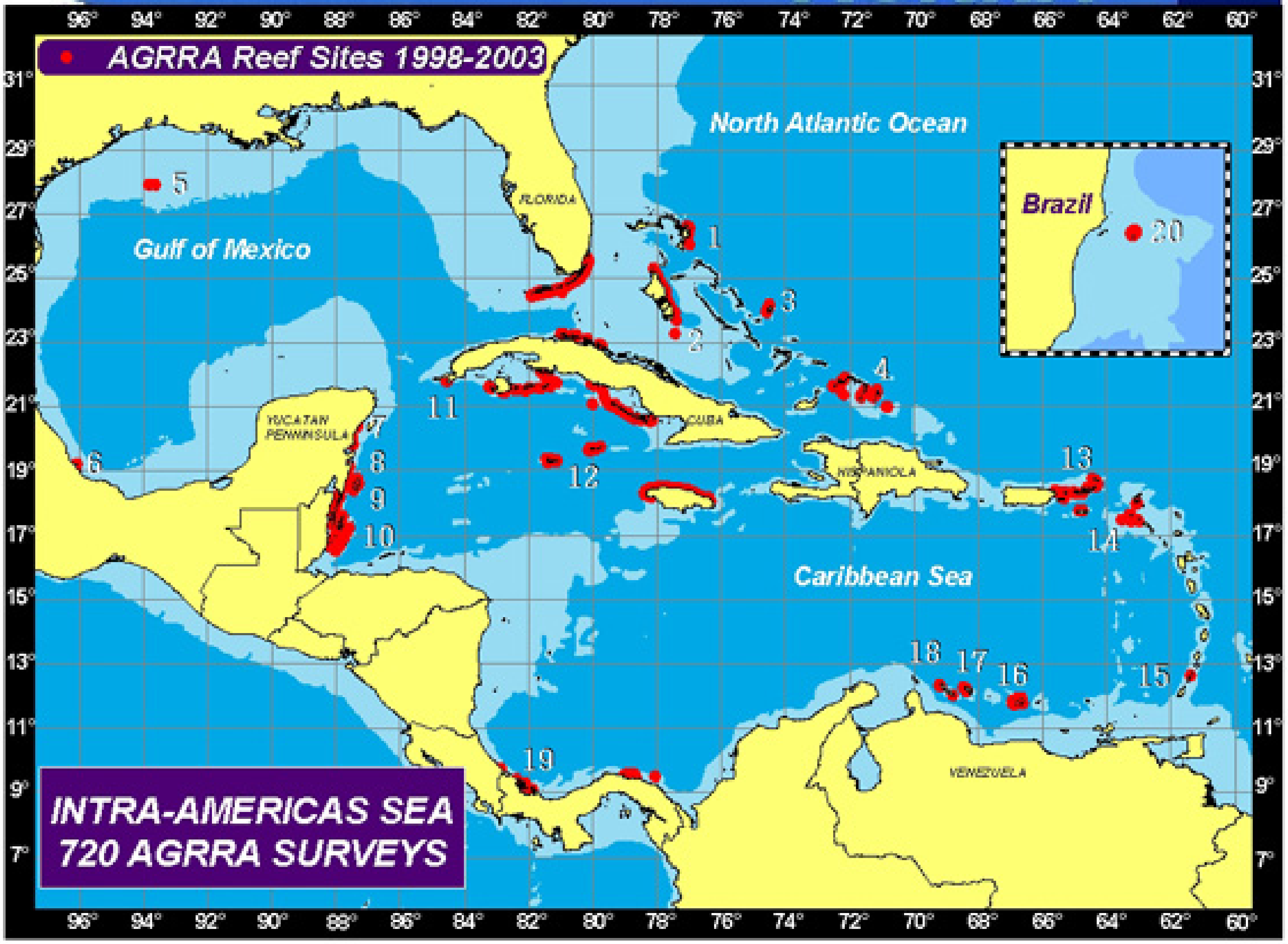
AGRRA



AGRRA Reef Sites 1998-2003
North Atlantic Ocean
Gulf of Mexico
FLORIDA
Brazil
YUCATAN PENINSULA
CUBA
HISPANIOLA
Caribbean Sea
VENEZUELA
INTRA-AMERICAS SEA
720 AGRRA SURVEYS
1
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19
20
96° 94° 92° 90° 88° 86° 84° 82° 80° 78° 76° 74° 72° 70° 68° 66° 64° 62° 60°
31° 29° 27° 25° 23° 21° 19° 17° 15° 13° 11° 9° 7°

CAVEATS FOR THE AGRRA "INITIAL RESULTS" VOLUME

BY

JUDITH C. LANG[1]

INTRODUCTION

The Atlantic and Gulf Rapid Reef Assessment (AGRRA) collaboration is designed for small teams of trained observers to quickly collect relatively simple quantitative indicators of the condition and/or abundance of stony corals, benthic algal groups, and reef-associated fishes at specific depth intervals in certain zones of maximum reef development. Results of the early (August 1997 to mid-2000) AGRRA assessments provide the focus of this volume. Coral reef ecosystems are so diverse, and their inhabitants engage in such intricate ecological relationships, that no rapid visual assessment technique can possibly provide in an unbiased manner all the information desired by scientists and resource managers for any given location. Comparisons among reefs are inherently constrained by numerous differences in physical environment, geomorphology, species composition, and proximity to direct human influences. Nevertheless, standardized application of the AGRRA methodology is facilitating multiscale spatial and temporal comparisons of key species, functional groups or guilds in the wider Caribbean (e.g., Ginsburg et al., 2000; Kramer, this volume). The purpose of this section is to alert readers to some of the special attributes of the AGRRA approach and some limitations in its initial application.

QUALIFICATIONS

General Considerations

Versions. The AGRRA protocols have undergone several changes since their original posting in 1997 (see http://coral.aoml.noaa.gov/agra/method/methodhome.htm for the current version). Version 2, which is the basis for most of the research reported herein, is summarized in Appendix One (this volume). Given in the Methods section of each assessment paper are the particular version of the protocol that was used and any changes made in response to field conditions (or for any other reason).

