Joint Artificial Reef Subcommittees Meeting

February 7 – 8, 2017

The Crowne Plaza Jacksonville Airport

14670 Duval Road

Jacksonville, Florida 32229

Webinar: https://global.gotomeeting.com/join/810271821 Conference Call: a) Call **1-888-394-8197** b) Enter passcode **222918**

Tuesday, February 7th

9:00 Call to Order – *Mark Rousseau*

- Welcome and Introductions
- Adoption of Agenda
- Approval of Minutes from the March 14-15, 2016 Meeting

9:20 HAPCs, Permitting, and Artificial Reef Deployment Discussion – *January Murray*

9:50 PCB-Free Military Vessels for Reefing – *Keith Mille*

10:20 Update on South Carolina's Deepwater Artificial Reef MPA – *Bob Martore*

10:50 BREAK

11:10 Review of 2016 National Artificial Reef Workshop – *Lisa Havel*

11:30 Lunch

1:00 Harwich Reef Update – *Mark Rousseau*

1:30 SMZ Designations in the EEZ off New Jersey – *Jeff Tinsman and Peter Clarke*

2:10 Update on the SAMFC Artificial Reef Policy Document – *Lisa Havel*

2:20 ROI with Relation to Large Artificial Reef Systems in Japan – *Kenta Suda, Tsukasa Takahashi, Jeffrey Stephens*

2:35 BREAK

2:55 Matching SFR Funds in Delaware – *Jeff Tinsman*

3:25 Overview and Implementation of Northeast Florida's Offshore Reef Fish Fisheries-Independent Monitoring Program – *Russ Brodie*

3:45 Status of Historical Resource Survey Requirements – *All*

4:10 Public Comment (including vendor updates on latest equipment and materials)

4:30 Adjourn Day 1

Wednesday, February 8th

8:30 Call to Order – *Mark Rousseau*

8:40 GSMFC – *James Ballard*

8:50 ASMFC – *Lisa Havel*

9:00 Federal Agencies – *NMFS, ACOE, BOEM*

9:10 Georgia – *January Murray*

9:20 South Carolina – *Bob Martore*

9:30 North Carolina – *Jason Peters*

9:40 Virginia – *Alicia Nelson*

9:50 Maryland – *Mike Malpezzi*

10:00 Delaware – *Jeff Tinsman*

10:10 New Jersey – *Peter Clarke*

10:20 New York – *Christopher LaPorta*

10:30 BREAK

10:40 Rhode Island – *Chris Deacutis*

10:50 Massachusetts – *Mark Rousseau*

11:00 Louisiana – *Mike McDonough*

11:10 Mississippi – *James Sanders*

11:20 Alabama – *Craig Newton*

11:30 Florida – *Keith Mille/Brad Ennis*

11:40 Texas – *Dale Shively*

11:50 Discuss Next Joint Meeting in 2017
Time
Location

12:00 Other Business incl. chair nominations

12:10 ADJOURN

National Artificial Reef Workshop

Alexandria, Virginia
June 9 – 10, 2016

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Presentations and Materials

All presentations and workshop materials are available online at:
http://www.nmfs.noaa.gov/sfa/management/recreational/artificial-reef-workshop.html

I. Workshop Recap

NOAA Fisheries and the Atlantic States Marine Fisheries Commission (ASMFC) convened a national artificial reef workshop June 9–10, 2016, in Alexandria, Virginia. Nearly 80 participants from around the nation—including state artificial reef program managers, scientists, recreational fishermen, and non-governmental organizations, among others—shared lessons learned in artificial reef application, discussed opportunities and challenges, and considered the potential future direction of artificial reefs in U.S. waters.

A steering committee of artificial reef experts coordinated closely with NOAA Fisheries and ASMFC staff to develop the following objectives for this workshop:

- Provide an overview of current science and applied experience (lessons learned) regarding the application of artificial reefs as a tool to support or enhance sustainable fisheries.
- Identify and examine key considerations associated with artificial reefs as a potential management tool to support and/or enhance sustainable fisheries.
- Identify management challenges and associated research needs, knowledge gaps and limitations, and strategies for monitoring, using, and managing artificial reefs.
- Discuss the potential roles of federal, state, and private sector partnerships in resolving artificial reef challenges and achieving objectives.

A series of opening presentations set the stage for collaborative discussion that took place throughout the course of the workshop. The facilitator presented a summary of pre-workshop survey findings that helped shape the agenda. Key experts then provided artificial reef history, introduced a frame of reference for considering artificial reefs as a potential fishery management tool, and created common understanding of the regulatory framework for all present. NOAA Fisheries staff also introduced the NOAA Ecosystem Based Fishery Management Policy (EBFM). Presentations/presenters included:

- *A Brief History of Marine Artificial Reef Development in U.S. Waters*
  Dr. Bill Gordon (on behalf of Richard Christian), University of Rhode Island
- *Artificial Reefs in Fisheries Management: Has the Time Come?*
  Dr. Steve Bortone, Gulf of Mexico Fishery Management Council (retired)
- *NOAA Ecosystem Based Fisheries Management Policy*
  Kirsten Larsen, NOAA Fisheries
- *Overview of the Regulatory Framework*
  Keith Mille, Florida Fish and Wildlife Commission

Six managers/practitioners from around the nation built upon early framing conversations by presenting on the artificial reef experience from their respective regions, and then participating in a panel discussion. The panel helped create awareness of various state artificial reef program

objectives, strategies, and applied experiences from around the nation. Interested readers are encouraged to view all presentations on the project webpage. Presenters/panelists included:

- *North and Mid-Atlantic:* Mark Rousseau, Massachusetts Department of Fish and Game
- *South Atlantic:* Bob Martore, South Carolina Department of Natural Resources
- *Gulf of Mexico:* Dale Shively, Texas Parks and Wildlife Department
- *Washington:* Theresa Tsou, Washington Department of Fish and Wildlife
- *California:* Eric Wilkins, California Department of Fish and Wildlife
- *Hawai'i:* Paul Murakawa, Hawai'i Department of Land and Natural Resources

Following the panel discussion all workshop participants gathered in small groups of 8 to 10 participants to share experiences and lessons learned, and begin discussing solutions to common challenges. Report-backs to the full group highlighted challenges, methods for overcoming barriers, and future needs. (A comprehensive description of session outputs is included on page 9.)

Day 2 of the workshop began with a series of five presentations, followed by a panel discussion among experts that explored the current state and potential future direction of the science. Presentations/panelists included:

- *Ecological Functioning of Artificial Reefs with Fisheries Management Implications*
  Bill Lindberg, University of Florida
- *Planning Artificial Reefs in the U.S.: Recent Trends and Evolutionary Challenges*
  Bill Gordon, University of Rhode Island
- *Science Informing Artificial Reefing Practices: Key Findings, Knowledge Gaps, and Future Directions from the Northwestern Gulf of Mexico*
  Greg Stunz, Texas A&M University Corpus Christi
- *Artificial Reef Socioeconomics: Everything but the Kitchen Sink*
  Bill Huth, University of West Florida
- *Artificial Reefs: The Good, the Bad and the Ugly*
  Jim Bohnsack, NOAA Fisheries

Similar to day 1 collaborative discussions, participants again self-organized into several small groups following the science presentations. The facilitation team organized tables by topics explored during the presentations. Participants then chose a topic of interest and rotated to other topics as desired. Each group explored science gaps, partnerships, and priorities. (A comprehensive description of the science session outputs is included on page 14.)

The final small group breakout session tasked all workshop participants to build a bridge toward future activities based on new knowledge gained and ideas shared among peers over the course of 2 days together. Specifically, small groups identified and discussed key workshop takeaways that will influence next steps (individual and collective), and improve communication and collaboration among artificial reef practitioners across the United States.

While not consensus-based, final report-backs to the full group identified numerous takeaways that may shape future actions across a broad range of categories, including:

- Management
- Science
- Funding
- Needs and potential future actions
- Identified concerns

At the culmination of the event, the conveners (NOAA Fisheries and ASMFC) thanked everyone for their collaborative engagement on an important national issue and noted that, moving forward, NOAA Fisheries will utilize workshop outputs to evaluate its future role in considering artificial reefs as a potential fisheries management tool. (Interested parties are encouraged to read the summary of workshop takeaways included on page 19.)

II. Welcome and Opening Remarks

NOAA Fisheries and ASMFC jointly convened a national artificial reef workshop June 9–10, 2016, at the Westin Alexandria in Alexandria, Virginia. Nearly 80 participants attended from around the nation, including state artificial reef program managers, scientists, recreational fishermen, and non-governmental organizations among others.

Russell Dunn, NOAA Fisheries National Policy Advisor for Recreational Fisheries, opened the workshop and welcomed participants. He acknowledged broad interest in artificial reefs, affirmed the need for a conversation about their potential role in fisheries management, and NOAA's need to better understand the science and management challenges, and benefits associated with artificial reefs.

Mr. Dunn thanked the steering committee for its guidance in shaping the workshop objectives and agenda. Patrick Campfield, Director of the Fisheries Science Program at ASMFC, also welcomed participants. He described ASMFC's and the Gulf States Marine Fisheries Commission's (GSMFC) 30-year history of coordinating information exchange and helping guide artificial reef development among the Atlantic and Gulf states.

The conveners thanked all participants for attending and expressed eagerness for new information sharing and discussion of a range of perspectives throughout the workshop. They noted that artificial reefs have been utilized and tested as restoration and mitigation tools in U.S. waters, but the potential as a fisheries management tool has not yet been explored to any meaningful extent.

Facilitator Rich Wilson of Seatone Consulting reviewed the workshop agenda, noting how presentations and panel discussions would frame a series of small group discussions during the course of the workshop. He drew attention to the Participant Workbook, where supplementary

text, an overview of all presentations, and additional materials were compiled as a resource for participants. (All presenter biographies can be found on pages 22–27 of the workbook.)

Workshop Objectives

- Provide an overview of current science and applied experience (lessons learned) regarding application of artificial reefs as a tool to support or enhance sustainable fisheries.
- Identify and examine key considerations associated with artificial reefs as a potential management tool to support and/or enhance sustainable fisheries.
- Identify management challenges and associated research needs, knowledge gaps and limitations, and strategies for monitoring, using, and managing artificial reefs.
- Discuss the potential roles of federal, state, and private sector partnerships in resolving artificial reef challenges and achieving objectives.

III. Summary of Pre-Workshop Findings and Themes

The facilitator presented a summary of key findings from a pre-workshop survey completed by nearly half of all invited participants. The survey captured perspectives and insights from prospective attendees on a range of artificial reef–related topics. Survey results revealed topics of interest, recent advances and important gaps in artificial reef science and management, potential for coordination and partnerships, and lessons learned from different regions around the nation. Most importantly, the results helped shape the workshop agenda and recruit guest presenters who framed key topics and issues that participants then discussed over 2 days.

IV. Background and History of Artificial Reefs

Scheduled presenter Richard Christian was unable to attend the workshop, so Dr. Bill Gordon, University of Rhode Island, presented *A Brief History of Marine Artificial Reef Development in U.S. Waters* on Mr. Christian's behalf.

The first documented marine artificial reef in U.S. waters was placed in 1850. That said, most artificial reef development occurred over the past five decades. Dr. Gordon described how construction has generally been driven by four factors:

1. An engaged constituency.
2. Availability of suitable materials.
3. Dedicated funds for construction, monitoring, and assessment.
4. Supporting artificial reef policies, state and local programs, and planning documents.

From the 1950s to 1980s, more than 80 percent of artificial reefs were constructed from materials that outlived their original purpose, or "materials of opportunity." Construction, Dr. Gordon noted, has generally out-paced scientific assessments of artificial reef effects on natural

habitat or as a potential fisheries management tool. Early artificial reef policies emerged in the 1970s, culminating in the landmark National Fishing Enhancement Act of 1984. The Act, however, did not provide spending authority for appropriations aimed at supporting artificial reef implementation.

Rigs-to-reefs programs also began developing in the early 1980s. As of 2015, 470 offshore oil and gas platforms have been converted to permanent artificial reefs in the Gulf region. The 1980s were also a popular time for designing reefs out of specific materials to suit a defined purpose. The Japanese government, Dr. Gordon noted, has designed structures for specific aquaculture and commercial fishing activities that may provide lessons learned for U.S. practitioners.

Today approximately half of coastal states have artificial reef program plans. These plans are unique to each state's habitat, geography, and resource use dynamics. The U.S. Federal Aid Sportfish Restoration Fund provides significant resources for state artificial reef programs. Increasingly, these programs will need to coordinate with other entities engaging in marine spatial planning so artificial reefs are appropriately sited and managed. Development of an information clearinghouse, containing a wide range of resources, would likely also benefit practitioners around the nation.

V. Artificial Reefs in a Fisheries Management Context

To help frame the issue of fisheries management, and the connection to artificial reefs as a potential management tool, Dr. Steve Bortone, retired Executive Director of the Gulf of Mexico Fishery Management Council, presented on the general topic, *Artificial Reefs in Fisheries Management: Has the Time Come?*

Dr. Bortone described how practitioners have deployed different artificial reef types for decades for various purposes (e.g., habitat mitigation, fish aggregation, trawling deterrents, water movement deterrents). He noted that, in defining fisheries management, the key phrase is "active manipulation based on quantitative choices" such that fisheries will be sustained or improved. The management process involves both resource manipulation and influencing human behavior.

Dr. Bortone suggested that artificial reef practitioners consider modifying Seaman and Jensen's 2000 definition of artificial reefs, to read: "One or more objects of natural or human origin deployed on the seafloor to influence physical, biological, and/or socioeconomic processes related to living aquatic resources." He further emphasized that this definition can be sensibly abridged to read "objects deployed to influence aquatic resources."

Currently, artificial reefs play virtually no role in the management of any fishery in U.S. waters, or for that matter, the world. That said, Dr. Bortone reviewed potential artificial reef applications in fisheries management:

- Increase habitat.
- Mitigate stressed or destroyed habitat.
- Enhance life stage survival of a species.
- Facilitate movement or colonization.
- Reduce pressure on natural fishing habitat.
- Redirect water movement.

Conversely, he noted obstacles to applying artificial reefs in fisheries management:

- Difficult to evaluate success in a fisheries management context because they have not been employed as fisheries management tools.
- Challenges with data compatibility and sampling methods.
- Lack of study replication.
- Unintended consequences.
- Studies often do not provide fishery managers the information needed for decision making.

While thousands of artificial reefs (or other objects that function as artificial reefs such as seawalls, docks, and pipelines) have been deployed throughout the world, Dr. Bortone estimated likely less than 0.001 percent of the continental shelf has been affected. To overcome obstacles, he noted, artificial reefs must allow reliable predictability of effects just as is required of other fisheries management options. Pressing needs to support implementation as a potential fisheries management tool include:

- Cooperation/organization.
- Nationwide information database.
- Estimate of artificial reef footprint and impacts.
- Energy budget.
- Meaningful management objectives.

Finally, notwithstanding ongoing scientific debates, Dr. Bortone suggested that future studies may want to focus on how artificial reefs generate both high attraction *and* production. Later workshop conversations, as well as past studies, pointed out a continuum from attraction to production. Resource managers, Dr. Bortone noted, may consider strategic implementation of artificial reefs as a tool directed at select species rather than entire species assemblages. He further stressed that managers need to better communicate to artificial reef researchers the management questions they need answered. (A summary of the question/answer session that followed Dr. Bortone's presentation is listed in Appendix I.)

Next, Kirsten Larsen, NOAA Fisheries Office of Science and Technology, provided an overview of NOAA's recently released *Ecosystem Based Fisheries Management Policy* (EBFM). The policy formalizes NOAA Fisheries' commitment to EBFM. While the policy is new, the concept itself is not. The policy is intended to capture the current state of EBFM within NOAA Fisheries and

provide both the agency and the Regional Fishery Management Councils guidance moving forward. Managing on an ecosystem level may provide more stability for fisheries. It also provides an opportunity to address trade-offs and different stakeholder priorities, balancing social and ecological needs.

NOAA Fisheries is a mandate-driven science agency whose work is needed to support management choices for 750+ taxa and over 5 percent of the world's ocean area. NOAA Fisheries adopted the EBFM policy to more efficiently and effectively fulfill its mandates. The forthcoming NOAA Fisheries EBFM Road Map, expected in summer 2016, builds upon the policy by providing a national implementation strategy. (A summary of the question/answer session that followed Ms. Larsen's presentation is listed in Appendix I.)

VI. Overview of the Regulatory Framework

In order to create common knowledge and understanding among workshop participants on artificial reef governance, permitting requirements, and associated regulatory issues, Keith Mille of the Florida Fish and Wildlife Conservation Commission provided an *Overview of the Artificial Reef Regulatory Framework*.

The majority of artificial reef activities, Mr. Mille noted at the outset, are overseen by the U.S. Army Corps of Engineers (ACOE). He provided an overview of relevant federal laws, ACOE regulations, and state regulatory jurisdictional issues that apply to artificial reef development in U.S. waters.

In Mr. Mille's home state of Florida, coastal governments (i.e., municipalities) hold artificial reef permits issued by the ACOE (required in both state and federal waters) and Florida Department of Environmental Protection (required in state waters). Regulatory constraints on artificial reef construction address issues such as spatial boundaries for navigation, channels, marine habitat resources, historic areas, sand borrow areas, existing structures and leases, etc.

Many states now implement materials limits for artificial reef structures. Some areas, Mr. Mille noted, face challenges with unpermitted material types and locations, especially for private deployments. Poor past artificial reef practices, many now prohibited, generated negative press from many vivid old photos and records and still contribute to misconceptions about modern artificial reef programs.

Mr. Mille stressed that opportunities do exist for improved coordination among parties working on permitting and regulatory issues. He encouraged pre-permit application consultations between applicants and regulatory agencies. He also noted that achieving permitting compliance does not necessarily mean that fisheries management objectives have been achieved.

Finally, Mr. Mille suggested that interested parties could further explore the topics presented in the opening session at a special artificial reef session planned for the annual meeting of the American Fisheries Society in Tampa, Florida, on April 20–24, 2017. (A summary of the question/answer session that followed Mr. Mille's presentation is provided in Appendix I.)

VII. Regional Experiences and Lessons Learned

a. Panel Discussion

Following the opening framing conversations, six managers/practitioners from around the nation shared brief presentations on the artificial reef experience from their respective region, and then participated in a panel discussion. The discussion helped create awareness of different state artificial reef program objectives, strategies, and applied experiences. (Interested parties are encouraged to view all regional presentations on the project webpage.)

Presentations/panelists included:

- *North and Mid-Atlantic:* Mark Rousseau, Massachusetts Department of Fish and Game
- *South Atlantic:* Bob Martore, South Carolina Department of Natural Resources
- *Gulf of Mexico:* Dale Shively, Texas Parks and Wildlife Department
- *Washington:* Theresa Tsou, Washington Department of Fish and Wildlife
- *California:* Eric Wilkins, California Department of Fish and Wildlife
- *Hawai'i:* Paul Murakawa, Hawai'i Department of Land and Natural Resources

Each presenter described specific examples, if available by region, of artificial reef fishery management and/or enhancement applications. All presenters addressed challenges, lessons learned, and needs moving forward. After the presentations the facilitator opened the panel discussion with an initial question, which was then followed by numerous questions, comments, and discussion between presenters and the full group. (A summary of the panel discussion that followed all presentations is listed in Appendix I.)

b. Small Group Breakouts

Utilizing a "World Café" style format, which encourages diversity of thought and ideas, all participants engaged in the first small group collaboration of the workshop. Groups of 8 to 10 participants shared experiences and lessons learned, and began discussing solutions to common and sometimes unique challenges. Each group considered three guiding questions:

1. What have been your biggest challenges regarding artificial reef application, and how have you overcome them?
2. What lessons have you learned, what has worked well, and what experiences can you share that may benefit others?

3. From your perspective (your constituency/interest group) what are your needs moving forward?

Discussion note: The facilitator acknowledged that funding challenges are no doubt paramount among many artificial reef practitioners. He requested participants also identify other important challenges and needs.

Report-Outs and Full Group Discussion
After breakout discussions, all participants reconvened and each small group shared highlights from their respective conversations. The following outputs reflect themes and associated responses presented during the report-outs and collected on note-taking sheets and poster paper provided to each group.

1. What have been your biggest challenges regarding artificial reef application, and how have you overcome them?

Science and Research

- Site selection and spatial habitat utilization by life stage and species life history (e.g., spawning, nursery).
- Addressing species bottleneck issues.
- Understanding if/how artificial reefs contribute to the existing mosaic of marine protected areas (MPAs).
- Unknown/unanticipated ecological impacts of artificial reefs (e.g., introduction of new predators or invasive species; converting one habitat to another; human impacts of favoring one fishery over another, etc.).
- Accounting for different concepts of scale.
- Understanding which species are habitat-limited.
- How to integrate artificial reef habitat into fisheries management stock assessment models.
- Science questions from managers are difficult to answer, especially with limited resources.
- Difficult to study and monitor productivity of artificial reefs with active fisheries.

Permitting and Regulations

- Permitting can be a "moving target" at both state and federal levels.
  - ⇒ The definition of an artificial reef in California is too specific.
  - ⇒ In Texas permits changed from each reef zone to each individual reef.
  - ⇒ Potential solution: Create a single entity (federal-state partnership) that can set permit standards for the nation so requirements do not change along with regional staffing changes.
- Delays associated with Endangered Species Act section 7 consultations.
  - ⇒ Potential solution: Create standardized protocols for data collection and possibly have a programmatic Environmental Impact Statement for an entire region.

- It is not always clear what matching funds are permissible for a project in permitting application materials.
- State permitting hurdles:
    - ⇒ Process can take several years and cost hundreds of thousands of dollars.
    - ⇒ Different review agencies require different levels of detail and different application methods.
    - ⇒ Potential solution: Need permitting consistency within each department and among designated permitting review staff.
- Federal plans may not fit regional needs.
- California lacks an artificial reef policy.
- Obtaining water quality certifications from issuing agency is difficult
- Lack of state policy and federal consistency.
- Liability

Monitoring

- Increased monitoring demands and difficulty obtaining accurate citizen science data.
- Lack of baseline data (for user group benefits, economics, recreational use, etc.).
- Limited ability to monitor artificial reefs due to inadequate resources.

Communication and Outreach

- Public perception and/or awareness of state artificial reef programs.
    - ⇒ Potential solution: Regular outreach and easily accessible information about public artificial reef sites (e.g., website and printed material for fishermen).
- Effective public education and outreach methods—cross-communication challenges among stakeholders with various interests, expertise, etc.
- Lack of awareness, and lack of public relations around artificial reefs.
- Overcoming the stigma of "ocean dumping."
- Identifying suitable sites for informal meetings with stakeholders.

Planning, Management, and Maintenance

- Recreational fishermen do not always acknowledge they are part of the problem.
- Capturing institutional knowledge within organizations.
- Defining a clear purpose(s) for new artificial reefs (e.g., socioeconomic, mitigation, etc.).
- Deployment challenges for large structures.
- Identifying potential user conflicts.
- Maintaining artificial reefs.
- Unclear goals and plans for proposed artificial reefs.
- User and interagency conflicts.
- Securing a reliable source of materials, transportation, and materials storage space.

2. What lessons have you learned, what has worked well, and what experiences can you share that may benefit others?

Science and Research

- Spatially explicit sampling of all habitat types is necessary.
- Research/report requirements could benefit by developing objectives and structure in order to standardize data collection and help put questions up-front.
- Success metrics should be clearly defined by the applicant and permitting agency in advance of project.
- Ensure metrics are concise, obtainable, and measurable.
- Specific artificial reef types can benefit one species more than others (e.g., gag grouper); design and implement artificial reefs according to specific management objectives.
- Citizen science does not always work well for monitoring artificial reef productivity.

Design, Siting, and Deployment

- Beneficial to aggregate materials into large clusters with satellite materials dispersed around the central cluster.
- Consult user groups and permitting agencies early in the process of artificial reef design, site selection, and project implementation in order to identify and address concerns.
- Develop a "Best Practices" document.
- Diversify materials to support different life stages of species.
- Recognize that concrete materials continue to cure/hydrate when underwater.

Permitting and Documentation

- Recognize benefits of streamlining the permitting process (e.g., regional permits, interagency review teams, programmatic consultations by NOAA and/or ACOE).
- Use innovative in-kind donations to help raise matching funds for artificial reef permitting costs (e.g., cost to build a structure, services training value of a decommissioned tank, logistics value for artificial reef deployment, etc.).
- Pay attention to funding source requirements. Build in funding for ongoing monitoring and maintenance.
- Recognize benefits of having a local partner who takes ownership of the artificial reef once installed, with a contract containing long-term management commitment.
- Maintain good artificial reef documentation with regular monitoring and data updates.
- Consider lessons learned from the Gulf region regarding how to streamline the permitting process among multiple agencies.

Outreach and Education

- Recognize the importance of doing outreach and education to all audiences (e.g., general public, fishing groups, environmental groups, NGOs, elected officials, etc.).
- Engage private sector/non-profit partnerships.
- Understand it is important to have a diversity of artificial reef materials that can provide suitable habitat for different life history stages of important species.

Other

- Recognize the benefits of securing buy-in across stakeholder groups.

- No “painless solution” exists. Balanced solutions require sacrifice from all stakeholders.
- Marine reserves and uncharted reefs help reef fish populations rebound. Advances in technology, however, make it easier for fishermen to locate uncharted reefs.
- Consider the “shifting baselines” phenomenon and how the concept applies to conservation perspectives and targets among different generations.
- Regional differences in the acceptance, or not, of artificial reefs as “the norm” affects the level of development.

3. From your perspective (your constituency/interest group) what are your needs moving forward?

Science, Research and Monitoring

- Better understanding of how research can inform science-based products for fisheries managers.
- Climate change planning—ecosystem effects, sea level rise, etc. affecting species composition.
    - ⇒ Understanding cumulative impacts of habitat alteration and/or habitat loss from wind farms.
    - ⇒ Working with renewable energy installations (e.g., wind farms) to achieve artificial reef effects.
- Scientifically defensible data to support artificial reef development, including greater understanding of the difference between designed and donated materials.
- Scientifically sound, standardized studies that cover large geographic areas.
- Reference points (e.g., artificial reefs where no fishing rules are enforced) are needed to implement monitoring for management effectiveness. Explore the possibility of using existing MPAs to install artificial reefs and create de facto reference sites.
- Habitat needs of species by life stages.
- Standardized coast-wide monitoring programs/protocols, including long-term monitoring. Use well-established, consistent monitoring metrics.
- Socioeconomic analyses by region (e.g., cost/benefit analyses).
- Piggyback/leverage data collection programs (e.g., Marine Recreational Information Program) of other agencies/researchers.
- Data on artificial reef catch rates and fishing efforts.
- Identify and address data gaps.
- More rigorous scientific data at the regional level.
- Synopsis of research completed since 1997.
- Science-based outreach to the public.

Relationship to Fisheries and Ecosystem Management

- More artificial reefs that enhance fishing and replace lost fishing opportunities from habitat loss, degradation, and fishing closures; reduce pressure on existing reefs.
- Artificial reefs to replace and/or recover lost reef habitats.
- Protection of existing commercial fishing opportunities.

- Management strategy evaluation trade-offs to develop adaptive management strategies.
- Reliable funding source for both baseline and continued monitoring.
- Measurable goals for artificial reef projects.

Permitting and Regulations

- Defined national priorities with regional flexibility.
- Streamlined, comprehensive permitting processes.
- Simplified regulations that help facilitate enforcement.
- Individualized/developed permits and regulations for each artificial reef (not permits "translated" from other federal/state environmental programs, such as wetlands).

Coordinated Planning

- National program (federal or federal/state partnership); coordination and consistency.
- National cross-dialogue, inclusive of diverse stakeholder types.
- Central clearing-house of artificial reef research and information.
- Non-regulatory national artificial reef coordination program.

Other

- Understanding needs for historical restoration and the role of artificial reefs.
- Staffing and training support for regulators.
- More diverse funding sources and private funding increases.
- Marketing campaigns directed at policy-makers.
- Receiving better materials from the Navy and Maritime Administration (MARAD).

VIII. Current State and Potential Future Direction of Science

a. Panel Discussion

A series of five presentations followed by a panel discussion with science experts explored the current state and potential future direction of the science. The session aimed to:

- Describe and facilitate discussion on the scientific basis that informs the application of artificial reefs as a potential management tool to enhance sustainable fisheries.
- Identify science gaps that need to be addressed to advance the potential for use of artificial reefs as a management tool.
- Illustrate key elements of partnerships and/or cooperative arrangements among federal, state, university, and other researchers.
- Identify short- and long-term priorities, then foster discussion on how future research might be better focused.

Presentations/panelists included:

- *Ecological Functioning of Artificial Reefs with Fisheries Management Implications*
  Bill Lindberg, University of Florida
- *Planning Artificial Reefs in the U.S.: Recent Trends and Evolutionary Challenges*
  Bill Gordon, University of Rhode Island
- *Science Informing Artificial Reefing Practices: Key Findings, Knowledge Gaps, and Future Directions from the Northwestern Gulf of Mexico*
  Greg Stunz, Texas A&M University Corpus Christi
- *Artificial Reef Socioeconomics: Everything but the Kitchen Sink*
  Bill Huth, University of West Florida
- *Artificial Reefs: The Good, the Bad and the Ugly*
  Jim Bohnsack, NOAA Fisheries

At the completion of all five presentations, the facilitator opened the panel discussion with an initial question and then welcomed questions and comments from the full group. He requested that both panelists and questioners keep comments relatively brief so as to allow for inclusive discussion on what may be various topics of interest during the panel discussion. Interested parties are encouraged to view all science presentations on the project webpage. (A summary of the panel discussion that followed all presentations is listed in Appendix I.)

b. Small Group Breakouts

Similar to the day 1 collaborative discussions, participants again self-organized into several small groups following the science presentations. The facilitation team organized tables by topics explored during the presentations. Participants then chose a topic of interest and rotated to other topics as desired. Each group explored science gaps, partnerships, and priorities.

1. From your/your agency's perspective, what are the primary **science gaps** related to this topic that need to be addressed to inform management and artificial reef application?
2. Related to this topic, can you describe key elements of successful **partnerships** and/or cooperative arrangements among federal, state, university and other researchers?
3. From your/your agency's perspective, what are the short- and long-term **science priorities** related to this topic, and how can future research be better focused?

Report-Outs and Full Group Discussion
After breakout discussions, the groups reconvened and shared highlights from their respective conversations. The following outputs capture responses presented during the report-outs and collected on note-taking sheets and poster paper provided to each group.

Discussion Topic: Fisheries Management/Reef Function

Primary Science Gaps
- Habitat use/needs by various life stages of species.

- Spatially explicit sampling of the different habitats and life stages (e.g., where is the bottleneck and how should reefs be designed)?
- How artificial reefs feed into the fisheries management process, and into science products for managers (e.g., stock assessments and fisheries allocations).
- Role of reefs—is it foraging space or a refuge? What species are actually benefitting from a particular artificial reef?
- Understanding how artificial reef habitat contributes to overall productivity.
- Understanding the type and amount of fishing effort occurring on artificial reefs.
- How natural habitats contribute to overall fisheries impact.

Key Elements of Successful Partnerships

- Identify leaders to initiate partnerships. Forged partnerships help leverage funding, streamline monitoring, etc.
- Recognize that personal relationships are the key to maintaining successful partnerships.
- Facilitate greater coordination and engagement with federal agencies in each step of the artificial reef permitting and development process.
- Ensure correct stakeholders are engaged when initiating a project (e.g., stock assessment scientists, ecologists, recreational fishing entities).
- Establish clear goals and outcomes at the outset of any partnership. Ensure accountability and engagement with all partners.

Science Priorities

- Integrate artificial reefs into ecosystem management and understand their potential role in fisheries management.
- Habitat use by various species and life stages.
- How/if artificial reefs can ameliorate climate change and species distribution shifts.
- Explore what site fidelity means for fish using artificial reefs.
- Duplicate peer-reviewed artificial reef science so management decisions are founded on robust science, and not one study.
- Establish clear goals and objectives up front so artificial reefs are designed to achieve defined outcomes. Identify who sets goals and tools used to achieve them.

Discussion Topic: Design, Siting and Deployment

Primary Science Gaps

- How to select appropriate materials to maximize ecological benefits (size, shape, concentration/density, etc.).
- Mapping the seafloor bottom to reduce potential for sinking/subsiding materials.
- Predictability and cost-benefits of using pre-designed materials versus materials of opportunity.
- Review and, when needed, refinement of stated artificial reef development goals.
- Artificial reef interaction with natural reef habitat.

- How to site reefs in shallow water without violating clearance regulations.

Key Elements of Successful Partnerships

- Demonstrate interdisciplinary capability and share resources (e.g., equipment, people, time, funds, etc.).
- Recognize partnerships are successful when:
  - ⇒ Fisheries management agencies take the lead.
  - ⇒ Partners provide information on artificial reef needs.
  - ⇒ Partners offer political leverage.
  - ⇒ The number of partners on one project is limited.
  - ⇒ Open information exchange occurs among all parties.

Science Priorities

- Design comparative studies.
- Understand the pros and cons of using different materials and site designs; keep information up to date as new technologies emerge.
- Explore how to improve access to artificial reefs and monitor how improved access affects reef ecology.
- Determine how to implement lessons learned by other countries.

Discussion Topic: Monitoring

Primary Science Gaps

- Regional-scale, scientifically sound, standardized studies (e.g., gear and methodologies that produce comparable data for stock assessments).
- More standardized, comparable studies on inshore reef sites and their ability to enhance nursery habitats.
- Baseline data on a site before artificial reef material is deployed in order to better assess environmental changes that result from the new reef.
- Standardized, baseline monitoring across regions to assess how artificial reefs are functioning over time and how they perform compared to natural reefs. Also need long-term consistent source of funding to support such monitoring.
- Assessment of changes in angling effort as a result of new deployments to reduce bias in long-term fishery-dependent surveys.
- Assessment of other user groups' activities on a proposed artificial reef site to help expedite the permit process.
- Comparable site versus system-related data.
- Clearly defined, realistic, and achievable goals for new artificial reef projects, and monitoring protocols that assess whether goals are being achieved.

Key Elements of Successful Partnerships

- Incorporate performance monitoring protocols into new artificial reef projects when applying for the permit. Helps expedite the permit process.
- Bring universities into state artificial reef programs to provide monitoring and scientific studies on artificial reef function.
- Get buy-in from other user groups on new artificial reef projects to bolster support for state programs and improve how they are perceived.
- Recognize that monitoring is an important aspect of collaboration.
- Be aware universities can assist state programs.
- Coordinate efforts through the ASMFC and GSMFC Artificial Reef Technical Committees; provides a venue for information sharing on what has worked and what has not, as well as information on new monitoring technologies.
- Consider coordination with Regional Fishery Management Councils.
- Use/share different gear types to help address monitoring visibility.
- Use volunteer divers and other citizen scientists where appropriate (surveys).
- Develop collective performance metrics.

Science Priorities

- Set clearly defined, realistic, and obtainable goals—and standardized monitoring protocols to assess those goals—for new artificial reef project permit applications.
- Outline standard monitoring procedures within permit paperwork. How is standardized monitoring determined? Via committee, use of templates, other?
- Conduct research on what material type(s) works for different species life cycles.
- Recognize monitoring and data collection feeds information to all other topics under discussion.
- Develop long-term, standardized studies that provide scientifically based answers to what is working best or demonstrate programs are meeting goals.

Discussion Topic: Socioeconomics

Primary Science Gaps

- Lack of data on user groups (fishermen, divers and other non-extractive users); inconsistency that results in lack of compatibility.
- Difficulty in setting up socioeconomic surveys and methodologies employed across regions; also poses difficulties in comparing studies.
- Use of aerial surveys.
- How to accurately consider extraneous costs, such as promoting diving and fishing at artificial reef sites.
- Ecosystem-wide socioeconomic evaluations; analysis of positive *and* negative artificial reef effects for all user groups; economic multiplier effects.

- How to measure dollar amounts by human use versus human effect on artificial reefs (e.g., scuba diving is more expensive than fishing, and brings in more revenue, but at many reefs more fishermen are present than divers).

Key Elements of Successful Partnerships

- Establish regional and national expert panels that conduct surveys.
- Learn lessons from academic partnerships. Partnerships are strong in some regions while not in others.
- Recognize up front stakeholder engagement is critical:
    - ⇒ Florida: Annual Sea Grant event organizes all regional stakeholders.
    - ⇒ Need active, frequent, and open communication.
- Integrate matching financial contributions for socioeconomic studies to instill partnerships that "go beyond words" to action.
- Capitalize on partnerships to think outside the box about development (e.g., using artificial reefs as living art).
- Share information to help create and maintain partnerships.

Looking Ahead

- Practitioners must consider existing regulated areas and sustainability of communities.
- Socioeconomics should be a primary consideration when discussing the potential of artificial reefs as fishery management tools.
- Socioeconomics is also critical to understand and implement human/user management on artificial reefs.
- How should practitioners determine what socioeconomic impacts are important for decision-making? Just because an artificial reef brings financial benefits to a single stakeholder group, does that mean it is the right thing to do?

Discussion Topic: The Good, the Bad and the Ugly

Primary Science Gaps and Priorities

- Artificial reefs as sources and/or sinks.
- Economic valuation of artificial reefs.
- Develop monitoring protocols at different scales—devise artificial reef plan based on population or local level?
    - ⇒ Establish control sites to understand impacts when artificial reef sites are fished/not fished.
    - ⇒ Conduct frequent sampling and replication.
    - ⇒ Design sampling for individual species and specific life stages.
- Recreational fish surveys: ask "did you catch fish on a reef or not?"
- Understand the role of artificial reefs in reducing natural mortality in order to relieve bottlenecks.
- California needs life history data to inform development of a future artificial reef plan (e.g., data on larval habitats).

- Design artificial reefs to target specific species.

Key Elements of Successful Partnerships

- Develop a "Best Practices" document to guide artificial reef practitioners:
  - ⇒ Perhaps update the National Artificial Reef Plan. Ensure any updates consider and incorporate regional differences.
  - ⇒ Create accessible, supplementary guidelines for small groups who do not want to utilize the full plan.
- Address issues where improvements are needed:
  - ⇒ Illegal reefs and not enough enforcement to address this problem.
  - ⇒ Ghost artificial reefs—no longer in human use but at times trap and kill turtles and other animals.
  - ⇒ Lack of expertise and training in artificial reef deployment.
- Partnerships should recognize regionally different priorities, including the purpose for applying artificial reefs (e.g., fishing, mitigation, etc.).
- Facilitate open and transparent planning processes, forge partnerships with the recreational fishing community and consider competing interests.
- Anticipate road blocks when developing partnerships (e.g., liability/insurance).

IX. Fostering Mutual Learning and Advancing the Discussion

During the last breakout, participants discussed how to build a bridge toward future artificial reef–related activities (individual and collective) based on new knowledge gained and ideas shared during the course of the workshop. Participants also discussed ways to improve communication, information sharing, and collaboration. Again in small groups, the facilitator suggested participants consider discussing the following topics, or any subject that came to mind as each group considered next steps:

- Enhancing communication and information sharing.
- Building partnerships and strengthening collaboration.
- Improving management, regulations, and policy.
- Advancing the natural and social science.
- Identifying and mobilizing resources (e.g., human, technological, financial).

The full group reconvened one final time and small groups shared workshop takeaways. The following themes and associated takeaways are not necessarily consensus-based. Rather, these outputs grew from 2 days of extensive information sharing and collaborative discussions about regional experiences, challenges, science, and lessons learned.

Management

- Incorporate artificial reefs into ecosystem-based management and marine spatial planning efforts.

- Consider arrays of artificial reef zones as potentially beneficial for drawing fishing pressure away from natural habitat zones.
- Science and management must recognize that humans are part of the ecosystem and their behaviors need to be factored into artificial reef planning.
- Artificial reefs may exacerbate problems in overfished stocks if not properly managed/enforced.
- Artificial reefs may play an important role for species success in the face of future climate change and warming ocean temperatures.
- On-the-water observations of recreational users are a valuable tool for monitoring and informing decision-making.
- Artificial reefs as a fisheries management tool needs formal recognition and regular discussion, even if society never gets to actually using them for this purpose.

Science

- Recognize "attraction/production" does not have to be an either/or question; it can be looked at as a continuum. Individual artificial reefs may produce both attributes.
- Standardize data collection/housing protocols so that information is easily accessible and usable for managers.
- Include artificial reefs in fisheries stock assessment analyses. The habitat component of stock assessment is too often (or nearly always) missing.
- Advance large-scale, scientifically based studies (e.g. monitoring, function, socioeconomics, etc.) to fill data gaps.
- Evolve state programs from opportunity-based to science-based. Target specific species and life history stages that benefit from increased suitable habitat.
- Do not let available artificial reef science go to waste because it is not perfect.
- Utilize targeted citizen science to benefit state programs.
- Recognize that now is the time to determine the role artificial reefs play in fisheries management models.

Funding

- Funds from the Deepwater Horizon catastrophe create an opportunity for the Gulf states to incorporate artificial reef research and development into applied science.
- Consider acquiring funds to integrate artificial reefs into new or revised coastal zone management plans and integrated seafloor planning efforts.

Needs and Potential Future Actions

- Create a national clearing house of information (i.e., database) where relevant, up-to-date information can be easily obtained; include information on artificial reefs, lessons learned from around the world, and video interviews with first generation practitioners.
- Be proactive with artificial reef design. For example, consider writing in pre-approved construction materials into permit applications (e.g., decommissioned bridge materials).
- Determine an effective grassroots mechanism to continue efforts from this workshop:
  - ⇒ Several participants stated the need for more artificial reef workshops.

    - ⇒ Several suggested using this workshop as a catalyst for continued collaboration.
- Foster consistent outreach about state programs to a variety of user groups.
- Consider using monitoring videos shared during the workshop as educational material for the general public. These videos present excellent visual demonstrations of activity occurring on artificial reefs.

Identified Concerns

- Most recreational fishermen believe artificial reefs have value, but not all resource managers are convinced. Recreational fishermen are connected to and can raise artificial reef issues in the fisheries management process. Federal agencies can and should play a role in coordinating some of these efforts.
- Conspicuous absence of commercial fishermen in this process (including this workshop).

X. Closing Comments

The facilitator thanked all note-takers, timekeepers, and those offering report-backs from collaborative discussions. Mr. Dunn thanked all participants and ASMFC, the workshop host. NOAA is pleased, he noted, to hear new ideas, connections, and possible future actions resulting from the workshop. Moving forward, NOAA will utilize the discussion outputs to evaluate its future role in considering artificial reefs as a potential fisheries management tool.

Appendix I: Presentation Q&A and Panel Discussions

A Q&A session followed most expert presentations, especially the Panel discussions. A summary of back-and-forth discussions between presenters and workshop participants, often helping to clarify key concepts or flag important issues, is included below. Readers should refer to sections above for a description of presentations that helped frame workshop discussions.

Presentation: *Artificial Reefs in Fisheries Management: Has the Time Come?*
Presenter: Dr. Steve Bortone, Gulf of Mexico Fishery Management Council (retired)

Summary of post-presentation comments, questions, and responses:

- Comment: Deploying artificial reefs in estuaries can play an important role in fisheries management. In Delaware, we have nine artificial reef sites in one bay, providing habitat for juvenile marine sea bass.
    - Response: This is an important point. Estuarine reefs are not highly touted, and more research and demonstration projects are needed in this area.
- Question: Regarding the "attraction/production" debate, is it recommended to look at whether artificial reefs are harmful or beneficial to production?
    - Response: This is a species-specific question. Both attraction and production can be studied to a degree for the species one is attempting to manage. Artificial reefs can also be multi-functional wherein the same artificial reef has different functions for several species. Some have argued it is a continuum from attraction to production. I would argue that there are at least two axes – attraction and production where you can have low and high attraction and low and high production that are not mutually exclusive characters.
    - Additional comment: The question about attraction versus production will almost always be impossible to answer unless the researcher is 100 percent sure of all activity of the reef the previous day or days (e.g., boating and fishing impacts), as this affects fish counts.
- Question: How might managers move beyond this long-debated issue?
    - Response: It is not possible to move beyond this debate, as it has embedded human elements. It is reasonable for an artificial reef to have high attraction and high production for some species; high attraction and low production for others; low attraction and high production for others; and low attraction and low production for others. Managers must decide what they want to manage for and be cognizant of the attributes of species they are interested in.

Presentation: *NOAA Ecosystem Based Fisheries Management Policy*
Presenter: Kirsten Larsen, NOAA Fisheries

Summary of post-presentation comments, questions, and responses:

- Question: Is NOAA Fisheries attempting to identify monitoring gaps as it considers how to conduct EBFM?
    - Response: Yes, data gaps will be addressed under item #2 in the EBFM Guiding Principles pyramid: "What is the foundational science we need?" NOAA Fisheries is exploring how to conduct and organize monitoring efforts and utilize data in new, innovative ways.
- Comment: Please consider the value of artificial reefs to recreational tourism. For example, artificial reefs make a significant contribution to the Florida economy.
    - Response: Indeed, there are human use benefits from artificial reefs beyond ecological considerations (e.g., recreational use/no commercial take).
- Question: Has NOAA considered the cumulative ecological impacts of introducing artificial reefs into large areas? For example, if one million acres of artificial reef habitat is introduced into a soft-sediment bottom will the entire species composition of that area change?
    - Response: NOAA scientists are currently researching this question.
- Comment: Japanese researchers have explored this topic and found it a matter of trade-offs. For example, artificial reefs in an area like this may attract octopus at the expense of reducing flounder because a large area of muddy bottom habitat was removed.
- Question: How will NOAA address monitoring and enforcement requirements, and funding needs associated with these activities, within its policy? These questions will come up when new permit requests or renewals are submitted to ACOE for review and approval.
    - Response: This is not yet known.
- Question: How will NOAA address scale in the context of ecosystems? Are humans considered as another dimensional scale in EBFM?
    - Response: Scale has been discussed at length within NOAA Fisheries. Most management decisions are made at the local or regional scale. Assessment design may initially be conducted at an individual stock level, and then scaled up to an ecosystem level as we continue to develop new models and collect needed data. Humans are an integral part of the ecosystem the way NOAA has defined "ecosystem."