Sites. Site selection criteria, and the rationale employed when any sites were chosen for "strategic" purposes, are specified in the Methods.

Nomenclature. The generic and specific names in the Methodology that were posted on the Internet and found in most of the papers in this volume are based on Foster (1987) for *Stephanocoenia,* Weil and Knowlton (1994) for the *Montastraea annularis*

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species complex, and two publications of the American Fisheries Society (AFS): Cairns et al. (1991) for the remaining stony corals and Robbins et al. (1991) for fishes. The nomenclature and/or spelling of certain species differ from those given in the several editions of Paul Humann's exemplary field guides that are widely used in the field by the AGRRA observers and/or from Eschmeyer's (1998) revised *Catalog of Fishes.*

Consistency. A degree of subjectivity is inherent in many of the decisions made when executing these protocols and subtle distinctions will occur as a function of the observer's knowledge and level of experience. Consistency training to standardize the visual assessments followed by periodic reviews are two important components of the AGRRA methodology. Specific efforts to reduce observer bias among team members are described in the individual assessment papers. It must be admitted, however, that when divers and/or time become limited, in-water reviews are likely to be sacrificed. Inter-observer variability undoubtedly contributes to some of the larger variance values, especially in the means for individual assessment sites.

Spatial coverage. During the time interval covered by the papers in this volume, several of the AGRRA geographic subregions were either poorly represented (e.g., Cuba, Lesser Antilles) or missing (e.g., Panamá, Hispaniola) as was the entire Florida region. Due to various circumstances (e.g., funding, geography), some papers are limited in spatial coverage and/or in the number of assessed sites. Furthermore, the two high-relief habitats of particular interest (*Acropora palmata* in ~1-5 m, and fore reef or equivalent in ~8-15 m) are not present in all coral reef areas or, if present, sometimes could not be assessed for other reasons such as remoteness or weather.