Presentation: *Overview of the Regulatory Framework*
Presenter: Keith Mille, Florida Fish and Wildlife Commission

Summary of post-presentation comments, questions, and responses:

- Question: Is the second regulation listed under 33 CFR 322.5(b) "*Facilitate access and utilization by recreational and commercial fishermen*" in direct opposition to special management zone regulations that exclude use of specific fishing gear at a certain site?
    - Response: ACOE regulatory requirements provide guidance for artificial reef construction that could be used for both recreational and commercial fishing activities. In order to protect certain artificial reefs from being fished or limit

specific gear types, or to minimize conflicts between user groups, some are designated as special management zones (SMZs). For example, sometimes funding sources such as USFWS Sport Fish Restoration (SFR) require assurance that recreational fishing access at SFR funded artificial reefs will not be impeded by commercial activities, and establishment of a SMZ might be necessary to comply with those funding requirements. While 33 CFR 322.5(b) could possibly be interpreted to mean that federal agencies cannot prohibit commercial fishing, regardless of whether the fishing occurs on a natural or artificial reef, restrictions on access may be a stipulation of the funding source which is not prohibited by ACOE permits. Additionally, for areas in state waters, the respective state permit may contain proprietary authorization which may similarly mandate use limitations as part of the sovereign submerged lands authorization. It is important to make the distinction between regulatory, funding and proprietary requirements. Comment: This is should be considered during the breakout groups or at a subsequent workshop/meeting.

- Question: How much information exchange occurs between Florida and the federal fishery management council system regarding decision-making on artificial reefs?
    - Response: Very little to none. Typically, the only time the fishery management councils have been directly involved in artificial reef permitting is during establishment of SMZs, which is rare.
- Question: If all of the man-made substrates were removed from the Gulf of Mexico would fish be able to survive on remaining natural habitat?
    - Response: Human contribution to seafloor structure is very small, especially in regions where there exist large expanses of existing natural reef structure. Historical records pre-dating artificial reef development demonstrate that fish would survive on natural habitat. The question then becomes will people be able to catch fish at the same rate in the absence of artificial reefs? The species, location and the quality of the artificial reef habitat are variables for consideration too. This question is also linked to the prior discussion on species-specific management (i.e. overfishing, habitat degradation).

Panel Discussion: Regional Experiences and Lessons Learned
Presentations/panelists included:

- *North and Mid-Atlantic:* Mark Rousseau, Massachusetts Department of Fish and Game
- *South Atlantic:* Bob Martore, South Carolina Department of Natural Resources
- *Gulf of Mexico:* Dale Shively, Texas Parks and Wildlife Department
- *Washington:* Theresa Tsou, Washington Department of Fish and Wildlife
- *California:* Eric Wilkins, California Department of Fish and Wildlife
- *Hawai'i:* Paul Murakawa, Hawai'i Department of Land and Natural Resources

Summary of comments, questions, and responses during the Panel discussion:

- Question: A number of panelists cite SMZs and MPAs as tools that help managers implement, monitor, and better understand artificial reefs. What are the drivers behind designating such zones? Are they designed proactively or in response to high fishing pressure? And do any scientific studies exist that demonstrate a spillover effect from regulated artificial reefs?
    - Response: In most cases, special designations are put in place to protect artificial reefs from fishing pressure. For example, a permit application can state that an artificial reef is intended as a SMZ. It is a long, complicated process to achieve such designations. Regarding spillover effects, some small-scale studies have been conducted though nothing published to date. Additional response: Planning zones in the Gulf are linked to the rigs-to-reefs programs and are intended to assist with accurate seafloor planning. If an artificial reef was proposed outside a particular zone, or was up for renewal, it was previously possible to bypass the general permit process until regulations changed about 1 month ago. Currently, a new permit must be filed for new artificial reefs, or if new material is to be added to an existing site.
- Question: From the perspective of a recreational angler, it appears the Atlantic and Gulf coasts have well established artificial reef programs, and the west coast states have a very limited number of artificial reefs. California recently set aside a percentage of its marine habitat as MPAs, where recreational fishing is limited or prohibited in certain areas. Is there an opportunity for artificial reefs to support recreational fishing in this state?
    - Response: There is a possibility for establishing artificial reefs in California, however a state plan is needed first that provides structure and appropriate regulations. It is critical for state agencies and their federal agency partners to be aligned on these issues. Additional response: Several California Department of Fish and Wildlife staff have visited Texas and Louisiana to learn from our artificial reef programs. This kind of workshop helps improve collaboration and learning among states and federal agencies, as states primarily operate independently.
- Question: Several years ago, a research effort revealed that sport and party boat owners were deploying their own materials in undisclosed locations, often illegally, to meet client demands. Is this an issue the states are concerned about and, if so, are there any suggestions on how to address it?
    - Response: Some regions struggle with this issue more than others. There is little that can be done to prevent these activities beyond increasing law enforcement, which is very costly. Additional response: In the Gulf, particularly in Alabama, members of the public can deploy their own materials as long as they are approved. Some have recently requested fish aggregation devices (FADs), though these tools may have limited to no habitat value.
- Question: What is your source of non-public funds for unpublished artificial reef sites that serve as MPAs in South Carolina waters?
    - Response: Funding has come from a variety of sources. For example, the South Atlantic Fishery Management Council provided its own project funding.

- Question: How does liability apply for permitting unpublished reefs? Is it navigation departments, habitat preservation departments, other?
    - Response: In the south liability lies with the permit holder. Additional comment: ACOE reviews whether or not applicants are insured. Insurance is difficult for private citizens to obtain, therefore states typically become applicants.
- Question: Are efforts underway to quantify economic activity generated by artificial reefs on the west coast?
    - Response: No such studies are currently underway in California or Washington. Additional comment: One past study demonstrated that the Yukon, a sunken ship in southern California, has generated $4.5 million in revenue for the state. Similar studies have been done for rigs-to-reefs projects.
- Question: Do protocols exist for monitoring sediments for toxins that leach from materials of opportunity?
    - Response: Such protocols are established on a case-by-case basis. Occasionally the U.S. Environmental Protection Agency (EPA) will establish regulations for monitoring the leaching of toxins.

Panel Discussion: The Current State and Potential Future Direction of Science
Presentations/panelists included:

- *Ecological Functioning of Artificial Reefs with Fisheries Management Implications*
  Bill Lindberg, University of Florida
- *Planning Artificial Reefs in the U.S.: Recent Trends and Evolutionary Challenges*
  Bill Gordon, University of Rhode Island
- *Science Informing Artificial Reefing Practices: Key Findings, Knowledge Gaps, and Future Directions from the Northwestern Gulf of Mexico*
  Greg Stunz, Texas A&M University Corpus Christi
- *Artificial Reef Socioeconomics: Everything but the Kitchen Sink*
  Bill Huth, University of West Florida
- *Artificial Reefs: The Good, the Bad and the Ugly*
  Jim Bohnsack, NOAA Fisheries

Summary of comments, questions, and responses during the Panel discussion:

- Question: From a scientific perspective, what are the enabling conditions that will allow resource managers to move in the direction of using artificial reefs for fisheries management, and what does that mean for the future direction of the science?
    - Response: As fish, crustaceans, mollusks, etc. grow, they rely on cavity space scaled to their body size for habitat. Sometimes animals outgrow this space. If a species demonstrates a bottleneck related to habitat structure in their life history, installation of artificial reef structures may help alleviate this bottleneck. However, this only occurs if a very strong year class is moving through the system, and it applies only to certain species. Spatial and temporal components

must be considered in population dynamics modeling. Fisheries performance can be one indicator of artificial reef performance.

- Question: If all artificial reefs and other man-made structures were removed from the coast of Maryland, would the resident reef fish populations (e.g., black sea bass, tautog) survive on remaining natural reef? Same question for red snapper off Texas?
    - Response: Some evidence exists showing that in muddy bottom portions of the western Gulf region of Texas, artificial reefs support colonization and rapid recovery of certain species. However, there is also a high abundance of different species on natural reefs, indicating that perhaps artificial reefs have enhanced populations in this area.
- Question: What does science tell us about production potential of red snapper and gag on artificial reef pyramids, and how this potential may change relative to the proximity of artificial reefs to natural reefs?
    - Response: One paper, currently under peer review, estimates a 2 percent or less production rate of artificial reefs located in close proximity to natural reefs. Fish are being caught young, before they are able to reproduce and contribute to reef productivity. Shrimp trawls are one big source of species mortality. Others are the large size and bag limits of the fishery. If artificial reefs were installed, and fishing limited or prohibited, these structures certainly show potential to contribute to production regardless of proximity to natural reefs.
- Question: Can the panelists speak on the topic of artificial reef habitat valuation?
    - Response: A growing number of scientists are engaged in this emerging area of ecosystem service valuation. Generally, valuation is conducted from the human perspective, and the collective science community is just beginning to explore this topic. It is an area that needs more attention, and could be included in more requests for proposal processes nation-wide.
- Question: Many studies have been conducted on the role artificial reefs play relative to recreationally important species, but have any studies been conducted on how artificial reefs may support bait fish that are the food source for recreational species?
    - Response: Some researchers are interested in studying this issue. Broadly speaking, the forage base issue is an important one in fisheries management, but has not been tightly linked with artificial reefs yet. In the Gulf, some initial characterizations of food source/forage species, and associated utilization of artificial reefs, are being conducted. Not much work has been conducted looking at how cryptic species use artificial reefs.
    - Response: One must consider if humans are competing with other fish species—and by extension affecting the goals for artificial reef functionality—by fishing at the base of the food web. This also gets to the point of catching fish before they reach reproductive age. In red snapper, one big, old female fish has the same reproductive capacity as 210 smaller females.
- Question: In your view, what is needed from fisheries managers to help strengthen artificial reef science, habitat science, etc. to inform decision-makers?
    - Response: Formal program evaluation is the key. Programs should be reviewed in a formative and summative way (possibly state by state). This formal review

method is not actively practiced in artificial reef resource management. Goals and parameters for success must be articulated at the outset of any program. Resource managers and scientists must have a solid understanding of *why* artificial reef programs are successful in order to articulate that success to decision-makers. An analogy can be made to the "Sesame Street" television program, where at the end of each episode viewers are informed of the math, communication, etc. skills the children have gained. This allowed the show to obtain a large amount of broadcast funding.

- Question: Do you see any future role for the Interstate Marine Fisheries Commissions relative to artificial reef management?
    - Response: Yes, there is a role, which is already happening in the Gulf. Moving forward, the Gulf region, as well as other states, could develop consistent sampling/monitoring methods and programs to compare and analyze artificial reefs from the management perspective. NOAA has not been actively engaged in any coordination or management of artificial reefs recently. That said, the Commissions could potentially act as liaison between NOAA and scientists.
    - Response: Coordination of research is highly important. Each state agency could partner with researchers and begin replicating studies on regional or even broader scales.

Appendix II: Workshop Participants

* Workshop Steering Committee Member

Name	*Affiliation*
Alisha Gray	Florida Fish & Wildlife Conservation Commission
Amy Comer	North Carolina Department of Environment and Natural Resources
Bill Gordon	University of Rhode Island
Bill Huth	University of West Florida
Bill Lindberg*	University of Florida
Bob Martore	South Carolina Department of Natural Resources
Bob Williams*	NOAA Fisheries
Brian Nunes-Vais	Ann E. Clarke Foundation
Chris Deacutis	Rhode Island Department of Environmental Management
Chris Laporta	New York Department of Environmental Management
Chris Meaney*	NOAA Fisheries Office of Habitat Conservation
Chris Wojcik	Artificial Reef Sculptor
Clay Tam	Western Pacific Fishery Management Council
Craig Newton	Alabama Department of Conservation and Natural Resources
Dale Shively	Texas Parks and Wildlife Department
Dan Reed	University of California Santa Barbara
Dave Witting	NOAA Fisheries Office of Habitat Conservation
David Bacon	Fish Reef Project
David Fries	Institute for Human Machine Cognition
David Molnar	Connecticut Department of Energy and Environmental Protection
Dawn Hayes	NOAA Office of National Marine Sanctuaries
Dean Rewerts	California Ships to Reefs
Dean Sensui	Western Pacific Fishery Management Council
Ed Bonner	Philadelphia Army Corp of Engineers
Ed Parnell	Scripps Institution of Oceanography
Eleanore Rewerts	California Ships to Reefs
Eric Wilkins	California Department of Fish and Wildlife
Fred Baddour	Artificial Reefs International
George Frankel	Eternal Reefs Sarasota
George Sedberry	NOAA Office of National Marine Sanctuaries
Greg Stunz	Texas A&M University-Corpus Christi
Heather Coll	NOAA Fisheries Office of Protected Resources
Heather Sagar	NOAA Fisheries Office of Policy
James Ballard*	Gulf States Marine Fisheries Commission
January Murray	Georgia Department of Natural Resources
Jason Peters	Georgia Department of Natural Resources
Jeff Stephens	Water Gremlin Company
Jeff Tinsman	Delaware Department of Natural Resources and Environmental Control

Jessica Coakley	Mid-Atlantic Fishery Management Council
Jim Bohnsack	NOAA Fisheries Southeast Fishery Science Center
Jimmy Sanders	Mississippi Department of Marine Resources
Joe Weatherby	Artificial Reefs International
John Froeschke	Gulf of Mexico Fishery Management Council
Kate Spidalieri	NOAA Office of National Marine Sanctuaries
Keith Mille	Florida Fish & Wildlife Conservation Commission
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Lisa Havel*	Atlantic States Marine Fisheries Commission
Mark Rousseau*	Massachusetts Department of Fish and Game
Meghan Lapp	Seafreeze, Ltd.
Michael Malpezzi	Maryland Department of Natural Resources
Moira Kelly	NOAA Fisheries Greater Atlantic Regional Office
Monty Hawkins	Recreational Fisherman (Maryland)
Patrick Campfield*	Atlantic States Marine Fisheries Commission
Paul Murakawa	Hawaiʻi Department of Land and Natural Resources
Pete Clarke	New Jersey Division of Fish and Wildlife
Puaʻala Pascua*	NOAA Fisheries
Rich Seagraves	Mid-Atlantic Fishery Management Council
Rob Workman	Artificial Reefs International
Ron Dean	NOAA Fisheries Office of Protected Resources
Roy Miller	Atlantic States Fishery Management Council
Russell Dunn*	NOAA Fisheries
Sean Meehan	NOAA Fisheries Southeast Regional Office
Stephanie Hunt	NOAA Fisheries Office of Sustainable Fisheries
Steve Bortone	Gulf of Mexico Fishery Management Council
Steve Donohue	Environmental Protection Agency
Steve Schroeter	University of California Santa Barbara
Terra Lederhouse	NOAA Fisheries Office of Habitat Conservation
Theresa Tsou	Washington Department of Fish and Wildlife
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JOINT GSMFC & ASMFC ARTIFICIAL REEF SUBCOMMITTEE MEETING

Georgia Artificial Reef Report

Jacksonville, FL
February 7th–8th, 2017

The Georgia's Department of Natural Resources (GADNR), Coastal Resources Division (CRD), Habitat Restoration and Enhancement Unit (HREU) continues to focus on providing suitable and accessible quality habitats for coastal recreational anglers through enhancement of Georgia's 30 marine and 15 estuarine artificial reefs. These reefs play an important role in Georgia's marine and estuarine ecosystems and coastal economies along with providing recreational opportunities as popular fishing and diving destinations. Reef project partnerships include local sport fishing clubs, private businesses, and other interested organizations as well as the acceptance of financial and material donations in order to further develop Georgia's Artificial Reef System.

Offshore Artificial Reefs

The Offshore Artificial Reef (OAR) Project covers ~116 square miles consisting of 30 artificial reef sites: 20 offshore reefs, two beach reefs, and eight Department of Defense (DOD) Tactical Air Crew Training System (TACTS) Towers. GADNR is currently consulting with the DOD on deployment plans to fully submerge the eight decommissioned TACTS Towers. Once deployed to the seafloor, the ownership of the Towers will be transferred to GADNR to allow the structures to continue to serve as habitat for marine life while providing recreational opportunities. Project SCUBA divers conducted material and compliance inspections during summer of 2016 where six reefs were visited and 46 dives were conducted.

During 2016, GADNR conducted one OAR enhancement through deployment of donated materials of opportunity. On June 30th, 2016 approximately 68 metal poultry transport cages (PTCs), 26 culvert sections, and six truckloads of concrete culvert/boxes were deployed at SAV Reef site (31°54.705'N / 80°47.195'W). This deployment would not have been possible without partnerships from the East Coast Terminal Company who staged materials landward in Savannah; Industrial Marine Services, Inc. who donated labor and equipment to load materials onto a contracted barge; Fieldale Farms Corporation who donated PTCs; TW3 Transportation who provided transportation of PTCs at a discounted rate; Astra Group, Inc. who donated 26 concrete culvert sections; and Consolidated Pipe and Supply Company who donated six truckloads of concrete culvert/boxes.

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All of GADNR's OARs, 30 existing and one proposed, are permitted under the United States Army Corps of Engineers (USACE) Regional Permit No. 36 (RP 36), (SAS-2008-00584). In 2016, GADNR requested a new beach reef site, BSF, be considered for addition to RP 36. This 400 yard diameter site, approximately 4 nm southeast of Little Tybee Island (center of reef 31°54.089'N / -80°50.073'W), was identified in partnership with the Savannah Sport Fishing Club. RP 36 authorizes the deployment and maintenance of materials at Georgia's OAR sites located in the Atlantic Ocean and remained valid until July 27, 2016. RP 36 renewal documents were submitted to USACE on January 11, 2016. In September 2016, USACE determined that the proposed project may affect, but is not likely to adversely affect the following species: North Atlantic right whale (Eubalaena glacialis), and the loggerhead (Caretta caretta) and Kemp's ridley (Lepidochelys kempii) sea turtles (Appendix I). In addition, USACE determined that the proposed reissuance may effect, but is not likely to adversely affect listed critical habitat for the North Atlantic right whale. In October 2016, USACE generated an effects determination/request for concurrence letter. National Marine Fisheries Service (NMFS) Section 7 consultation was initiated in November 2016 and GADNR responded to a list of questions in December 2016 (Appendix II).

In 2016 the HREU drafted an Artificial Reef Strategic Plan (ARSP) to establish strategies for promoting reef habitat enhancement along the Georgia coast. The ARSP is intended to serve as a blueprint for HREU statewide operational activities, serve as a guide for future activities, and to provide a coordinated approach to habitat enhancement projects. GADNR also maintained a You Tube Channel that houses OAR videos (https://www.youtube.com/channel/UCHrnTJ6fzvAF8BoItzN9-Nw) which are linked to the Georgia Outdoor Map website (http://georgiaoutdoormap.com). The Georgia Outdoor Map is an interactive map that identifies GADNR managed lands and outdoor recreational opportunities, including offshore and inshore artificial reefs, by using any device with a web browser.

Inshore Artificial Reefs

The Inshore Artificial Reef (IAR) Project consists of 15 total sites located within seven of Georgia's estuaries, covering all six coastal counties. Thirteen of the reefs were established within the intertidal zone, zero to three feet deep at mean low water (MLW). These reefs provide small vessel anglers additional fishing opportunities since they were designed to replicate oyster beds and other naturally occurring structures. Two reef sites, Little River and Jekyll Island Pier, were established as subtidal reefs which are accessible by land. These reefs were positioned in waters eight to twelve and five to six feet deep MLW respectively.

During April 2016, GADNR conducted two IAR enhancements at estuarine reef sites identified for development within existing permitted areas while working with coastal sport fishing organizations, anglers, and donors. The Troupe Creek reef (31°13.772'N / 81°26.501'W) is located northeast of the Troupe Creek Marina, St. Simons Sound, Glynn County whereas the Joe's Cut reef (31°55.910'N / 80°59.297'W) is located at the mouth of Romerly Marsh Creek, Wassaw

Sound, Chatham County. Both of these habitat enhancement sites used fabricated Fish Aggregating Device (FAD) units: a FAD consisting of a three foot square, four inch thick concrete base with 1.5 inch diameter PVC protruding from the surface of the base combined with a donated steel frame. FAD units constructed by Department personnel provided each IAR site structurally complex fish and oyster habitat. On April 8th and 11th a total of 50 FAD units were deployed by GADNR staff at Troupe Creek reef in partnership with Rayonier Inc., Jesup Plant (donation of frames); Boykin Steel and Crane (donation of transportation); and a private property owner Dr. Neal Boswell (donation of use of property to stage materials). On April 26th a total of 48 FAD units (Figure 1, foreground) were deployed by GADNR staff at Joe's Cut reef in partnership with Rayonier Inc., Jesup Plant (donation of frames); the Savannah Sport Fishing Club (donation of funding); Boykin Steel and Crane (donation of transportation); and TW3 Transportation (discounted transportation).

Oyster Reefs

Georgia's estuaries contain a high density of natural oyster spat. However, there is a lack of suitable "natural cultch" materials available for oyster settlement; therefore shell and other materials must be reintroduced into the environment to promote growth and expansion of new oyster reefs. In order to have shell available for projects GADNR manages seven Shell Recycling Centers along the coast where community members from restaurants, oyster roasts and other events voluntarily donate oyster shells to be used in future projects. Shell is also bagged through volunteer outreach events and placed at designated restoration sites each spring. After shells are planted, oyster spat attach and grow creating a new oyster reef. Forty-four volunteers participated in a total of four "bagging events" where approximately 1,117 bags (8.4 tons) of recycled oyster shells were created thus donating a total of 88 hours to project activities. GADNR's Oyster Shell Recycling Project provided 37.9 tons of cured (three to six months) shells for use in 2016 projects but only 3.6 tons of shells were required in two oyster reef maintenance projects in Chatham and Glynn counties, creating a 34.3-ton reserve.

Performance monitoring at both Overlook Park (Glynn) and Florida Passage (Chatham) sites indicated maintenance deployments were required to augment existing areas of oyster reef restoration sites that had been overtaken by sedimentation. On March 30th-31st, 2016 Overlook Park maintenance materials, 100 oyster balls placed on top of 25 wooden double pallets including 75 oyster shell bags, were deployed adjacent to prior restoration materials (2013-2015). This type of maintenance material was subsequently tested on site (2015) and found to be successful in combatting sedimentation as well as recruiting oysters quickly. On April 4th, 2016 400 oyster shell bags were deployed on top of the existing footprint covered by sedimentation at the Florida Passage site. While the perimeter of the previously deployed (2013) reef materials were sufficient to recruit and sustain large (2"- 3") oyster growth, the majority of the remaining footprint was buried by sediment. Both sites were monitored bi-annually according to methods established in the GADNR Oyster Reef Restoration Monitoring Plan (2015). Maintenance deployments were

conducted under previously obtained state (CMPA No. 600) and federal (USACE Nationwide No. 27: SAS-2012-00898 and SAS-2012-00524) permits.

The "Georgia Oyster Reef Mapping Project" was conducted in partnership with The Nature Conservancy, Georgia Coastal Management Program, and National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management to create a Geographic Information System (GIS) dataset of existing natural and restored oyster reefs along the Georgia coast. This project mapped existing inventories of oyster reef locations using 2013 high resolution low tide aerial imagery. The data from this project were converted from a shapefile format to a polygon overlay in a .kml file that can be displayed in Google Earth™ for broader usability. This dataset can be used to search for favorable conditions of potential oyster reef restoration sites while not disturbing known oyster reefs. The dataset is available for public use and can be downloaded from NOAA's Digital Coast data repository at: https://coast.noaa.gov/dataregistry/search/dataset/info/benthiccover or viewed via the GADNR Georgia Wetlands Restoration Access Portal (G-WRAP) at: http://gcmp.maps.arcgis.com/apps/webappviewer/index.html?id=7fcb79b84b9440f9b35b3a5e4efd6afc

Figure 1. Joe's Cut Inshore Artificial Reef materials. In 2014, steel frames (photograph background) were deployed at this site to enhance fish and oyster habitat. Historical FADs consisting of concrete bases and PVC pin-cushion style arms (photograph midground) were deployed in the 1990's directly on the mudflat and have subsided below the mudline with only a small portion of the arms remaining. In 2016 a modfided FAD design was deployed, historical FAD units placed inside a steel frame in order to minimize subsidance (photograph foreground).

APPENDIX I

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

MEMORANDUM

To: Sarah Wise, USACE Regulatory Division

From: January Murray, Habitat Restoration and Enhancement Unit Leader

Date: September 21, 2016

RE: Reissuance of RP0036: No Effects on Protected Species

There are 30 approved and one proposed offshore artificial reef sites maintained by DNR, four of which were located within the 1994-defined Southeast right whale critical habitat. In early 2016 the Southeast right whale critical habitat was expanded so that 20 reefs are now within the critical habitat boundaries. During the last 5-year permit cycle (July 2011 - 2016), reef material was deployed 11 times on six of the 30 reef sites. Two of these deployments occurred during the right whale calving & migration season (November 1st to April 30th) in areas that were not at the time within the critical habitat but are now inside the expanded critical habitat boundary.

We anticipate deploying materials approximately two to four times each year during the next five years, with the majority of deployments occurring outside of the right whale calving window due to inclement weather and staff availability. Most reef materials are "material of opportunity" donated to the Department and we do not have long-term staging facilities to store these materials for a six-month period. If we are not able to deploy them within a few weeks of the proposed donation, which occurs throughout the year, we may be forced to turn them down. The Department would like the ability to deploy materials on all 31 reef sites throughout the year and have incorporated the following measures to ensure that there are no effects on protected species:

Vessel Strike Avoidance Measures:

1. DNR will ensure that vessel operators and crews maintain a vigilant watch for manatees, cetaceans and sea turtles by maneuvering, slowing down or stopping their vessel to avoid striking protected species.
2. DNR will ensure that all vessels 65 feet or larger comply with the NOAA Right Whale Ship Strike Reduction Rule (50 CFR 224.105 et. seq.) in order to reduce the likelihood of collisions with right whales.
3. DNR will maintain 500 m or greater separation distance from any right whale, 100 m or greater separation from any other whale species, and 50 m or greater separation from any

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dolphin or sea turtle species.

4. DNR will ensure that vessel operators and crew are briefed to ensure they are aware of the above requirements.

Material Deployment Measures:

1. DNR will ensure that a 200 m exclusion zone is maintained at the deployment site to protect manatees, cetaceans and sea turtles for the duration of all deployments. A 500 m exclusion zone will be maintained for right whales.
2. The exclusion zone will be monitored by a protected species observer posted on the deployment vessel or another vessel located at the immediate deployment site.
3. Deployments will not be conducted at any time when lighting or weather conditions (e.g., darkness, rain, fog, sea state) prevents visual monitoring of the exclusion zone.
4. Clearance of exclusion zone: Deployment activities will not commence until the protected species observer reports has reported the exclusion zone clear of all cetaceans and sea turtles for at least 60 minutes.
5. Shut down procedures: Deployments activities will cease immediately if a sea turtle, manatee or cetacean is sighted within the exclusion zone. Deployment activities will not recommence until the exclusion zone has been cleared for at least 60 minutes of sea turtle, manatee or non-delphinoid cetacean and for at least 10 minutes of delphinoid cetacean.

Reporting Requirements:

1. DNR CRD staff will report all documented and suspected manatee, cetacean and sea turtle injuries and mortalities to DNR Nongame Conservation Section staff immediately, and will assist with carcass salvage if requested. Incident reports will be completed and submitted to the National Marine Fisheries Service Southeast Regional Office (for cetaceans and sea turtles) or the U.S. Fish and Wildlife Service Jacksonville Office (for manatees) within 48 hours, respectively.
2. All sightings of right whales will be reported to the U.S. Coast Guard immediately.

cc: Spud Woodward, Director of Coastal Resources Division

APPENDIX II

GEORGIA
DEPARTMENT OF NATURAL RESOURCES
COASTAL RESOURCES DIVISION

MARK WILLIAMS
COMMISSIONER

A.G. 'SPUD' WOODWARD
DIRECTOR

MEMORANDUM

To: Sarah Wise, USACE Regulatory Division

From: January Murray, Habitat Restoration and Enhancement Unit Leader

Date: December 19, 2016

RE: Additional Information NMFS, Protected Resources Division Requested by Jacquelyn A. DeAngelo, Endangered Species Biologist

1) Please provide a project description including methods:

a) How will artificial reef materials be deployed?

Offshore Artificial Reef (OAR) deployments involve materials transported via a barge and tow vessel to the deployment site. The barge typically contains some type of earth moving machinery (e.g. a skid-steer, backhoe, or small bulldozer) to push materials off the barge while the tow vessel operator maintains the position above the seafloor at a specified location. In situations where an entire vessel is deployed, holes are cut in the hull, and the seacocks and/or scuppers are opened to expedite sinking. The time for a vessel to sink to the seafloor varies by size, sea conditions, and structural integrity. Average sinking time is 30 minutes and staff remain on site until the vessel is resting on the seafloor and a latitude/longitude location is recorded. When possible, additional materials are loaded onto the vessel to add to the footprint and complexity of the reef.

b) How will artificial reef materials settle on the existing artificial reef or on the ocean floor?

Materials are pushed over the side of the barge within the reef footprint and gravity settles the materials onto the ocean floor.

c) How will it be determined that reef materials are settled in the accurate location.

The desired deployment location within the reef site is determined prior to deployment. Whenever possible/feasible, new materials are placed adjacent to existing materials and/or form groups of materials on the seafloor. Enhancing offshore habitats in this configuration allows for mobile fish to utilize both the artificial reef and the transitional zone (adjacent sand habitats) thereby dispersing fishing effort over a wider area. Once Georgia Department of Natural Resources (GADNR) staff are at the desired deployment location, a survey is conducted via side scan or conventional sonar to confirm the condition of the seafloor. A small anchored float is deployed to serve as a visual reference point to maintain the barge in a specified location throughout the deployment. The marker float is removed post deployment and latitude/longitude coordinates for the location of the deployed material are recorded.

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d) What method of monitoring will be used?

In order to help ascertain the long-term structural integrity and performance of deployed materials, monitoring surveys are conducted annually (May – October) utilizing the 13.7 m (45 foot) *R/V MARGUERITE* at as many offshore reef sites as possible. Monitoring surveys consist of visual inspection of the material and associated marine life by divers. Due to poor water clarity at many artificial reef sites, visual inspection is not feasible. In those situations, sonar technology and navigation electronics are used to confirm material locations are within permitted site footprints and depth clearances.

2) When were reef sites previously authorized? Did NMFS consult on the existing artificial reef structures?

The OAR Project began in 1970 under the authority of the Georgia State Game and Fish Commission and is currently administered by GADNR Coastal Resources Division (CRD) to create fisheries habitat and fishing opportunities in the Atlantic Ocean. GADNR has not been asked to coordinate with the NMFS previously during the process of renewing the USACE permits for offshore artificial reefs. GADNR records indicate the following Corp permits:

USACE Permit #	Date Issued	Reef Sites & Descriptions
074 OYN 003918	11/08/1978	KC
074 OYN RP0036	08/27/1985	KC; L; J; F; G; A
074 OYN RP0036	10/07/1985	Modification requested to include C Reef in this permit
074 OYN 006965	03/06/1989	Modification requested to J Reef height limits
074 OYN RP0036	04/03/1989	Modification requested to include SAV; DUA; CAT; SPL; ALT; KBY in this permit
199100977 074 OYN RP0036	08/02/1991	New KBY and CCA Reefs added to this permit; Updates to corner coordinate for C and A Reefs
199191718 074 OYN RP0036	02/06/1995	5 year reissuance
970003532 074 OYN RP0036	12/16/1998	New WW Reef added to this permit
200012980	11/27/2000	Modifications to this permit
200501190	05/22/2001	Modifications to this permit, add or rename reef sites
200501190	09/03/2005	5 year reissuance and modifications to this permit
074 OYN RP0036	12/22/2006	Request to modify SFC Reef perimeter coordinates
200800584	01/16/2011	Modifications to this permit, added 8 TACTS Tower sites
074 OYN RP0036	07/27/2011	5 year reissuance
200501190	03/31/2014	Modifications to this permit

Reef names have periodically changed throughout the history of the OAR Project. For example, CCA-JL formally known as CCA Reef; CDH formally known as C Reef; HLHA formally known as G Reef; JY formally known as J Reef; and KTK formally known as SPL Reef.

3) Please provide a benthic survey of the proposed beach reef site, BSF.

Side scan sonar (SSS) surveys were conducted on September 8, 2015 at a potential beach reef site in the near shelf waters approximately 4 nm southeast of Little Tybee Island. Beach reefs are located in highly dynamic sand-sharing zones typified by strong currents and wave action. SCUBA

diving at the potential beach reef site was not feasible due to poor underwater visibility. The 400-yard diameter potential beach reef site was vetted with extensive public review by GADNR staff and liaison with the Georgia commercial shrimping fleet, recreational anglers, and in partnership with the Savannah Sport Fishing Club. The BSF site was identified by recreational anglers interested to develop an additional beach reef site located offshore and within sight of land especially in light of rising fuel costs. Attached are BSF survey map and SSS screen shots confirming bottom conditions.

4) What time of year will be materials be deployed?

GADNR anticipates deploying materials approximately two to four times each year during the next five years, with the majority of deployments occurring outside of the right whale calving window due to inclement weather and staff availability. GADNR OAR Project receives material and financial donations as they become available and deployments may occur during the right whale calving season when necessary to prevent the loss of donated material. Although GADNR does not have the ability to forecast the timing of donations, every reasonable effort will be made to persuade donors to allow GADNR to schedule deployments outside of the right whale calving season.

5) Will the artificial reef materials include any sort of exposed rebar or other protruding steel components?

The GADNR-CRD policy is to not deploy any offshore artificial reef materials with exposed rebar or other protruding steel components.

7) How does the applicant intend to avoid entrapment of marine turtles, mammals or fishes in the artificial reef materials or in derelict fishing line/gear?

The South Atlantic Fishery Management Council (SAFMC) has designated 19 of the GADNR OAR sites (A; ALT; CAT; CCA-JL; CDH; DRH; DUA; DW; F; HLHA; JY; KBY; KC; KTK; L; MRY; SAV; SFC; WW) as Special Management Zones (SMZs). SMZs assist in increasing numbers of fish in an area and / or create fishing opportunities that would not otherwise exist (SAFMC 2014). The basic premise of this concept is to reduce user conflicts through gear and harvest regulations at locations that feature limited resources, managed for specific user groups. SMZs allow for: 1) fishing gear restrictions to prevent overexploitation of fishery resources; 2) orderly use of fishery resources on and around artificial reefs; 3) reductions in potential user group conflicts; and 4) maintain the intended socioeconomic benefits of artificial reefs. GADNR SMZ gear restrictions include: 1) fishing may only be conducted with hand line, rod and reel, and spearfishing; 2) use of sea bass pot or bottom long line is prohibited; and 3) possession of South Atlantic snapper-grouper taken with a power head is restricted to bag limits specified in federal code ss 622.187(b).

8) Please define the term "Material of opportunity" what materials are you proposing to use for the artificial reef?

Artificial reefs materials are typically of two general types, man-made manufactured/designed reef structures and materials of opportunity. Due to funding limitations, Georgia's artificial reef development efforts have been opportunistic with regards to materials utilized for artificial reef

construction. These projects have relied on surplus concrete and metal materials, as well as natural materials such as rock. Since the availability of these materials is unpredictable, they have been broadly categorized as "materials of opportunity," also known as "secondary use materials," since their function as reef structures is not the primary purpose behind their construction. Additional background information on types of artificial reef materials are found in the Guidelines for Marine Artificial Reef Materials, Second Edition (Lukens and Selberg 2004) and the National Artificial Reef Plan (Stone 1985).

a) What is the size of the materials proposed for use in the artificial reefs?

b) What materials will be used for the artificial reefs?

8(a-b): Sizes of materials vary for use in artificial reefs. Before approving any materials for reef construction, GADNR carefully inspects items to ensure they are designed to be suitable for submersion in an ocean environment, environmentally safe, and capable of being deployed in a cost-effective and safe manner. All materials utilized shall minimize impacts to environmental quality and must be free of hydrocarbon, contaminants, and toxins, as required by the United States Army Corps of Engineers, Environmental Protection Agency, United States Coast Guard, and other agencies involved in the permitting of an artificial reef in offshore waters. All trash, wood, lines, and other floating debris must be removed from materials prior to sinking. A variety of concrete and metal materials of opportunity have been utilized to create productive long-term fisheries habitat off the Georgia coast: concrete materials include designed units, rubble, bridge supports, transmission line poles, pallet balls, culvert/boxes, whereas metal materials include vessels; tugs, barges, subway cars; poultry transport cages, bridge supports, debarking drums, and surplus military equipment.

c) Will there be openings for the species to enter/exit? If so:

All artificial reef materials will include openings for species to enter and exit.

d) What will the size and shape of the openings be for entry/exit?

Size and shape of artificial reef openings will vary based upon the materials deployed. Openings are designed to allow for light penetration; current flow; and forage fish species such as anchovies, cigar minnows, etc.; small demersal fish; juvenile fish; and motile epifauna entry and egress from artificial reef materials.

9) Do any of the proposed reef sites overlap with recommended shipping lanes off of Brunswick, Savannah, or St. Mary's?

No.

10) Will artificial reef sites be marked with buoys or moorings?

No. However, the sites are clearly designated on all NOAA charts and precise location and description of each individual deployment within each site is available on our website.

a) How will buoys or moorings be anchored?

Not applicable (N/A).

b) What precautions will be taken to avoid mooring entanglement?

N/A.

11) Are any of the artificial reefs located within recommended shipping lanes or in an area that would fall within a recommended lane if the lane were extended eastward along the same orientation and same width?

APPENDIX II

None of the artificial reefs are located within recommended shipping lanes nor are they located in an area that would fall within a recommended lane if the lanes were extended eastward along the same orientation and same width.

a) Do you have a shapefile of the existing and proposed artificial reefs?

Yes. Available upon request.

b) If so, is this shapefile available for replication in maps for public notice?

Yes.

12) Is the applicant willing to:

a) Report any collision(s) with and/or injuries to any sea turtle, sawfish, whale, or sturgeon occurring during the construction of the proposed project and report immediately to NMFS's Protected Resources Division (PRD) at (727-824-5312 <tel:%28727-824-5312>) or by email to takereport.nmfsser@noaa.gov <mailto:takereport.nmfsser@noaa.gov>

It is GADNR-CRD policy to immediately report to an up line supervisor all interactions with protected species. Incident reports will be completed and submitted to the National Marine Fisheries Service Southeast Regional Office (for cetaceans and sea turtles) of the U.S. Fish and Wildlife Service Jacksonville Office (for manatees) within 48 hours.

b) Perform all work only during daylight hours

GADNR will conduct all work only during daylight hours.

13) It must be ensured that right whales are able to move over and around reefs so that they may select a combination of dynamically occurring habitat features.

GADNR's offshore artificial reefs are located in areas where right whales have been observed. A habitat model by Gowan and Ortega-Ortiz (2014) found right whales are most likely to occur at depths of 10-25 m in the Southeast United States. Consultation with GADNR's Wildlife Biologist, Mr. R. Clay George, who regularly conducts right whale boat and aerial surveys confirmed that right whales are rarely found in Georgia waters shallower than 10 m (personal communication). Mr. George doubts right whales would normally travel inshore to the areas where beach reefs are located because the surrounding habitat is too shallow. Mr. George stated it is possible that right whales may avoid offshore artificial reefs or just swim around them as there is nothing barring them from doing so. Right whales have been frequently seen in close proximity to the shallower offshore reefs such as: CAT, KTK, ALT, F, A, and KBY and Mr. George has not observed any anecdotal evidence that right whales avoid those reef areas.

14) Is the applicant willing to move proposed artificial reef BSF to an area with an existing depth greater than 30'?

No. The location (center of reef 31°54.089'N / -80°50.073'W) of this 400 yard diameter reef was vetted with extensive public review by GADNR staff and liaison with the Georgia commercial shrimping fleet, recreational anglers, and in partnership with the Savannah Sport Fishing Club. The BSF site was identified by recreational anglers interested to develop an additional beach reef site located offshore and within sight of land especially in light of rising fuel costs. The Mean Low Water depth at the proposed site is 29 feet. Moving the proposed artificial reef to a location with a depth of over 30' would provide minimal protection for the cost and effort associated with having to repeat the public review process.

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15) Is the applicant willing to limit reef heights to less than 20' off the sea floor?
Yes. The BSF site is intended for low relief concrete and/or metal materials. For example, materials include but are not limited to concrete: rubble, pallet balls (designed units), culvert / boxes / tetrahedrons, and metal: poultry transport cages, bridge supports, etc.

16) Is the applicant willing to plan/place BSF such that the resulting placement does not exceed two reefs (existing plus new per 10 nmi2
Yes.

An additional typo correction is required for the documents submitted to USACE on 1-11-16 for Special Condition 15 (z): "SFC" Artificial Reef perimeter coordinates. "SFC" Artificial Reef corner coordinates should be updated to: 31°00.8'N, 81°03.4'W; 31°00.8'N, 81°01.4'W; 30°59.3'N, 81°03.4'W; and 30°59.3'N, 81°01.4'W. Located approximately 18.0 nm east of Little Cumberland Island, Georgia. Minimum authorized water depth clearance: -28'MLW. "SFC" Reef consists of a 1.72 nm x 1.5 nm footprint.

References:

George, R. Clay. Wildlife Biologist. Georgia Department of Natural Resources, Coastal Resources Headquarters, Wildlife Resources Division, Nongame Conservation Section, 1 Conservation Way, Brunswick, Georgia 31520. (Personal communication).

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South Atlantic Fishery Management Council. *Special Management Zones.* Web. 18 August 2014.<http://safmc.net/managed-areas/special-management-zones-smzs>

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South Carolina Artificial Reef Activities
February 2017 Update

- It has been a very average year for the SC Marine Artificial Reef Program. Sixteen material deployments were made during the past calendar year, comprised of surplus concrete material, designed structures, and vessels. One new reef site was permitted.

- A concerted effort is being made to construct and deploy new reef modules in-house. Three new designs of concrete and steel have been built which can be deployed from our own research vessels. Two of these designs have already been placed on three separate reef sites while the third, which is larger than the others, is currently under construction. These new structures will be monitored regularly to determine which warrant further construction and distribution.

- Our request to the South Atlantic Fisheries Management Council (SAFMC) to have our two unpublished experimental reefs declared Type II Marine Protected Areas (MPAs) has been approved as part of the Council's Amendment 36 to the Snapper Grouper Fishery Management Plan. These areas are now classified as Spawning Special Management Zones (SMZs).

- The latest site visit to our deep-water artificial reef MPA, now 2-years old, revealed numerous grouper species including Warsaw, Snowy, Misty, Yellowedge, and Scamp, as well as Red Snapper. The original purpose for creating this reef was to provide spawning habitat precisely for these species so, although no spawning behavior was observed, their presence here is highly encouraging.

- A fifth edition of the "Guide to South Carolina Marine Artificial Reefs" has been printed and is being distributed as requested. This guide is a comprehensive listing of all reef sites and materials, with GIS generated maps of all South Carolina artificial reefs.

North Carolina Reef Program Update

During 2016, the NCDMF reef programs have spent a considerable amount of time in preparation for increased enhancements and development in the coming years. This increase is largely attributed to substantially expanded budgets for estuarine restoration and public support for reef development. The following sections summarize the progress of our two high relief reef development programs, Artificial Reefs and Oyster Sanctuaries, within four categories: construction, monitoring, outreach, and other administrative considerations.

Reef Construction:

In 2016, four projects were completed, resulting in one new 10 acre oyster sanctuary, two vessels sunk on a nearshore reef site, rock and reef unit enhancements to an existing inshore fishing reef, and eternal reef deployments at a nearshore fishing reef. The Oyster Sanctuary Program budget was increased substantially in 2016 and federal funds were leveraged by a local nonprofit to build a 40 acre oyster sanctuary site in southern Pamlico Sound, called Swan Island Oyster Sanctuary. Presently, this reef is in the planning, permitting, and contracting phase. Sometime in 2017, the reef will be constructed using 25,000 tons of marine limestone marl. Elsewhere, our Artificial reef program has focused efforts on improving user access to artificial reef fishing opportunities. We have sited two new reefs in Bogue Sound (near Morehead City), which will serve as very small experimental reefs, constructed by newly designed reef structures built by NCDMF staff. Those reefs are under permit review and should be constructed in mid-2017. Also under permit review is a vessel sinking project at a nearshore site off Pine Knoll Shores (Atlantic Beach). This project is funded through state recreational fishing license money and will be completed in partnership with a local dive club. Once permits are received, we anticipate the project to progress quickly, with both vessels being sunk by mid-2017.

Monitoring:

Since the last ASMFC/GSMFC Artificial Reef meeting, our state programs have worked to focus our monitoring effort on collecting meaningful data to better guide fishery management decision making. We completed our first year of estuarine finfish and oyster sampling, which included 38 gillnet, longline, and chevron trap samples, as well as 114 oyster quadrat samples. The objective of this 10-year proposed study is to evaluate community differences among different materials in different estuarine environments. As for other monitoring, the two programs jointly developed and implemented protocol to (1) map all new reef construction using multi-beam side scan sonar, (2) ground-truth abiotic environmental conditions in our estuaries using water quality data sondes, and (3) evaluate stability and durability of reef materials using multiple approaches (side scan and diver surveys). Finally, the material deployment database was overhauled and expanded to include the deployment history of both the oyster sanctuary program and artificial reef program, dating back to the early 1970s.