Temporal Coverage. Some of the individual assessments predate the 1998 ENSO while others either overlap with or postdate this extreme event, the effects of which were not experienced uniformly across the western Atlantic. Hurricanes (Georges, Mitch, Lenny) and outbreaks of disease also had nonrandom spatial and temporal distribution patterns profoundly affecting some of the assessed reef areas without influencing others. Particularly when recent partial mortality estimates of stony corals from different areas are compared, it is important to note the dates of the various assessments.

Synthesis. In order to include all the data in the initial Synthesis, Kramer (this volume) has provisionally classified each site as either shallow (≤5 m) or deep (>5 m) on the basis of its mean depth under the benthic transect lines with some resulting mixing of habitats and reef types. Each assessment has been treated as a separate unit and given equal weight in his analysis (Kramer, this volume). Hence its contribution is independent of the areal extent of the local reef system and of the numbers of assessed sites (or habitat types). In other words, the small (Costa Rica, Flower Garden Banks) and large (Cuba) areas, each with few assessed sites as of mid 2000, have been treated the same as the small (windward Netherlands Antilles) and large (Andros) areas for which a larger number of sites had been assessed (The corresponding numbers of habitats are three, one, two, numerous, and two, respectively.)

As explained by Kramer (this volume), the specific datasets and methodology used for calculating site means in the Synthesis chapter differ from those employed in most of the individual assessment papers.

Stony Corals

Condition. The prevalence of bleaching, disease, predation, overgrowth, etc. are each expressed as a percentage of the surveyed population, i.e., all colonies of ≥10 cm (or ≥25 cm) maximum diameter that underlie the haphazardly placed 10-m transect lines. Observers vary in how much information they record as a function of time available and/or by their familiarity with these disturbances. Photographs and descriptions of the perturbations that commonly affect the wider Caribbean's stony corals are now available at several web sites, in sets of laminated field cards, and in Bruckner (2002), yet there is no substitute for good, in-situ training. Given the variability of signs displayed by disturbed corals, however, even the most experienced observers are presently unable to reliably distinguish between the effects of certain diseases and certain predators, particularly during rapid "snapshots" like the AGRRA assessments. Therefore "absence of evidence" in some locations cannot be taken as necessarily indicating "evidence of absence." For example, the AGRRA geologists have a tendency to report a higher proportion of stony corals that are "standing dead" (= completely dead with the colony still in growth position and recognizable at least to genus) than have the AGRRA biologists (P. Kramer, personal communication).

Mortality. "Recent" and "old" mortality of stony corals is estimated as the percentages of their outward-facing surfaces that are dead when seen from above the colonies. Hence, average "partial-colony mortality" (or partial mortality) refers to the mean percent of tissue loss/colony and not to the percent of colonies with any (necessarily unspecified amount of) tissue loss. "Recent partial mortality" (after Diáz et al., 1995) in the AGRRA benthos protocol encompasses that percentage of the colony surface in which the skeleton is white and covered by a (necessarily thin) layer of algae or fine mud. "Old partial mortality" is used to describe the corresponding percentage in which the skeletal structures are no longer white and have either been lost or are covered by epibenthic organisms that are not easily removed. Standing dead corals are included in the calculations of mean values for old and total (= recent + old) partial mortality in all but one of the individual assessment papers; in the Synthesis they are excluded from the mean values of old partial mortality (Kramer, this volume).