Outreach:

Most notably, in 2016 the Artificial Reef program published a long-awaited new edition of its Artificial Reef Guide in both print and interactive web formats. To produce this guide, current and former staff side-scanned each reef, digitized the existing materials on site, and labeled each material to provide information such as material type, GPS location, and deployment date. All of that is provided the public in waterproof, color print booklets for free. Online, the same guide is offered in pdf but also in

interactive format, allowing users to personize maps, measure distances, overlay various data layers, and connect to material meta-data (vessel histories, etc.). Beyond the new reef guide, the Artificial Reef program redesigned its website, offering updated information on the program and providing an avenue to collect user feedback through an anonymous survey. The Artificial Reef an Oyster Sanctuary programs also participate in numerous public meetings and conferences to present program developments.

Other Administrative Accomplishments and Considerations:

Throughout 2016 and continuing into 2017, both the Oyster Sanctuary and Artificial Reef programs have made tremendous progress to standardize reef construction methodology, streamline processes, and find efficiencies. Particularly, since the official transition from Loran to GPS technology years ago, a substantial error was found between the supposed and actual locations of NC reefs in many cases. For this reason, the NOAA nautical charts, state and federal permitting agencies, and USCG all held inconsistent records of reef sites and their boundaries. NCDMF has set an inter-agency meeting for mid-February 2017 to reconcile these records and subsequently provide NOAA with corrections to charted fish haven designations. In the interim, The USCG is assisting with Artificial Reef buoy removal operations in the ocean, since ocean buoys have surpassed their system life-expectancy.

As with other states, our reef construction permits are undergoing a new level of review by NOAA's Protected Resources Division in St. Petersburg, FL. As a result, our permit review timeline has been extended substantially. So, we are working with state and federal agencies to develop long-term strategies for permitting and development. In preparation for these discussions, our reef programs have written technical specifications for all acceptable reef materials and incorporated those into a new draft version of our NC Artificial Reef Master Plan. This plan will provide guidance on all aspects of reef development from conception, to permitting, to implementation, as well as monitoring. To supplement the Master Plan, the reef programs have outlined a 5-year development plan for all enhancement projects through 2021.

Virginia Artificial Reef Update

Artificial technical committee meeting- February 2017

In 2016, the Virginia artificial reef program completed four deployments to existing reef locations. All of the material consisted of materials of opportunity. Overall, it was a very slow year, as 18,000 tons of material expected from the Lesner Bridge renovation project were delayed.

Ocean deployments:

Two deployments occurred on one of 5 offshore Virginia reefs managed by the program. Both were on the Triangle reef, located 25 miles off of Virginia Beach. Incidentally, this area is also part of the Virginia Wind Energy Management Area. In May, 90 tons of armored undersea cable were placed in the North West corner of the permitted reef area. In October, the Coast Guard deployed five concrete sinkers, each weighing approximately 12,000 pounds, stacked in a pyramid shape at the site.

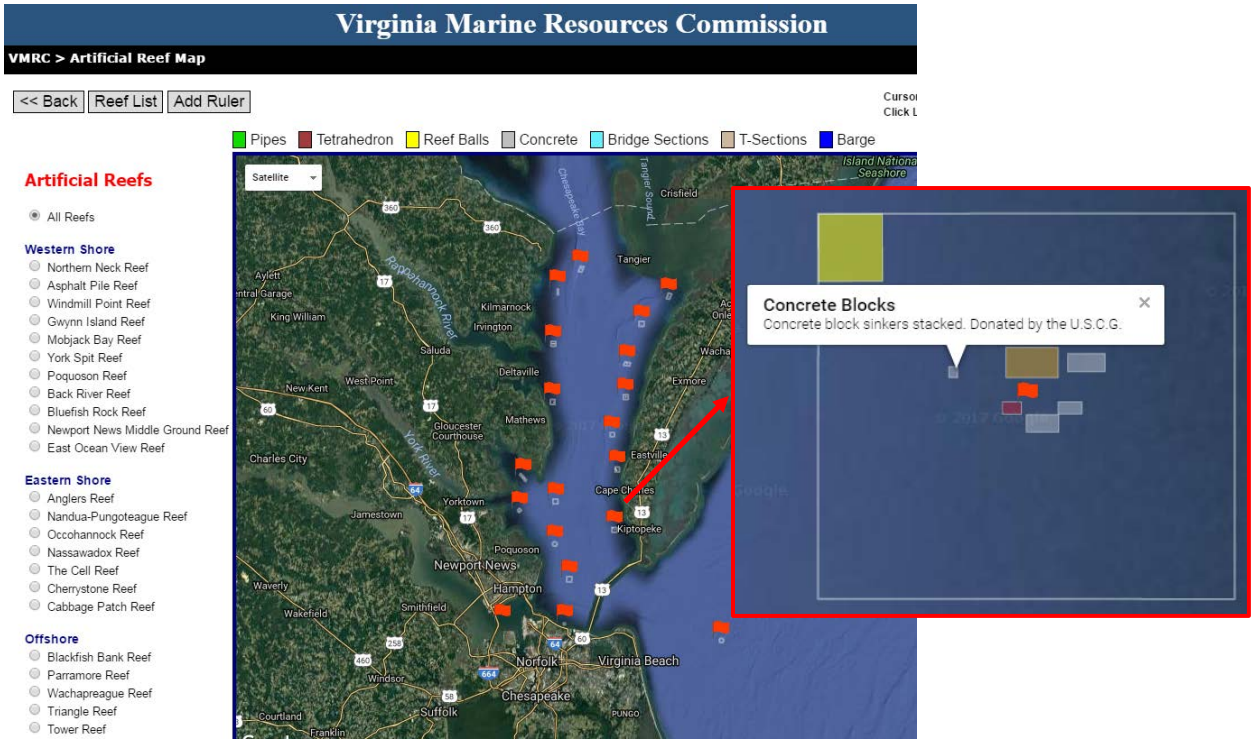
Bay deployments

The cabbage patch reef, located in the south eastern corner of the Chesapeake Bay received two deployments in 2016. The first was the initial load of Lesner bridge material (450 tons of concrete decking pieces) deployed in March. On February 2, 2017, the first full load of this material from the Lesner Bridge was deployed, with more barge loads expected in the next few months. The second deployment consisted of five concrete Coast Guard sinkers (12,000 pounds each) stacked in a pyramid shape deployed in September.

Plans for 2017:

In addition to the Lesner Bridge deployments expected this winter and spring, the program is working on a new public mapping system for the reef program. Past mapping efforts included broad grid maps that utilized icons for every deployment on record. The new system, includes an interactive GIS map that will allow users to zoom in on the reef location with metadata on each deployment listed. As side scans of each reef site become available, we hope to remove material that is no longer providing relief in order to ease confusion. This information will also be available through the agency smart phone app so that anglers can locate and track reef activity in real time.

Updated Reef Mapping:



In April, the reef staff has a scheduled presentation at the 73rd annual NEAFWA conference titled "Continuing a 40-year legacy: Maintaining Virginia's Artificial Reef Program." This presentation will highlight the history of the program, challenges since losing funding and staffing, and future plans moving forward (including the new mapping application).

In 2016, the reef program was approached by a representative from the Oyster Company of Virginia with a request to donate reef tech reef modules on a regular basis to the program. The contract is still being negotiated between the agency and the Oyster Company of Virginia. If successful, this will be a source of scheduled, engineered reef material being deployed at our Chesapeake Bay reef locations, beginning in 2017.

Summary of Maryland Artificial Reef Initiative Activities
Joint ASMFC/GSMFC Artificial Reef Subcommittee Meeting
February 2017

Permit:
The Federal Corps of Engineers permit for our Chesapeake Bay sites expired in August 2015. A new permit was issued by the Corps in June 2016. This is a 10-year "umbrella permit" that covers 21 sites in Chesapeake Bay through the end of 2026.

Deployments:
Deployed 55 "lo-pro" reef balls at Memorial Stadium Reef, Chesapeake Bay in May 2016. The reef balls were constructed by volunteer groups organized by a local Maryland Saltwater Sportfishing Association chapter and deployed from the Chesapeake Bay Foundation's vessel *Patricia Campbell*.

DNR reef program completed three deployments at the Love Point reef site in northern Chesapeake Bay. These deployments consisted of a total of 1,900 tons of secondary use concrete materials including concrete rubble, slabs, pilings and road barriers. This material was placed either free of charge or at cost by marine contractors who would otherwise pay to have it transported to a landfill.

Seventy "mini bay-ball" reef balls were deployed at the Tilghman Island reef site in July 2016. The reef balls were constructed by volunteers from local Coastal Conservation Association chapters and students at Carroll County Public Schools, and seeded with oyster spat at Chesapeake Bay Foundation's Oyster Restoration Center.

Six hundred tons of concrete rubble donated by Dominion Resources was deployed at the Cedar Point reef site in Chesapeake Bay near the mouth of the Patuxent River in November 2016. The material was composed of concrete slabs, blocks, and rubble left over from demolition work at the Dominion Cove Point facility in Lusby, MD. The cost of deployment was covered by Dominion.

Future Projects:
We currently have deployments scheduled for Love Point, Plum Point, and Tangier Sound reef sites in the first quarter of 2017, all utilizing recycled materials. In addition, we anticipate a steady stream of concrete from the Baltimore region in the next year: pier renovations at Dundalk Marine Terminal, demolition and reconstruction of the I-895 overpass, and construction work in southern Baltimore. Looking further ahead, the demolition and replacement of the Rt. 301 Bridge over the Potomac River (Rt. 301) will likely be a major source of material for many of our sites in the next 3-4 years. In general, we plan on relying largely on secondary use concrete and volunteer-built reef balls in the coming year.

Delaware Reef Program Update-February, 2017

Recent On-going Activity:

During The past several years, the reef program has been deploying large concrete pieces in transects on site #9, about three miles S.E. of Rehoboth Beach, Delaware, in about 60' of water. These low profile reefs allow us to make use of a site where 50' clearance above structure is a permit requirement. This area holds tautog and summer flounder seasonally. Large summer flounder appear to be attracted to these structures, with fish exceeding 10 pounds and up to 13 pounds caught annually. This effort will eventually result in more than 12,000 tons of concrete products being deployed, significantly developing the S.E. portion of this site.

2016:

The major effort of the reef program in 2017 was preparation of the Zuni/ Tamaroa, a 205' Navy tug/USCG cutter. This vessel has had a storied history, participating in the battle of Iwo Jima in WWII, the rescue of passengers from the sinking of the liner Andrea Doria in the 1950s and the rescue of 6 people during the "Perfect Storm" in the 1990s. Regulatory issues slowed the efforts and we lost our weather window in October, 2017. This necessitated an extension of our federal aid project into 2017 in order to complete the work and sink the vessel in calm weather. Deployment is expected by early summer, 2017 on the Del-Jersey-Land site, 26 nm S.E. of Indian River Inlet. The Delaware Reef Program is the lead agency on this project, conducted jointly with New Jersey. Delaware is providing SFR funds and the New Jersey Annie E. Casey Foundation providing the required 25% matching funds. This is a second example of cooperative efforts of multiple states to conduct reefing efforts in the mid-Atlantic area.

Loss of "Banked Match" for SFR funds:

Following the first round of subway car deployments (2001-2003), Delaware requested and was granted permission to "bank" the donation of clean-up costs and transportation costs for 619 NTC subway cars for use in future project segments. This amounted to over $6M. Use of this never-ending supply of matching funds has made reefing very easy. During 2016, federal auditors took exception with this practice. Project renewal for 2017 was already well underway and the SFR Office allowed us to use the banked match, as proposed in this final project segment. In 2018, Delaware will have to generate match within the project segment during which SFR funds are spent. This will make life much more challenging and may make large vessel projects very difficult.

2017-18:

During 2017 and 2018, the Delaware Reef Program hopes to acquire, clean, prepare and reef a 325' "Stealth Vessel", which will create the best fish habitat, the best fishing destination and the best dive destination in the mid-Atlantic region. This project is currently in the late planning stages and details cannot be shared at this time.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

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New York Artificial Reef Program
ASMFC Reef Committee Update / February 2017

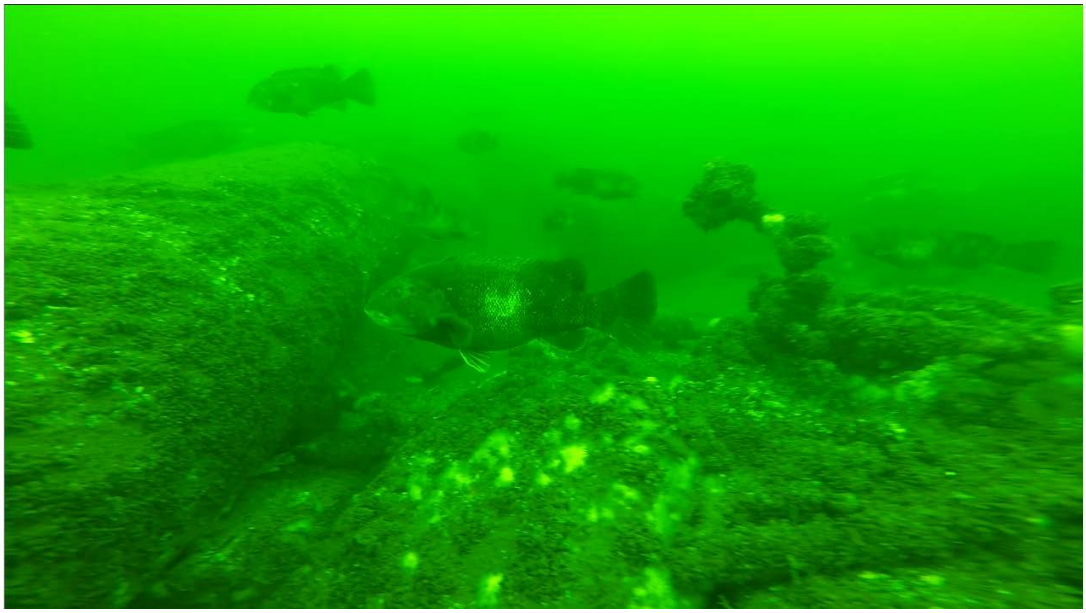
- In May 2016 Marine Resources regained Division status in NYSDEC. This change is resulting in some staffing increases. Am still flying the Reef Program solo.

- The New York Reef Program holds valid permits for six of its ocean sites: Rockaway Reef, Hempstead Reef, Fire Island Reef, Moriches Reef, Shinnecock Reef and Twelve Mile Reef. Twelve Mile Reef is New York's largest (850 acres) and deepest (120-140 FSW) site and is currently undeveloped. The Hempstead and Fire Island Reefs are second largest at 740 acres each and are approximately half improved.

- Program is currently undergoing the scoping process for a Supplemental Environment Impact Statement (SEIS) to update New York's current GEIS & Reef Plan. The SEIS will be a requirement for future reef permits which expire in late 2018.

- The *SUNY School of Marine and Atmospheric Sciences* completed a contracted biological monitoring study comparing the use of multiple survey methods on two oceanic sites. The project's final report is pending review and will be incorporated into the future SEIS.

- An update on the *Rockaway Delivery Lateral Northeast Connector Project remediation* work on Rockaway Reef. The 450 sections of 13 foot by 3 foot concrete coated steel pipe deployed on 16 targets in October 2015 have been colonized and are now home to healthy populations of tautog, black sea bass, scup and lobster among other inhabitants. The following photo demonstrates that "*Culvert is King*" and makes for some superior reef habitat.



- *New York Environmental Protection Fund* (EPF) monies have been secured to deploy an 85 foot steel tugboat on the Fire Island Reef later this year. EPF is a potential revenue source for future reef projects.

- The U.S. Coast Guard Aids to Navigation (USCG ATON) successfully deployed 75,000 pounds of concrete buoy sinkers on the Hempstead Reef in March of 2016. Recent contact was made by the same USCG ATON requesting permission to deploy additional sinkers on New York reef sites in the near future.

- Program was contacted by and has been in ongoing discussion with the Tappan Zee Construction Company (TZC) who is undertaking both construction and demolition of the Tappan Zee Bridge. Program has also been contacted by various Marine Contractors regarding the use of its reefs sites for material disposal. This project has potential to yield large volumes of concrete and steel beginning this year.

- *The New York Reef Building Foundation,* (NYRBF) a western Long Island organization formed by local fishermen received its 501c3 not for profit status in August of 2016. The next step for this organization will be to raise funds for select future reef projects.

Prepared by: *Christopher J. LaPorta*
New York Artificial Reef Program Coordinator

Artificial Reef Mtg Feb7-8, 2017

Rhode Island Update 2017

Fish Habitat Restoration planning for the urban marine environment

Providence River (top of the Bay) looking South

The water quality in the urban Providence River has shown improvements due to increased treatments of wastewater discharges (including a >50% decrease of nutrients), major decreases (> 90%) in toxics from dischargers, and major decreases in raw sewage discharges from Combined Sewer Overflows. The RIDEM Division of Fish & Wildlife Marine Fisheries Program is engaged in a multi-year collaborative study with The Nature Conservancy (TNC) funded by Sport Fish & Wildlife Restoration funds to examine whether fish habitat has improved in the urban Providence and Seekonk Rivers. Seining surveys (12-14 sta) as well as benthic video transects and water quality measurements (T,Sal,D.O.) in these urban areas were initiated in summer 2016 and will continue with the addition of fish pot surveys through 2017. Overall, we will be looking for evidence of changes in juvenile fish species occupying these areas due to both warmer local waters and improved water quality (decreased toxicity and less hypoxia).

This information will be used to develop plans for habitat improvement opportunities. Once we have an idea of where the best zones are for juvenile fish and what species are utilizing the area, we will develop plans for potential habitat enhancement and restoration efforts that can improve the conditions for growth and survival of juvenile fish. We will be considering a variety of habitat enhancement and restoration techniques, from “reef balls” to oyster cultch reefs, to other types of structures, as well as any opportunities to improve the few areas of salt marsh that provide fish habitat.

contacts: Chris Deacutis, RIDEM F&W Christopher.deacutis@dem.ri.gov

Initial seine stations Providence - Seekonk Rivers, Narragansett Bay

Massachusetts Artificial Reef Program update
Joint ASMFC / GSMFC Artificial Reef Committee meeting
February 7-8, 2017

Massachusetts Artificial Reef Program

Submitted by Mark Rousseau

The Massachusetts Division of Marine Fisheries continues to administer the MA Artificial Reef Program on a part time basis. To date, the Program has relied on Federal Aid in Sport Fish Restoration (Wallop-Breaux) money for reimbursement of a portion of agency funds for staff time used to provide technical assistance on projects that provide benefits to recreational fishing, including artificial reefs. Agency personnel direct resources toward supporting projects that promote and advance responsible artificial reef development.

In 2016 MA DMF:

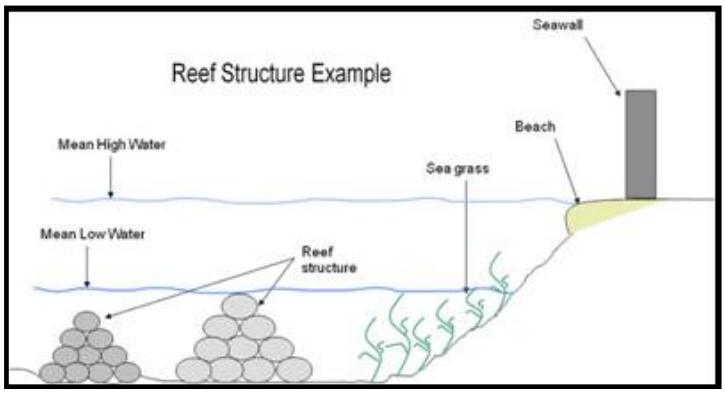
- Created a new 10 acre artificial reef two miles off Saquatucket Harbor in Harwich, the first artificial reef deployment in MA in a decade. Concurrent with creating the reef, a regulation prohibiting all commercial fishing activity on the Harwich reef site and within a buffer zone extending an additional 100 meters from the site in all directions was enacted. This regulation establishes the Harwich artificial reef site as the first and only site in Massachusetts dedicated exclusively to recreational saltwater fishing.

- Received funding from the MA Marine Recreational Fisheries Development Fund for long-term support of reef monitoring and development. These funds support monitoring efforts at all permitted artificial reef sites in MA. In 2016, acoustic receivers were deployed to five artificial reef sites to begin tracking the patterns of tagged migratory fish species of commercial and recreational importance.

- Explored new potential artificial reef sites in lower Cape Cod Bay. Collaborated with the Cape Cod Bay Commercial Charter Captains Association to site additional near shore artificial reefs in the southern portion of Cape Cod Bay. Work is expected to begin late summer, 2017.

- Attended National Artificial Reef Workshop on June 9-10, 2016 in Alexandria, VA. The Workshop was sponsored by NOAA fisheries and included more than 80 invited participants affiliated with artificial reefs nationwide. The workshop focused on the future direction of artificial reefs in US waters.

- With funding from a NFWF Hurricane Sandy grant, DMF launched a project focused on siting and designing near shore artificial reefs. Alternatives to shoreline armoring, beach re-nourishment and other traditional coastal protection measures has become an emerging issue in MA due to predicted climate change scenarios. The intent of this project is to examine the feasibility of reefs that could be used for shoreline protection as well as serve as productive biological habitats. The project was initiated after discussions of how to beneficially reuse dredged rock material expected to come from the Army Corps Boston Harbor Deepening Project in 2017. A multi-agency working group of Federal, State, Local and nonprofit resource agencies vetted potential options for the beneficial reuse of dredge rock. In 2015, 33 preliminary sites were identified and filtered down to 10 potential sites through a site selection process. In 2016, two sites were selected and pre-permitting studies were initiated.



Louisiana Artificial Reef Program
Status and Activities
February 2017

The Program continues to be very active in accepting new platforms into permitted artificial reef sites. Multibeam survey imagery of the offshore reefs can be found at: http://www.wlf.louisiana.gov/fishing/artificial-reef-program

- 76 established offshore reefs
  - Oil & gas jackets accepted (380 total)
    - 15 deployed in 2016
    - 29 additional structures permitted for deployment
    - 28 in permit process
  - Drill rig legs accepted (8 total)

The Program now has 5 established nearshore reefs. Our Artificial Reef Council approved twelve Nearshore Planning Areas. There is one active permit request for a new nearshore reef. The Program is actively soliciting the owners of platforms within Nearshore Planning Areas for potential reefing opportunities.

The Program now has 27 established inshore reefs. The Artificial Reef Council also approved two new inshore reef sites located in the southwest portion of Lake Pontchartrain and the southeast portion of Calcasieu Lake. Permitting for these new sites, as well as enhancing the existing Point Mast reef site in Lake Pelto is ongoing. These three inshore reef projects are slated to be constructed later this fiscal year. The Program has been conducting pre-deployment monitoring at the planned inshore project sites, and post-deployment biological monitoring at the recently enhanced Independence Island reef site.

The Program continues multi-beam surveys of selected reef sites, followed by high resolution video ROV surveys.

Mississippi Department of Marine Resources Artificial Reef Bureau 2016 Annual Update for the ASMFC-GSMFC Joint Artificial Reef Subcommittees

Prepared by
Jimmy Sanders
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During 2016, the Artificial Reef Bureau (ARB) continued to monitor fish assemblages and physiochemical parameters at selected inshore reef sites. Personnel periodically checked and re-marked 22 inshore reefs in the three (3) coastal counties (Hancock, Harrison and Jackson) to assist small boaters in locating the low-profile reefs. Offshore reef sites were visited to check reef sustainability, subsidence rates, and fish community structure. ARB staff also assisted the Finfish Bureau with collecting samples for a reef fish assessment project funded by the National Fish and Wildlife Foundation (NFWF).

The ARB continued work on securing and deploying structure. In 2016, the ARB secured approximately 1,475 concrete culverts from five local construction companies. This material was stockpiled at the Gulfport staging site for future offshore deployments. During the months of May and June, the ARB deployed 222 juvenile reef fish habitat boxes in FH-3, FH-13, and FH-14 for the Coastal Impact Assistance Program (CIAP).

Artificial Reef Bureau members also used side scan equipment for in house applications and to assist the Shellfish Bureau. Mapping to monitor deployed cultch material was completed in April for the Mississippi Oyster Cultch Early Restoration Project. ARB members also utilized side scan equipment to map historic oyster bed locations in Biloxi Bay. Eleven inshore artificial habitats were side scanned to assess reef status and precise boundaries of deployed habitat.

Additionally, the ARB partnered with NFWF to complete the Artificial Reef Habitat Mapping Program. This program consisted of 100% multibeam coverage and 100% side scan sonar coverage and included the survey of all 15 offshore Artificial Reef sites and all 8 Rigs to Reefs sites. The survey provided the following: coverage graphic of the location of each feature, an image of the side scan feature, a 3-D perspective image from the multibeam point cloud, position of the feature in NAD83, the dimensions of the feature and the minimum depth of the feature below MLLW.

Throughout the year, the ARB contributed to multiple outreach events and educational meetings. Staff personnel represented the bureau and MDMR at several outreach events including Capital Day in Jackson, MS in February, the Biloxi Boat Show in Biloxi, MS in March and the Wildlife

Expo in Jackson in August. In March, the ARB attended the Gulf States Marine Fisheries Commission & Atlantic States Marine Fisheries Commission Artificial Reef Subcommittee Meeting in San Antonio, TX. In June, ARB staff also attended the Artificial Reef workshop in Alexandria, VA. In October, ARB staff members attended the Gulf States Marine Fisheries Commission 67th Annual Spring Meeting.

Lastly, the ARB is currently preparing for and working on ongoing projects. The Coastal Conservation Association and the ARB are collaborating to deploy concrete culverts within Cat Island Reef site. Also, MDMR is working with Oscar Renda Contracting to obtain and deploy valuable artificial reef material. The concrete culverts will be deployed in several locations in FH-1, FH-2 and FH-13.

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Our mission is to manage the State's marine fishery resources through research, enforcement, and education for the maximum benefit of the resources and the citizens of Alabama.

JOINT GSMFC & ASMFC ARTIFICIAL REEF SUBCOMMITTEE MEETING

Alabama Artificial Reef Report

Jacksonville, FL
February 7-8, 2017

The Alabama Marine Resources Division (AMRD) continues to be active in maintaining, constructing, and deploying artificial reefs within its territorial waters and adjacent Federal waters of the Gulf of Mexico up to 65 nautical miles offshore of Alabama.

Inshore reefing projects during 2016 resulted in the construction of 2 new reefs near Point Clear and Fort Morgan, Alabama and the enhancement of existing reefs. The 9.7 acre reef near Point Clear was constructed with 9,710 tons of 3" X 6" limestone aggregate and 6 USCG approved lighted pilings. The 3.6 acre reef north of the Fort Morgan Peninsula was constructed with 5,490 tons of 3" X 6" limestone aggregate and 4 USCG approved lighted pilings. A total of 26,460 tons of 3" X 6" limestone aggregate was deployed to enhance 13 existing inshore fishing reefs covering approximately 22 acres. Two additional inshore fishing reefs sited on approximately 21 acres of historic oyster bottoms were enhanced with 9,102 tons of #2 limestone aggregate. In total, $2,197,922 were invested in inshore reef construction projects during 2016 (Figure 1).

A USACE permit to construct new inshore reefs in the Mississippi Sound and Pelican Bay has been acquired and a $400,000 contract has been awarded to construct the reefs. A total of 132 pedestal style modules will be deployed to construct approximately 24 acres of new reef bottoms. Construction is expected to begin in February 2017.

Alabama Marine Resources Division continues to develop the reef habitats within the nearshore zones offshore of Alabama (Gulf beach to 9 miles offshore). A USACE application submitted in May 2014 is still pending authorization. An Endangered Species Act (ESA), Section 7 consultation with NMFS has been completed and a National Historic Preservation Act (NHPA), Section 106 cultural resources remote sensing survey is currently being conducted.

A USACE permit application to construct 3 snorkling reefs has been submitted and AMRD is waiting on ESA and NHPA concurrence. Each of the 3 proposed snorkling reefs are approximately 8 acres in size and depth ranges from approximately 8’ to 23’.

In addition to seeking authorization to develop additional reef zones in the nearshore waters offshore of Alabama, AMRD has constructed 25 new reef sites using 125 pedestal-style, low-profile anchored reef modules. These reef modules deployed approximately 3 miles offshore of Baldwin County, Alabama have been heavily utilized by juvenile gray triggerfish and red snapper. Additional habitat in the same general area, therefore, should increase the production potential in these nearshore waters (Figure 2).

Alabama continues to develop the Rigs-to-Reefs program. The jacket of the MP 255 platform was cut approximately 90’ below sea level and reefed on site in approximately 333’ of water 54 nm south of Fort Morgan, Alabama. Also, the jacket of the MP 261 platform is scheduled to be reefed later in 2017. The top section of MP 261 will be cut at 110’ and placed approximately 50 nm south of Dauphin Island, AL in the Tatum-Winn North Artificial Reef Zone.

Modular type concrete units and “materials of opportunity” were utilized to create and enhance numerous offshore reefs. Eleven existing reef sites were enhanced with 36” and 48” culvert pipe, large manholes and box culverts. Additionally, a “scattered” reef was created with the concrete materials of opportunity. The “scattered” reef was created by placing culverts/manholes approximately 20’ around a single 650’ diameter area. Fifty large relief pyramids were similarly deployed to enhance existing reefs and construct new reef sites. Previously deployed 25’ tall pyramids appear to be utilized by a more diverse reef fish assemblage, therefore, constructing additional reefs with these large pyramids could result in a more stable reef community. The large pyramid modules were utilized to construct 17 new reef sites containing 2 modules per site and a single pyramid was deployed at 16 existing reef sites where the previous structure had subsided or was reaching the end of its usable life.

Alabama Power Company, Cooper T. Smith and the Alabama Wildlife Federation donated resources to construct a large artificial reef approximately 25 nm offshore of Alabama. The reef was constructed with two 18’ X 40’ boilers placed inside of a 195’ X 35’ hopper barge.

A pre-bid meeting for the construction of a shipwreck reef is scheduled for February. The project has a $1,000,000 budget and the winning contractor will be selected based upon the largest, most complex shipwreck proposed within budget.

Figure 1. Deployment of limestone aggregate to enhance/construct inshore reefs.

Figure 2. Installation of a pedestal-style low relief module.

Figure 3. 25’ concrete pyramid modules used to enhance existing reef sites and construct new reef sites.

State of Florida Artificial Reef Program 2016 Annual Update for the ASMFC-GSMFC Joint Artificial Reef Subcommittees

February 7-8, 2016 Jacksonville, FL

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Florida Fish and Wildlife Conservation Commission

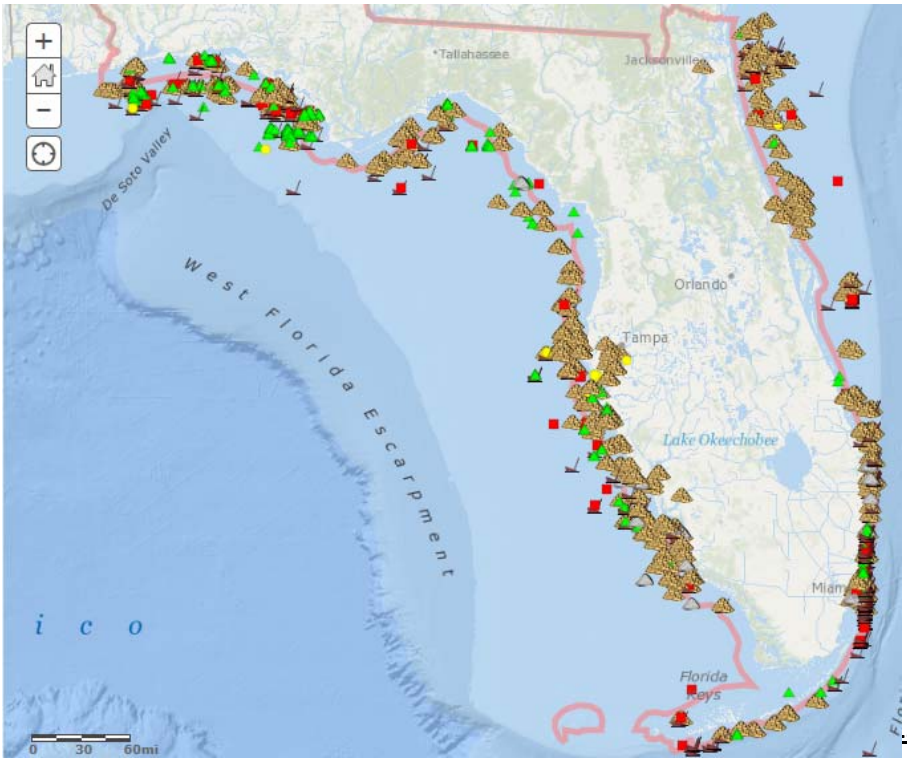
MyFWC.com

Florida Fish and Wildlife Conservation Commission (FWC) Artificial Reef Program

The primary objectives of the Florida Fish and Wildlife Conservation Commission state artificial reef program are to provide financial and technical assistance to coastal local governments, nonprofit corporations, and state universities to help develop, monitor, and evaluate artificial reefs in Florida's state and Federal waters. The FWC Artificial Reef Program coordinates administers state funding (recreational fishing license and general revenue funds) and federal funding (USFWS Sport Fish Restoration Program funds) as grant agreements to local governments, state universities, and non-profits to implement new artificial reef construction, research, and monitoring activities statewide.

As of December 2016, Florida reports a total of 3,264 public artificial reefs. 1,061 of the public reef deployments are off of Florida's Atlantic Coast and 2,203 on the Gulf Coast. During 2016, a total of 115 new deployments were completed state-wide; 28 off the Atlantic Coast and 87 off the Gulf Coast (See Appendix A).

Five artificial reef construction projects were funded using federal dollars. Four of the five projects took place on the Atlantic Coast and one of the projects took place on the Gulf Coast. Two additional projects were planned for the Gulf Coast but were not successfully completed. Within the Atlantic Coast activities, two construction activities occurred off central east Florida (St. Lucie County; Martin County) and two construction activities took place off southeast Florida (Palm Beach County; Miami-Dade County). The completed Gulf Coast reefing activity, took place offshore of the Florida 'Panhandle' area (City of Carrabelle and the City of Mexico Beach).



Click the QR code to view the online GIS mapping application:

http://arcg.is/1MxCd5y

- Concrete (1362) 42.0%
- Vessel/Barge (518) 15.8%
- Modules (915) 28%
- Metal (274) 8.3%
- Rock (115) 3.5%
- Other (80) 2.4%

5.

Bay County (Northwest Florida, Gulf of Mexico)

On May 14, 2016, Bay County, located in Northwest, Florida, five prefabricated artificial reef modules. One reef complex was used among the five reef sites. The reef complex used was a prefabricated module called a "Super / Ecosystem Reef". The "Super Reef" Artificial Reef module is a concrete tetrahedron module measuring 15 ft. tall and 15 ft. wide at the base, with nine 12 inch by 18 inch rectangular openings through each of three upright limestone studded concrete sides. This module alone weighs approximately 36,000 lbs. Each "Super Reef" has two "Ecosystem Reefs" placed on top. The "Ecosystem Reef" module are three layers of the cylindrical shaped limestone embedded concrete disks approximately 3 ft. in total height. The total height of the "Super / Ecosystem Reef" is 18 ft. tall. There were a total of five of these modules deployed. All of these reef structures were designed, manufactured, and deployed by Walter Marine of Orange Beach, Alabama. The total cost for the project was $60,000 provided by state funds.

Broward County, Lady Luck (Southeast Florida, Atlantic)

On July 23rd, 2016 1.25 miles of Pompano Beach in Broward County, Florida, the *Lady Luck* (formerly known as the Newtown Creek), is a 324 ft. sludge tanker was sunk. The ship is the centerpiece of what will become known as Shipwreck Park, surrounded by 16 other existing wrecks covered with marine life. The ship was towed from New York to a facility on the Miami River for cleanup and preparation for deployment. One of the unique aspects of this wreck is that it contains concrete sculptures in honor of one of its main sponsors, Isle Casino. Artist Dennis MacDonald created an underwater casino scene with five oversized dice, a card table with an octopus and three card "sharks", a life size mermaid barmaid, and a steel slot machine. A comprehensive sink plan was assembled by Resolve Marine and the *Lady Luck* began it's slowed decent at 8:30 am on the 23rd. It took almost 8 hours for the Lady Luck to be deployed. She is now resting upright in 120 ft of water at 26° 13.807' N, 80° 03.807' W. It took over the expected amount of time and water to successful flood the *Lady Luck* and with hundreds of impatient private boater the day was hectic. After deployment and dive inspection to remove diver and fishing hazards, traces of small amounts of oil were seen seeping from the ship. The next day the Coast Guard was made aware of the oil. Total funds for the project was $800,000 from local donations from The Shipwreck Park Inc., The City of Pompano Beach and Isle Casino Racing Pompano Park.For a 3-D of the ship before deployment and to see additional pictures please visit http://shipwreckparkpompano.org/index.html

Broward County, Limestone Boulders (Southeast Florida, Atlantic Ocean)

On September 28, 2016 Broward County and McCulley Marine Services deployed 510 tons of clean limestone boulders off Deerfield Beach in a water depth of 67 ft. All material was deployed in the issued Army Corps of Engineers Permit #SAJ-1989-90804 (Site A1) and Florida Department Environmental Protection Permit #06-0324675 (Site Deerfield Shallow). The new artificial reef is an addition to last year's 'Mt. Deerfield' project. The deployment was completed in compliance with the permit requirements.

Once the tug and barge cleared the area, the dive team made a final inspection. The boulders spread in a 60 ft. diameter footprint and piled 15 ft. high with a clearance of 52 ft. to the surface. The final coordinate for the reef is: N 26° 19.0654' W -80° 03.7202'. The artificial reef was created using FWC Grant #15234 for $60,000.00 of state funds.

City of Mexico Beach (Bay County, Northwest Florida, Gulf of Mexico)

Between May 9 and May 10, 2016, the City of Mexico Beach, located in eastern Bay County in Northwest Florida, deployed 77 structures consisting of prefabricated modules and secondary-use materials. 49 Florida Limestone Artificial Reefs, 17 Grouper ecosystem reefs, 1 Florida Special Tetrahedron, 2 large cable reels and 8 chicken transport devices with one to six structures placed at each patch reef for an average of three modules per patch reef for a total of 26 patch reefs distributed among eight permitted sites in Gulf of Mexico state and federal waters.

Five different pre-fabricated structural designs were used among the 26 patch reefs. One type of structure was a prefabricated module called a "Florida Limestone Artificial Reef". The "Florida Limestone" Artificial Reef module is a concrete tetrahedron module measuring 8 ft. tall and 10 ft. wide at the base, with three 12 inch by 18 inch rectangular openings through each of three upright limestone studded concrete sides. This module alone weighs approximately 6,000 lbs. There were 49 of these units deployed. The second type of module deployed was a prefabricated module called a "Grouper Ledge / Ecosystem" hybrid module measuring 6 ft. tall, 5 ft. wide, and 10 ft. long, with a single large opening on one side with three layers of the cylindrical shaped limestone embedded concrete disks placed on top. There were 17 of these units deployed. The third type of structure was a prefabricated module called a "Florida Special". The "Florida Special" is a steel reinforced concrete tetrahedron with steel sides measuring 10 ft. tall and 11 ft. wide at the base and weighs approximately 6,000 lbs. There was one of these units deployed. The fourth structure deployed were secondary-use cable reels with stand assemblies. The cable reels are steel spool structures measuring 11 ft. tall, 16 ft. wide and 30 ft. long. Each spool weighs approximately 36,000 lbs. The fifth structure deployed were secondary-use steel chicken transport devices. These chicken transport devices are constructed of steel and measure 4 ft. tall, 4 ft. wide and 8 ft. long. Each steel chicken transport device weighs 800 lbs. All of these reef structures were either designed and manufactured or acquired by the City's competitively selected marine contractor, Walter Marine of Orange Beach, Alabama.

Fourteen of the deployed structures ("Florida Limestone/Grouper Ledge" modules and chicken transport devices), were designated as research refugia reefs by the City of Mexico Beach and Mexico Beach Artificial Reef Association (MBARA). The exact coordinates of these sites will not be published to allow MBARA divers to monitor the fish populations over time. This will allow data collection for comparison of publicly noticed artificial reefs with unpublished artificial reefs.

The total cost for this project was $142,888.64. The City of Mexico Beach contributed a total of $25,201.64, the Mexico Beach Artificial Reef Association contributed a total of $57,687.00, the state share was $10,000.00, and the federal grant funds expended were: $50,000.00.

City of St. Marks (Franklin County, Bigbend Region of Florida, Gulf of Mexico)

The City of St. Marks deployed 101 pre-fabricated modules at 25 patch reef locations within the St. Marks Artificial Reef permitted area (SAJ-19689-60014). The St. Marks Artificial reef permitted area is a 17 acre rectangular shape permitted area located in Apalachee Bay in the Gulf of Mexico, south of Wakulla County, with the center of the existing site being located approximately 5.3 nautical miles to the south of the entrance to the St. Marks River. The approximate depth of water within the site varies from 18-21 feet relative to the Mean Lower Low Water (MLLW).

All reef material was deployed during a single deployment operation on 12/3/2016. The deployment operations was performed by the subcontractor Coleen Marine. Coleen Marine used spuds and live boating in order to place reef material at designated patch reef locations. Patch reef locations were marked using an anchored buoys. FWC staff was on site during deployment operations. No permit compliance issues were observed during the deployment operations.

The total cost for this project was $49,612.12. The state share of this project was $49,612.12. There was no federal funds or local match provided for this project.

Escambia County (Northwest Florida, Gulf of Mexico)

On January 13, 2016, Escambia County sunk tug boat *Ocean Wind* roughly 10 nautical miles southeast of Pensacola Pass in 82 ft. of water. *Ocean Wind* was built in 1952 and served as a ship docking assist tug, most recently in Pensacola, until it was retired in September 2013. It is 87 ft. long by 25 ft. wide with a draft of 10 ft. The height from the keel to the top of the mast is 37 ft. Prior to being sunk, *Ocean Wind* was removed of bilge waste, hydrocarbon residue in the steering system, diesel and oil pipes in the engine room, and cleaning of fuel tanks. All rooms had been stripped down to the exposed wall and base flooring. All areas observed, including the engine room, were broom-swept with no loose debris, and there were no residual oil on the walls or floors. Additionally, numerous holes had been cut on the deck of the boat and between the rooms in the interior of the tug to help and control the flooding process of the vessel during deployment. The tug was successfully deployed and resting upright and stable on the seafloor.

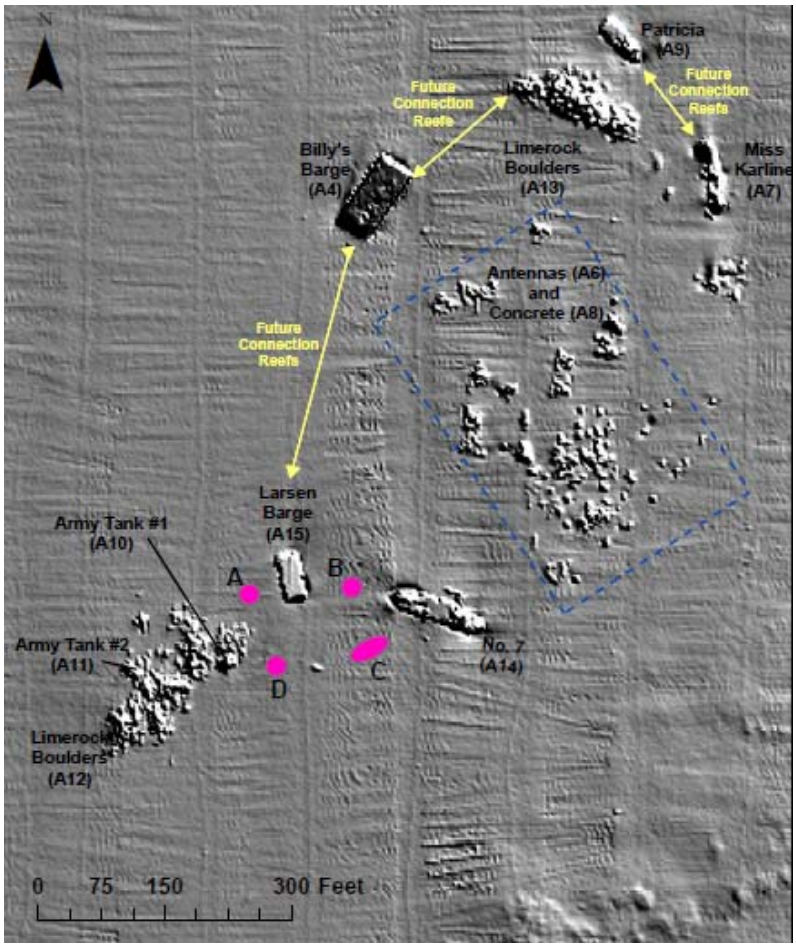
The total cost for this project was $145,000. The state share of this project was $100,000.00 with county match of 45,000.