Attempts to "flesh out" these definitions and, in the absence of published data, to add putative temporal ranges to the definition of recent mortality, are given in the Methodology section of the AGRRA web site and by Bruckner and Bruckner (this volume), Kramer (this volume), and Steneck and Lang (this volume). Recently occurring mortality will be underestimated when: (a) exposed skeletal surfaces are quickly covered with sediment and/or algae (Fonseca, this volume); (b) turf algal-sediment mats expand at the expense of stony corals without creating any noticeable "recently dead" areas at their interfaces (Roy, personal communication); and (c) in the presence of superior spatial competitors (Deschamp et al., this volume) like the rapidly growing *Trididemnun solidum* (Bak et al., 1981) since the skeleton that is being overgrown is never exposed to view.

Algae

Functional algal groups are characterized by their abundance in 25 cm x 25 cm (= 0.0625 m^2) quadrats with at least 80% coverage by any kind of benthic algae. The location of the quadrats is spatially limited to a 1-m radius of the 2-m marks on the transect lines. Although not a measure of algal cover, the abundance of each group on exposed substrata that are available to herbivores is provided by these data. As the identity of the functional groups that are assessed was changed between Versions 2 and 3 of the protocol, the usage of "relative abundance" has been restricted in this volume to the groups that were estimated in Versions 1 and 2 (i.e., macroalgae, turf algae and crustose coralline algae).

Fishes

The AGRRA benthos protocol is a novel collaborative creation (see the Forward and Appendix One, this volume) that is still being fine-tuned as we gain experience with its application in diverse geographical areas. In contrast, only minor adjustments have been implemented thus far with the fish belt transects (here restricted to ecologically important herbivores and commercially significant carnivores) and Roving Diver Technique (Schmitt and Sullivan, 1996). Both had been thoroughly tested for some years prior to their adoption for the AGRRA fish protocol. Hence their relative strengths and limitations are better understood (e.g., Brock, 1954; Sale, 1980; Thresher and Gunn, 1986; Fowler, 1987; Schmitt et al., 2002). For example, serranids (e.g., Pattengill-Semmens and Semmens, this volume) are generally underreported in the belt transects, especially on reefs with high structural complexity (Kramer, Marks and Turnbull, this volume). Also underestimated in belt transects are roving schools of scarids or acanthurids (Nemeth et al., this volume). While the Roving Diver Technique provides a relatively rapid quantification of reef fish assemblage, longer search times or a larger number of searches than are appropriate for rapid assessments would be needed to fully estimate species richness (Nemeth et al., this volume; Marks, personal communication; Semmens, personal communication).

AFFIRMATION

Caveats notwithstanding, our understanding of reef condition in the western Atlantic is enhanced as a result of the early (August 1997 to mid 2000) AGRRA efforts reported in this volume. Some important geographical gaps have been filled during subsequent assessments: northern and western Jamaica; southwestern and south-central Cuba; Bocas del Toro and western Kuna Yala, Panamá; and Upper and Lower Keys, Florida. The data added from these (and remaining as-yet unvisited) areas is certain to modify some of the initial conclusions presented in this volume. Pending the outcome of their analysis we anticipate being able to provide a more complete accounting of the overall status of the coral reefs in the Intra-Americas Seas and Brazil.

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Atlantic and Gulf of Mexico Rapid Reef Assessment (AGRRA) Program

Coral reefs, a Caribbean crown jewel, are suffering from a variety of natural and people-produced impacts. Just how serious are the resulting declines is the subject of this volume. It offers the initial results of a new approach to assessing reef ecosystems at multiple sites with a standardized method. The locations marked on the map above denote the areas where trained divers have evaluated the conditions of stony corals, fish and algae, three major reef elements. The results of these first twenty, widely distributed reef assessments, including one in Brazil, testify to the promise of this region-wide approach. For example, progress is made in separating the effects of regional versus local impacts, creating norms of current reef condition comparable to those for human health (levels of blood pressure or cholesterol), and identifying candidate areas for protection or remediation. The next steps in this program, which are already underway, are to expand the surveys to representative reefs throughout the Western Atlantic. The completed regional assessment will provide the first comprehensive evaluation of its coral reefs, facilitating multiscale comparisons of key indicators of reef condition, and establish baselines against which future changes can be determined.

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