Martin County (Central Florida, Atlantic Ocean)

Martin County deployed 3,245 tons of clean secondary-use concrete culverts, poles, pilings, barricades and other concrete and reinforced steel construction materials to create four patch reefs within northwest corner of the MC South County Phase 3 permitted area and three patch reefs within the western edge of Sirotkin permitted area. All material was deployed between July 28th and August 16th 2017. Both reef sites are in federal waters and permitted to Martin County by the U.S. Department of the Army, Corps of Engineers (USACE) Permit Number SAJ-2006-01955(IP-LCK), and SAJ-1995-04128 (IP-MJW) respectfully. The patch reefs were spaced 800 ft. apart based on conditions set in the Martin County Artificial Reef Plan. The Sirotkin patch reefs were planned to create a dive trail between the existing Tetrahedron Reef "Black" and the Railroad Tie Stack Reef. The total cost for both project was $180,000. Martin County contributed $38,000, the state share was $92,000 and the federal grant funds expended were: $50,000.

Miami-Dade County (Southeast Florida, Atlantic Ocean)

Miami- Dade County deployed 930 tons of limestone boulders at a depth of 50 feet within the Anchorage Artificial Reef Site. The 3 to 5 foot diameter limestone boulders created four patch reefs between three existing steel reefs, the Larsen Barge, Army Tanks and No. 7, within the Anchorage Artificial Reef Site. The deployment coordinates are located 3.5 nautical miles at a bearing of 30° from Government Cut. The Anchorage Artificial Reef Site is a rectangular permitted area located in state waters off Miami-Dade County in the Atlantic Ocean. The Anchorage Artificial Reef Site is permitted to Miami-Dade County by the U.S. Department of the Army, Corps of Engineers Permit Number SAJ-2003-04250 (IP-PK), which is valid until July 24, 2024, and by the Florida Department of Environmental Protection Permit Number 13-0180248-001, which is valid until August 14, 2016. The deployment locations were located within the eastern center of the permitted site. Analysis of LIDAR survey information and visual assessment radial surveys conducted using SCUBA at the proposed deployment location confirmed sand substrate with no exposed hardbottom or submerged aquatic vegetation within 150 ft. of the project boundaries. The total cost for this project was $175,942.38. The state share was $55,942.38 and the federal grant funds expended were $120,000.00.



Pinellas County (Central Florida, Gulf of Mexico)

Pinellas County deployed over 2,000 tons of secondary-use concrete comprised of clean culverts, pilings, slabs, and rubble within the existing Veteran's Reef Permitted Area (SAJ-1998-00788 (IP-MLS)). The Veteran's Reef Permitted Area is located approximately 9.6 nautical miles west of Hurricane Pass (Pinellas County) in Federal waters in the Gulf of Mexico. Pinellas County publicly advertised request for reef construction services and awarded the project to McCulley Marine Services, Inc. (Bid No. 156-0130-B(LN). Four barge loads of secondary-use concrete were deployed within the northwest section of the Veteran's Reef Permitted Area Between June 16, 2016 and June 27, 2016 creating four patch reefs in close proximity to each other (~100 ft.) comprised of approximately 500 tons of material for a total deployment material weight of 2,000 tons. Collectively, the four patch reefs had a maximum relief of 15 ft. and a minimum vertical clearance of 30 ft.

Reimbursed services for this project included loading, transportation, and deployment of secondary-use concrete material from the Pinellas County Artificial Reef Program Staging Area to the Veterans Artificial Reef Permitted Area. The total cost for this project was $89,000.00. The state share or this project was $89,000.00. There were no matching funds.

Deployment	Date (M/D/Y)	Weight (Tons)	Depth (ft)	Relief (ft)	Latitude (DM)	Longitude (DM)
1	6/16/2016	550	45	15	28 03.039 N	83 00.802 W
2	6/22/2016	500	45	15	28 03.074 N	83 00.800 W
3	6/23/2016	500	45	15	28 03.071 N	83 00.817 W
4	6/27/2016	450	45	10	28 03.055 N	83 00.798 W

Palm Beach County, Ana Cecilia (Southeast Florida, Atlantic)

On July 13th, 2016 Palm Beach County sunk the *Ana Cecilia***,** 170 ft. long cargo vessel. The ship, built in 1972, and is most recently known for the drug smuggling confiscation by The U.S. Custom and Border Protection in 2015. The ship has three plaques honoring missing or lost at sea community members, Austin Stephanos, Perry J. Cohen, Palm Beach County Sheriff Deputy Fernandez Jones, Jaden Jones, and Willis Bell. The Ana Cecilia is the 45th ship to be scuttled in Palm Beach County (PBC) in recent decades and was successfully flooded and sunk upright 1.25 miles off the Lake Worth Inlet in 85 feet of water (coordinates: 26 47.118/-80 00.960). The total cost of this project was $103,750 all provide by local funds.

Palm Beach County, Modules (Southeast Florida, Atlantic Ocean)

Palm Beach County deployed 100 prefabricated modules and 250 tons of limestone boulders within the Palm Beach County Jupiter Inlet Site C permitted (SAJ-2006-7012 (IP-JWH) valid until February 14, 2018. The Palm Beach County Jupiter Inlet Site C permitted area is a rectangular permitted zone measuring 0.77 nautical mile wide and 0.93 nautical miles long, encompassing approximately 0.75 square nautical mile of area in federal and state waters off Palm Beach County. The permitted site is located approximately 0.5 nautical miles on a bearing of 45 from Jupiter Inlet, Florida. Post deployment surveys confirmed sand substrate with no exposed hardbottom or submerged aquatic vegetation within the project boundaries.

Three different modules were used to create 25 patch reefs, each patch reef consisting of approximately four modules placed in the shape of a diamond. The patch reefs are generally oriented as two columns running northwest to southeast for approximately 750 feet within the permit boundaries. The 250 tons of limestone boulders mark the furthest northwest deployment. One type of structure was a prefabricated module called a “Florida Limestone Artificial Reef”. The “Florida Limestone” Artificial Reef module is a concrete tetrahedron module measuring 8 ft. tall and 10 ft. wide at the base, with three 12 inch by 18 inch rectangular openings through each of three upright limestone studded concrete sides designed by Walter Marine of Orange Beach, Alabama and constructed locally by McCulley Marine of Ft Pierce, Florida. This module alone weighs approximately 6,000 lbs. There were 50 of these units deployed. The second type of module deployed was a prefabricated module called a “Coral Head”. These modules were constructed using thick mesh metal sheets, bent and oriented into horizontal and cylindrical shapes similar to sponges and coral and then covering the sheets with sprayed gunite (shotcrete) concrete. These modules measure approximately 8 ft. tall by 10 ft. wide at the base, with vertical

and horizontal openings and ledge space throughout the structure. There were 30 of these units deployed. The third type of structure was constructed with the assistance of volunteer boy scouts which consisted of stacking and cementing cinder blocks to form modules structures measuring approximately 6 ft. tall by 10 ft. wide at the base. All 20 of these cinder block modules were different shapes and complexity with a singular steel reinforced column placed in the middle for lifting with a crane during deployment.

There was total of three deployment days for this project August 8, August 9, and August 11, 2016. All deployments were performed by the subcontractor McCulley Marine. McCulley Marine utilized a unique mooring technique for all deployments in order to assure high accuracy of placement of reef materials. The total cost for this project was $156,977. The Palm Beach County contributed a total of $96,977.00, the state share was $20,000.00, and the federal grant funds expended were: $40,000.00.

Sarasota County (Central Florida, Gulf of Mexico)

The Reef Ball Foundation deployed 51 prefabricated reef modules at a single location (82 48.112' W, 27 12.520 N) within the Sarasota County M-8 permitted site (SAJ-1994-2027). The Sarasota County M-8 permitted site is located approximately 13.9 nautical miles on a bearing of 252° from New Pass in federals waters on Florida's Gulf coast. The total reported tonnage for this deployment was 126 tons based on known weight of individual modules. The prefabricated reef modules for this project were manufactured by the Reef Innovations. Two types of modules were deployed for this project Goliath Ball (50) and Pallet Ball (1) forms.

All reef material for this project was deployed on November 23, 2016. Deployment operations were performed by the subcontractor Florida Dredge and Dock, LLC out of Tarpon Springs Florida. Deployment operations were observed and coordinated by Reef Innovations and Sarasota County. The total cost for this project was $60,000.00. The state share of this project was $60,000.00 with no federal funds or local match.

St. Lucie County (Central Florida, Atlantic Ocean)

St. Lucie County deployed 1,550 tons of clean concrete culverts, concrete railroad ties, concrete light poles, concrete storm water basins and other concrete construction materials at a single location (27 31.790' N, 80 10.652' W) within the St. Lucie County North Nearshore permitted (SAJ-2008-3568 (IP-GGL)). The St. Lucie County North Nearshore permitted area is a square permitted zone measuring one nautical mile on a side, encompassing approximately one square nautical mile of area in federal waters off St. Lucie County. The permitted site is located approximately 5.6 nautical miles on a bearing of 61º from Ft. Pierce Inlet, Florida. Post deployment surveys confirmed a continuous and compact patch reef with a relief of 19 feet at a depth of 57 feet within the permit area boundaries. There was total of three deployments for this project July 13, July 15, and July 20, 2016. All deployments were performed by the subcontractor McCulley Marine. McCully Marine utilized mooring technique for all deployments in order to assure accuracy of placement of reef materials. No issues were reported in the deployment operations. The total cost for this project was $65,500.00. The St. Lucie County contributed a total of $5,502.00, the state share was $19,998.00, and the federal grant funds expended were: $40,000.00.

Volusia County (Central Florida, Atlantic Ocean)

Between August 22nd and September 21st, 2016, Volusia County, deployed seven patch reefs each consisting of 400 tons of clean secondary-use concrete barriers, for a total deployment weight of 3,310 tons. Three of the seven patch reefs were deployed in Sunglow permitted area and the remaining patch reefs in Flagler permitted area (SAJ-2014-0037 SP-TSD). The patch reefs were spaced 250-400 ft. apart with a vertical profile of 20 ft., and depth ranging between 38 to 50 ft.

The total cost for the project was $159,960. Volusia County contributed $99,960, the state share was $60,000.

Completed or Ongoing State Funded Artificial Reef Monitoring Projects During 2016

Martin County Fish and Benthic Monitoring (Southeast Florida, Atlantic Ocean)

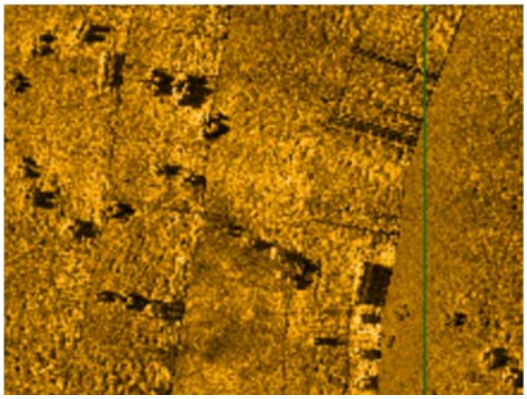
Martin County, was contracted to perform fish and benthic surveys as well as collect multibeam imagery at two permitted reef sites (Donaldson Reef and South County Reef) out of the St. Lucie Inlet in order to compare fish and benthic communities associated with two artificial reef sites in Martin County ranging in age from two years to eight years. This study will compare fish communities at reef locations in permit sites designated for fisheries habitat enhancement and general recreation (.i.e angler, scuba). Fish censuses for this study include identification of trophic guilds and size classes to describe utilization by fishes, and are being conducted using the Reef fish Visual Census (RVC) method for comparison to the multi-year RVC database in Martin County.

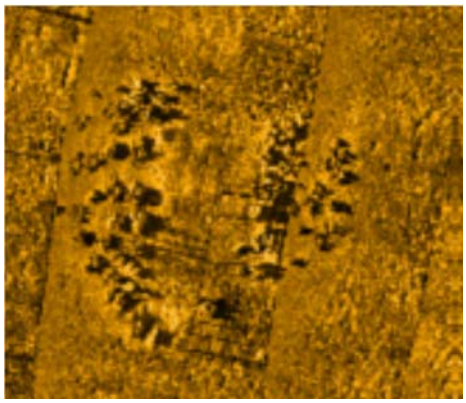
Assessment of Natural and Artificial Reefs off Palm Beach County, Palm Beach County Reef Research Team (Southeast Florida, Atlantic Ocean)

A non-profit group, The Palm Beach County Reef Research Team, was contracted to perform fish monitoring and mapping dives on 21 artificial and natural reefs during 2016 to continue a 20 year long-term reef monitoring effort off of Palm Beach County. The main objective for this research project was to assess and compare fish and benthic assemblages on both artificial reefs of differing structural makeup and adjacent natural reefs. As of January 2017, The Reef Research Team has finished the dives associated with this project and will be submitting a final report summarizing their findings early this summer. A total of 145 species of fish representing 44 families were recorded during the 26 point count surveys in 2015. Overall, in comparing substrate types among the artificial reef sites, combination sites (i.e. reef sites with both natural hard bottom and artificial reef structures) had the highest averages for species and family counts and numbers of individuals; these averages were all greater than those of the natural reefs.

Sarasota Bay Estuary Program Assessment of Fish Assemblages on Intercostal Reef Modules and Surrounding Habitats (Central Florida, Gulf of Mexico)

A non-profit group, The Sarasota Bay Estuary Program, was contracted to survey three artificial reef permitted sites within Sarasota Bay (Hart's Family Reef, Walker's Reef, and Sportfish Angler's Club Reef) using sidescan sonar imagery and conduct fish census surveys using baited underwater cameras in order to better characterize fish species utilization of inshore artificial reef modules. The SBEP has subcontracted the sidescan and BRUV surveys to CB&I. As of January 2017, a sidescan survey has been completed and BRUV monitoring is scheduled to begin this summer.





Assessment of User Activities on Artificial Reefs and Natural Reefs off Pinellas County, University of South Florida (Central Florida Gulf Coast).

FWC contracted with the University of South Florida to engage in a project utilizing passive acoustic listening devices to assess boating activity over and immediately adjacent to three artificial reef sites and their paired natural reef sites. The final report from the acoustic dataset indicated that the artificial reef sites are receiving significantly higher boating visitation activity than the paired natural reef sites.

Targeted Lionfish Removals on Northern Gulf of Mexico Artificial Reefs, University of West Florida (Northwest Florida)

The University of West Florida (UWF) was funded by FWC to conduct a two-year study starting in 2014 to examine the effectiveness and ecological benefits of targeted lionfish removals at experimental Escambia East-Large Area Artificial Reef Site (EE-LAARS) artificial reefs (n = 27; varying module designs) off northwest Florida, where lionfish had achieved densities among the highest in the western Atlantic by 2013. The EE-LAARS reef sites were original deployed by FWC in 2003 with the intent to use the reefs as research sites to monitor artificial reef fish communities. Subsequently, the exact coordinates of these sites were not distributed. All lionfish were removed from 17 of the selected sample sites via spearfishing from in December 2013, with nine of the sites being periodically cleared of lionfish through May 2015. The remaining 10 sites

served as un-cleared controls. Both juvenile and adult lionfish quickly recruited to cleared reefs, with lionfish reaching pre-clearance densities in less than a year on reefs that were cleared only once. Lionfish removal treatment and sample timing significantly affected reef fish community structure at experimental reefs, but lionfish removal was insufficient to achieve substantial gains for most fish species, and declines in several species were observed throughout the study regardless of treatment.

Oriskany Reef Fish PCB monitoring, Escambia County and FWC (Northwest Florida)

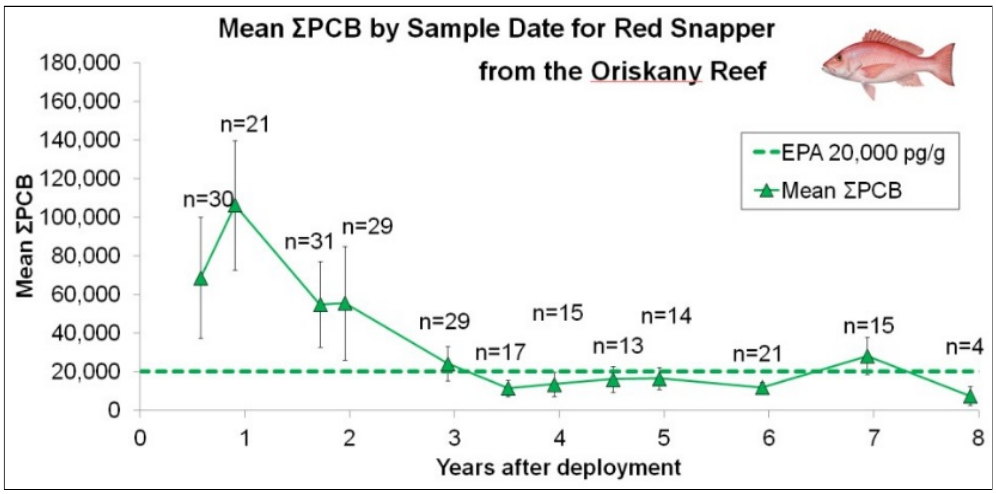
The FWC and Escambia County continued sampling legal-size recreationally targeted reef fish (red snapper, gray triggerfish, red and whitebone porgy, vermilion snapper, gag, red, and scamp grouper) for polychlorinated biphenyl (PCB) analysis (using skin-on lateral muscle tissue fillets) in compliance with requirements of the EPA risk-based PCB disposal permit for the ex-U.S.S. Oriskany (CVA-34), sunk as an artificial reef in 212 feet of water 22.5 nautical miles off Pensacola Pass on May 17, 2006. Between Dec. 14, 2006, and April 24, 2015, 13 reef fish sample collection events were completed, nine during the spring and four during late fall/winter. A total of 438 reef fish collected on the Oriskany have been retained for PCB sampling from December 2006 through April 2015. Collected species include nine reef fish species: 241 red snapper, 102 vermilion snapper, 30 red porgy, 24 whitebone porgy, 16 scamp grouper, 11 bank sea bass, seven gag grouper, four red grouper, and three gray triggerfish.

Of the nine fish species retained for analysis, only Red Snapper and Vermilion Snapper were caught with typically at least 11 or more legal-size fish per sample event (even though at least 15 were targeted). For Red Snapper, initially the mean total PCB level within the first three years had values exceeding the EPA screening value of 20 ppb, but by sample round 6, collected at 3.5 years, the mean total PCB level decreased to below the EPA screening value and remained low through sample round 10 at 5.9 years, but increased to 28 ppb during round 11, 6.9 years after sinking, and then dropped to 7 ppb. For Vermilion Snapper, mean total PCB levels were consistently below 20 ppb. For the other six species, mean total PCB levels exceeded 20 ppb for some samples, but the number of fish caught were below the minimum 15 fish required for human health risk assessment. The highest recorded total PCB concentrations for any of the individual 412 Oriskany Reef PCB sampled fish were from red porgy (1,654.7 ppb) during sampling round four and 1,222.7 ppb in sampling round eight). These individual Oriskany Reef fish had total PCB levels 24 to 33 times higher than the FDOH screening level. Only five legal size piscivorous grouper (scamp) were available for capture at the Oriskany Reef with two of three captured in sampling round eight exceeding the FDOH screening threshold (highest concentrations 208.7 ppb and 94.1 ppb respectively), and one captured in sampling round eight exceeding the FDOH screening threshold (292 ppb).

The downward trends of red snapper mean total PCB levels to below screening levels and the consistently low vermilion snapper mean PCB levels did not result in fish consumption advisory actions. The remaining analyzed species (triggerfish, groupers, porgy) represent too few specimens sampled with too great a PCB variability among individuals of the same species to take any species specific fish consumption advisory action, but due to elevated levels observed in

scamp grouper and bank seabass, Escambia County requested a toxicology consult from the Florida Department of Health and on June 27, 2016, the FDOH issued the following consumption "guidelines" (The Department of Health does not offer advisories for fish species caught outside of state waters): Bank Seabass – two meals per week; Scamp Grouper – one meal per week.

Oriskany Reef sampling and monitoring will continue until directed otherwise by EPA Region 4. The next sampling event is scheduled to place in April 2017.



June 27, 2016

Mr. Robert Turpin
Marine Resources Division Programs, Escambia County
3363 West Park Place
Pensacola, Florida 32505

Dear Mr. Turpin:

PURPOSE

This letter serves as a toxicology consult for the Escambia county Marine Resources Division Programs (MRDP) from the Florida Department of Health (Department), Public Health Toxicology Section. The MRDP is tasked with monitoring reef fish for polychlorinated biphenyls (PCBs) at the Oriskany reef. The reef was created by the sinking of the Navy ship in May 2006, in federal waters, 22.5 nautical miles southeast of Pensacola Pass. One of the concerns for MRDP is whether fish from the Oriskany reef are safe to eat. Fish sampling data for the Oriskany reef gathered in April 2015 were forwarded to the Department for review to recommend consumption advisories for fish harvested at the reef.

METHODS

The Department based recommended advisory levels on scamp grouper (OR-SG) and seabass (OR-BSB) fish tissue samples provided by MRDP. The advisories pertain to these species only. The Department prefers to base advisories on a sample number (n) of eight fish tissue samples or more. However, because of the difficulty in obtaining samples, the threshold number was reduced to as low as six samples (n = 6). Fish species that had fewer than six samples were not included.

Fish tissues were analyzed for individual polychlorinated biphenyls including all 209 congeners. Total PCBs were provided with the data and averages for OR-SG and OR-BSB were used for this consultation.

The Department's health advisories for consuming an eight ounce fish meal contaminated by PCBs is as follows and is based upon the mean total PCB concentration (in parts per billion, ppb):

<50 ppb	two meals per week
50-100 ppb	one meal per week
110-500 ppb	one meal per month
>500 ppb	DO NOT EAT

FINDINGS

The contaminant levels varied between the two species analyzed. OR-BSB (n = 7, average = 26 ppb) was found to be lower in total PCBs than OR-SG (n = 6, average = 178 ppb).

RECOMMENDATIONS

The Department does not offer advisories for fish species caught outside of state waters. However, the following information is provided as guideline recommendations for the two species analyzed:

Seabass (OR-BSB) - two meals per week
Scamp grouper (OR-SG) - one meal per month

The Department recommends eating a variety of foods in one's diet. According to USDA's "Choose My Plate" program, proteins should be varied each day. The U.S. Food and Drug Administration recommends pregnant women consume 2-3 meals of a variety of fish each week, lower in mercury, to support fetal growth and development. Women of child bearing age and young children should choose this variety of fish from sources without known contamination, including PCBs. This consult shows that other individuals can consume up to two meals per week of Seabass (our highest fish consumption recommendation) and one meal per month of Scamp Grouper from this site.

Sincerely,

Kendra F. Goff, PhD, DABT, CPM
State Toxicologist & Chief
Bureau of Environmental Health

Joseph Mark Higginbotham PhD, MS
Deputy State Toxicologist
Bureau of Environmental Health

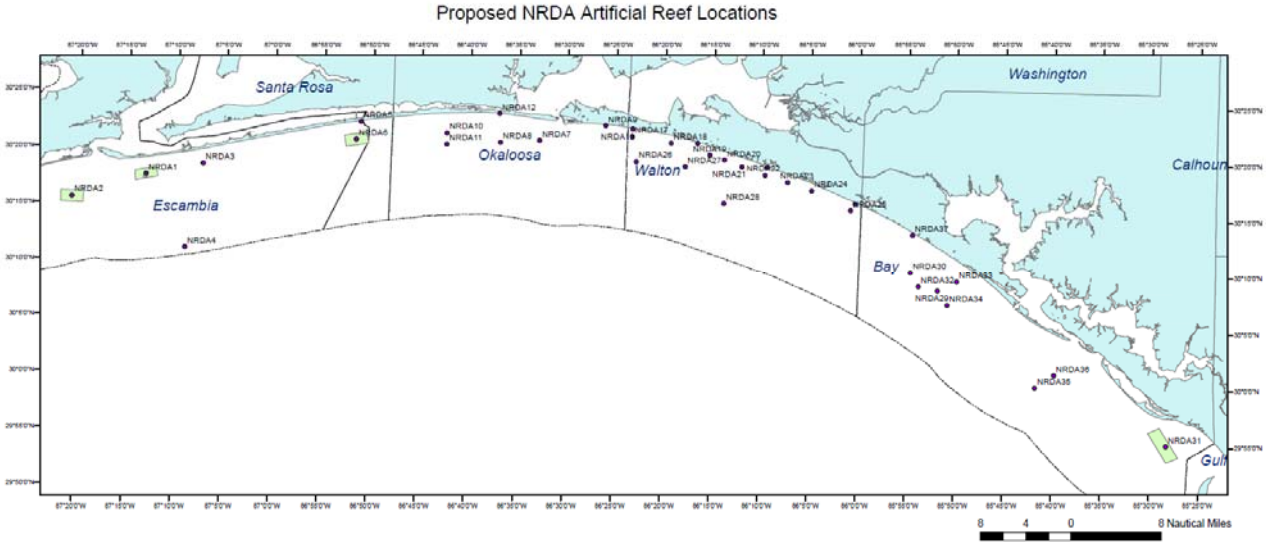
KFG/JMH

cc: Dr. John Lanza, FDOH-Escambia County
Mr. Robert Merritt, FDOH-Escambia County
Mr. Chips Kirschenfeld, Marine Resources Division Programs

Other Program Updates

Natural Resource Damage Assessment (NRDA)

A northwest Florida regional artificial reef project involving Escambia, Santa Rosa, Walton, Okaloosa and Bay Counties and the city of Mexico Beach was moved from NRDA Phase II to designation as one of 28 Florida NRDA phase III projects with a project cost of 11.4 million dollars. Further project planning continued during 2014-2015 where FWC Artificial Reef Program Staff coordinated with Trustees on development of a project Biological Assessment and Environmental Impact Statement. The Trustees approved the Deepwater Horizon Oil Spill Programmatic and Phase III Early Restoration Plan and Early Restoration Programmatic Environmental Impact Statement ("Phase III Plan") on October 2, 2014 and on February 26, 2015 a Memorandum of Understanding was executed between the Florida Department of Environmental Protection and FWC to implement the specified NRDA Phase III early restoration projects. The February 26, 2015 MOU included the stipulations for the $11.4M Florida NRDA Artificial Reef Project and allowed for funds to be released from FDEP to FWC. In accordance with the MOU, during May 2015, the FWC Artificial Reef Program Administrator hired a full-time Fishery Biologist, Alex Fogg to provide contract management oversight of the FWC NRDA Artificial Reef Project. Six construction agreements were executed with Escambia County, Santa Rosa County, Walton County, Okaloosa County, Bay County, and the City of Mexico Beach, by January 31, 2016, all grants were executed. Construction commenced in September 2016 off Mexico Beach and is anticipated to continue through early 2018.



Florida's 2016 Artificial Reef Deployments
(January 1 - December 31 2016)

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Count	DeployID	County	DeployDate	Deployment Name	Primary Material	Tons	Relief	Depth	Lat (DM)	Long (DM)
1	ES0048	Escambia	01/13/2016	Tug Ocean Wind	Tugboat 87'	141	31	83	30° 10.995' N	87° 12.017' W
2	DA0218	Miami-Dade	01/27/2016	Venetian Demo	Bridge Rubble	7,000	14	26	25° 48.784' N	80° 10.228' W
3	TA0036	Taylor	02/21/2016	SFMA-Public Reef #13	Lindberg Cube (35)	35	3	37	29° 39.615' N	83° 45.107' W
4	TA0037	Taylor	02/21/2016	SFMA-Public Reef #14	Lindberg Cube (36)	36	3	37	29° 39.239' N	83° 45.145' W
5	TA0038	Taylor	02/21/2016	SFMA-Public Reef #11	Lindberg Cube (48)	48	3	39	29° 39.166' N	83° 45.522' W
6	TA0039	Taylor	02/21/2016	SFMA-Public Reef #10	Lindberg Cube (48)	48	3	38	29° 38.741' N	83° 45.613' W
7	TA0040	Taylor	02/21/2016	SFMA-Public Reef #12	Lindberg Cube (48)	48	3	40	29° 38.541' N	83° 44.984' W
8	TA0041	Taylor	02/21/2016	SFMA-Public Reef #15	Lindberg Cube (36)	36	3	40	29° 38.325' N	83° 45.318' W
9	TA0042	Taylor	02/21/2016	SFMA-Public Reef #9	Lindberg Cube (48)	48	3	40	29° 38.316' N	83° 45.707' W
10	DA0215	Miami-Dade	02/22/2016	Eternal Reef #21	Reef Ball Bay (5)	1	3	44	25° 57.768' N	80° 5.899' W
11	CO0116	Collier	05/02/2016	Tod Sirod Reef - I	Walter Marine Florida Limestone Reef (34)	102	8	40	26° 7.825' N	82° 2.265' W
12	BA0045	Bay	05/09/2016	MB-182 Unnamed	Walter Marine Florida Limestone Reef (4)	19	8	94	29° 47.009' N	85° 41.952' W
13	BA0048	Bay	05/09/2016	MB-183 Unnamed	Walter Marine Florida Limestone Reef (4)	19	8	96	29° 46.859' N	85° 42.507' W
14	BA0049	Bay	05/09/2016	MB-184 Unnamed	Walter Marine Florida Limestone Reef (4)	19	8	95	29° 46.861' N	85° 41.791' W
15	BA0051	Bay	05/09/2016	MB-185 Unnamed	Walter Marine Florida Limestone Reef (2)	10	8	95	29° 46.606' N	85° 41.686' W
16	BA0052	Bay	05/09/2016	MB-189 Unnamed	Walter Marine Florida Limestone Reef (2)	10	8	98	29° 43.488' N	85° 40.747' W
17	BA0053	Bay	05/09/2016	MB-190 Unnamed	Walter Marine Florida Limestone Reef (2)	10	8	95	29° 43.818' N	85° 40.946' W
18	BA0091	Bay	05/09/2016	MB-187 Unnamed	Walter Marine Florida Limestone Reef (4)	16	8	102	29° 44.937' N	85° 42.413' W
19	BA0094	Bay	05/09/2016	MB-188 Unnamed	Walter Marine Florida Limestone Reef (5)	19	8	103	29° 44.275' N	85° 42.418' W
20	BA0060	Bay	05/10/2016	Breen Memorial Reef	Walter Marine Florida Limestone Reef (1)	7	8	66	29° 44.160' N	85° 29.334' W
21	BA0088	Bay	05/10/2016	Kerns Memorial Reef	Walter Marine Florida Limestone Reef (1)	7	8	77	29° 55.458' N	85° 32.683' W
22	BA0090	Bay	05/10/2016	Barrow Memorial Reef	Walter Marine Florida Limestone Reef (1)	7	8	58	29° 54.909' N	85° 36.110' W
23	BA0095	Bay	05/10/2016	Hoptop Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	60	29° 54.554' N	85° 32.372' W
24	BA0152	Bay	05/10/2016	Swiger Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	77	29° 54.912' N	85° 35.940' W
25	BA0165	Bay	05/10/2016	Lawrence W. Cox Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	22	29° 54.275' N	85° 27.697' W
26	BA0219	Bay	05/10/2016	Golden Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	21	29° 56.021' N	85° 29.311' W
27	BA0246	Bay	05/10/2016	John Thompson Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	22	29° 54.173' N	85° 27.977' W
28	BA0325	Bay	05/10/2016	Bayou Bash Reef	Walter Marine Florida Special (1)	3	10	63	29° 54.386' N	85° 32.404' W
29	BA0327	Bay	05/10/2016	MB-149 Unnamed	Walter Marine Florida Limestone Reef (1)	4	8	84	29° 46.359' N	85° 36.160' W
30	BA0326	Bay	05/12/2016	MB-186 Steel Cable Reels	Cable Reel 30' X 14' X 16' (2)	54	14	64	29° 54.809' N	85° 32.859' W
31	BA0016	Bay	05/14/2016	BC2015-Set#17	Walter Marine Super Reef w/ Ecosystem (1)	19	17.5	74	30° 10.196' N	85° 54.607' W
32	BA0017	Bay	05/14/2016	BC2015-Set#18	Walter Marine Super Reef w/ Ecosystem (1)	19	17.5	75	30° 10.179' N	85° 54.567' W
33	BA0018	Bay	05/14/2016	BC2015-Set#19	Walter Marine Super Reef w/ Ecosystem (1)	19	17.5	75	30° 10.176' N	85° 54.603' W
34	BA0019	Bay	05/14/2016	BC2015-Set#20	Walter Marine Super Reef w/ Ecosystem (1)	19	17.5	73	30° 10.153' N	85° 54.594' W
35	BA0043	Bay	05/14/2016	BC2015-Set#21	Walter Marine Super Reef w/ Ecosystem (1)	19	17.5	73	30° 10.153' N	85° 54.602' W
36	DA0217	Miami-Dade	06/13/2016	Eternal Reef #22	Reef Ball Bay (8)	5	4	43	25° 57.774' N	80° 5.895' W
37	PB0093	Palm Beach	07/13/2016	Ana Cecilia	Cargo Ship 170'	540	31	87	26° 47.058' N	80° 0.096' W
38	SL0051	St. Lucie	07/15/2016	2016 North County Nearshore	Culverts	1,550	19	57	27° 31.790' N	80° 10.652' W
39	BO0114	Broward	07/23/2016	Lady Luck	Steel Tanker 324'	2,557	70	130	26° 13.807' N	80° 3.807' W
40	FR0063	Franklin	07/28/2016	CCA Billy's Barge Memorial Reef	Barge 100'	113	8	52	29° 39.660' N	84° 30.014' W
41	MI0104	Martin	07/28/2016	13 South County	Pilling, Culverts, Barriers (193)	500	13	73	27° 5.793' N	80° 1.873' W
42	FR0039	Franklin	07/29/2016	Robby's Reef 2016 Addition	Concrete Boxes and Culverts (4)	18	4	52	29° 39.595' N	84° 29.977' W
43	FR0064	Franklin	07/29/2016	Price's Point Memorial Reef	Walter Marine Florida Limestone Reef (16)	48	10	35	29° 47.101' N	84° 27.995' W
44	MI0110	Martin	07/30/2016	Site 3 Sirotkin	Boxes, Slabs, and Barricades (179)	500	10	86	27° 12.265' N	80° 2.320' W
45	MI0105	Martin	08/02/2016	14 South County	Culverts (240)	500	11	65	27° 5.784' N	80° 2.158' W
46	MI0107	Martin	08/05/2016	15 South County	Culverts (203)	495	14	75	27° 5.881' N	80° 1.868' W
47	PB0092	Palm Beach	08/09/2016	Andrew Harris No Shoes Reef	Walter Marine Florida Limestone Reef (50)	650	8	55	26° 57.702' N	80° 3.216' W
48	MI0106	Martin	08/10/2016	16 South County	Culverts (277)	400	12	70	27° 5.883' N	80° 2.152' W
49	PB0094	Palm Beach	08/11/2016	Andrea's Reef	Mermaid and Sealife (Turtle, Ray etc.) Sculpture (5)	20	3	78	26° 47.600' N	80° 1.081' W

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50	MI0109	Martin	08/12/2016	Site 2 Sirotkin	Power Poles (112)	400	9	85	27° 12.321' N	80° 2.333' W
51	ME0088	Manatee	08/14/2016	Whale Key 4	Reef Ball Juvenile Log Habitat (5)	6	2.5	10	27° 23.489' N	82° 36.254' W
52	MI0108	Martin	08/16/2016	Site 1 Sirotkin	Poles (174)	400	7	90	27° 12.377' N	80° 2.350' W
53	CO0117	Collier	08/18/2016	Jackson Fish Camp Memorial Reef	Walter Marine Florida Limestone Reef (34)	102	10	43	26° 3.684' N	82° 3.425' W
54	VO0046	Volusia	08/22/2016	Sunglow W	Barriers	410	7	46	29° 9.133' N	80° 57.387' W
55	DA0222	Miami-Dade	08/24/2016	2016 Anchorage Connection Reef C	Limestone Boulders	240	10	50	25° 48.673' N	80° 5.423' W
56	DA0221	Miami-Dade	08/26/2016	2016 Anchorage Connection Reef B	Limestone Boulders	240	10	50	25° 48.691' N	80° 5.426' W
57	DA0223	Miami-Dade	09/07/2016	2016 Anchorage Connection Reef D	Limestone Boulders	240	12	50	25° 48.676' N	80° 5.439' W
58	VO0047	Volusia	09/08/2016	Sunglow N	Barriers	815	6	48	29° 9.300' N	80° 57.334' W
59	VO0049	Volusia	09/10/2016	Sunglow NE	Barriers	410	7	50	29° 9.355' N	80° 57.227' W
60	VO0050	Volusia	09/11/2016	Flagler S	Barriers	425	8	40	29° 2.479' N	80° 52.874' W
61	DA0220	Miami-Dade	09/12/2016	2016 Anchorage Connection Reef A	Limestone Boulders	210	9	50	25° 48.695' N	80° 5.448' W
62	ME0089	Manatee	09/14/2016	Bayshore North 3	Reef Ball Juvenile Log Habitat (10)	5	2.5	10	27° 24.503' N	82° 36.123' W
63	ME0090	Manatee	09/14/2016	Bayshore South 2	Reef Ball Juvenile Log Habitat (10)	3	2.5	11	27° 23.871' N	82° 35.619' W
64	ME0091	Manatee	09/14/2016	Bayshore South 1	Reef Ball Juvenile Log Habitat (5)	3	2.5	11	27° 23.941' N	82° 35.633' W
65	ME0092	Manatee	09/14/2016	Whale Key 5	Reef Ball Juvenile Log Habitat (5)	3	2.5	10	27° 23.502' N	82° 36.251' W
66	BA0328	Bay	09/15/2016	MB-191 John W. Grimsom Memorial Reef	Walter Marine Florida Limestone Reef (1)	5	8	55	29° 54.784' N	85° 31.889' W
67	BA0329	Bay	09/15/2016	MB-195 Unnamed	Walter Marine Florida Limestone Reef (15)	28	8	20	29° 55.089' N	85° 28.294' W
68	BA0330	Bay	09/15/2016	MB-196 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	21	29° 54.891' N	85° 28.161' W
69	BA0331	Bay	09/15/2016	MB-197 Unnamed	Walter Marine Florida Limestone Reef (15)	38	8	21	29° 54.696' N	85° 28.014' W
70	BA0334	Bay	09/15/2016	MB-193 Unnamed	Walter Marine Florida Limestone Reef (5)	85	18	67	29° 55.066' N	85° 34.134' W
71	BA0332	Bay	09/17/2016	MB-192 Unnamed	Walter Marine Super Reef (2)	36	18	62	29° 55.052' N	85° 32.974' W
72	BA0333	Bay	09/17/2016	MB-194 Unnamed	Walter Marine Florida Limestone Reef (5)	85	18	72	29° 55.088' N	85° 35.253' W
73	ES0051	Escambia	09/18/2016	Unnamed Site 1 Casino Reef	Reef Ball (3)	7	6	56	30° 18.749' N	87° 7.285' W
74	ES0052	Escambia	09/18/2016	Unnamed Site 2 Casino Reef	Reef Ball (4)	9	6	56	30° 18.768' N	87° 7.280' W
75	ES0098	Escambia	09/18/2016	Unnamed Site 3 Casino Reef	Reef Ball (3)	7	6	56	30° 18.798' N	87° 7.253' W
76	VO0051	Volusia	09/19/2016	Flagler Center	Barriers	400	8	40	29° 2.553' N	80° 52.927' W
77	BA0335	Bay	09/20/2016	MB-198 Unnamed	Cable Reels 28' X 28' X 18' (3)	162	28	75	29° 54.922' N	85° 36.338' W
78	BA0336	Bay	09/20/2016	MB-199 Unnamed	Cable Reels 22' X 22' X 19' (3)	162	22	77	29° 55.082' N	85° 40.755' W
79	VO0045	Volusia	09/20/2016	Flagler SSW	Barriers	435	7	38	29° 2.515' N	80° 53.004' W
80	VO0052	Volusia	09/21/2016	Flagler NNW	Barriers	415	7	38	29° 2.585' N	80° 53.012' W
81	BO0115	Broward	09/28/2016	Mt. Deerfield II	Limestone Boulders	510	15	67	26° 19.065' N	80° 3.720' W
82	ES0192	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Ecosystem on Pedestal (1)	3	4	40	30° 15.980' N	87° 19.911' W
83	ES0193	Escambia	09/29/2016	Unnamed Memorial Reef	Walter Marine Florida Limestone Reef (1)	3	8	45	30° 17.798' N	87° 13.990' W
84	ES0194	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Ecosystem on Pedestal (1)	3	4	40	30° 15.506' N	87° 20.207' W
85	ES0195	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Ecosystem on Pedestal (1)	3	4	40	30° 15.149' N	87° 21.680' W
86	ES0196	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Florida Limestone Reef (1)	2	6	40	30° 15.176' N	87° 20.670' W
87	ES0197	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Florida Limestone Reef (1)	2	6	40	30° 15.176' N	87° 20.670' W
88	ES0198	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Florida Limestone Reef (1)	2	6	40	30° 15.510' N	87° 21.274' W
89	ES0199	Escambia	09/29/2016	Escambia Nearshore East Unnamed	Walter Marine Florida Limestone Reef (1)	2	6	40	30° 15.993' N	87° 20.844' W
90	BA0369	Bay	10/14/2016	MB-203 Unnamed	Walter Marine Florida Limestone Reef (7)	18	8	20	29° 54.775' N	85° 27.741' W
91	BA0370	Bay	10/14/2016	MB-205 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	22	29° 54.865' N	85° 27.475' W
92	BA0371	Bay	10/14/2016	MB-8 Mexico Beach CDC Reef	Walter Marine Florida Limestone Reef (2)	5	8	22	29° 54.474' N	85° 27.836' W
93	BA0372	Bay	10/14/2016	MB-206 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	20	29° 54.566' N	85° 27.592' W
94	BA0373	Bay	10/14/2016	MB-204 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	28	29° 54.664' N	85° 27.330' W
95	BA0374	Bay	10/14/2016	MB-207 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	20	29° 54.368' N	85° 27.444' W
96	BA0375	Bay	10/14/2016	MB-208 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	20	29° 54.468' N	85° 27.178' W
97	BA0376	Bay	10/14/2016	MB-202 Unnamed	Walter Marine Super Reef (2)	36	18	76	29° 55.085' N	85° 36.315' W
98	BA0377	Bay	10/14/2016	MB-200 Unnamed	Walter Marine Super Reef (4)	85	18	80	29° 55.082' N	85° 38.594' W

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99	BA0378	Bay	10/14/2016	MB-201 Unnamed	Walter Marine Super Reef (4)	87	18	81	29° 55.088' N	85° 39.650' W
100	BA0351	Bay	11/10/2016	MB-15 Billie & Jack Smith Reef	Walter Marine Florida Limestone Reef (5)	13	8	24	29° 54.798' N	85° 28.701' W
101	BA0352	Bay	11/10/2016	MB-219 Unnamed	Walter Marine Florida Limestone Reef (7)	18	8	23	29° 54.976' N	85° 28.556' W
102	BA0353	Bay	11/10/2016	MB-13 Mike Trombley Reef	Walter Marine Florida Limestone Reef (4)	10	8	24	29° 54.701' N	85° 28.543' W
103	BA0354	Bay	11/10/2016	MB-14 Karl Sinclair Franz Memorial Reef	Walter Marine Florida Limestone Reef (8)	20	8	25	29° 54.466' N	85° 28.463' W
104	BA0355	Bay	11/10/2016	MB-220 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	25	29° 54.202' N	85° 28.320' W
105	BA0356	Bay	11/10/2016	MB-221 Unnamed	Walter Marine Florida Limestone Reef (6)	15	8	23	29° 54.364' N	85° 28.106' W
106	BA0357	Bay	11/10/2016	MB-8 Mexico Beach CDC Reef	Walter Marine Florida Limestone Reef (2)	5	8	21	29° 54.474' N	85° 27.836' W
107	BA0358	Bay	11/10/2016	MB-222 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	25	29° 53.994' N	85° 28.173' W
108	BA0359	Bay	11/10/2016	MB-140 John & Darlene Cox Family Memorial Reef	Walter Marine Florida Limestone Reef (4)	10	8	22	29° 54.275' N	85° 27.696' W
109	BA0360	Bay	11/10/2016	MB-223 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	25	29° 53.858' N	85° 28.074' W
110	BA0361	Bay	11/10/2016	MB-12 Capt. Tom Hudson Memorial Reef	Walter Marine Florida Limestone Reef (5)	13	8	22	29° 54.109' N	85° 27.592' W
111	BA0362	Bay	11/10/2016	MB-170 Billy Gillen Memorial Reef	Walter Marine Florida Limestone Reef (4)	10	8	21	29° 54.137' N	85° 27.333' W
112	BA0339	Bay	11/11/2016	MB-211 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	20	29° 56.304' N	85° 29.196' W
113	BA0340	Bay	11/11/2016	MB-212 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	24	29° 55.898' N	85° 29.572' W
114	BA0341	Bay	11/11/2016	MB-177 Micheal Golden Memorial Reef	Walter Marine Florida Limestone Reef (6)	15	8	21	29° 56.014' N	85° 29.304' W
115	BA0342	Bay	11/11/2016	MB-213 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	24	29° 55.690' N	85° 29.423' W
116	BA0363	Bay	11/11/2016	MB-171 Jimmy Stephens Family Memorial Reef	Walter Marine Florida Limestone Reef (3)	8	8	20	29° 56.573' N	85° 29.224' W
117	BA0364	Bay	11/11/2016	MB-209 Unnamed	Walter Marine Florida Limestone Reef (6)	15	8	24	29° 56.109' N	85° 29.719' W
118	BA0365	Bay	11/11/2016	MB-192 Unnamed	Walter Marine Florida Limestone Reef (10)	25	8	64	29° 55.052' N	85° 32.974' W
119	BA0366	Bay	11/11/2016	MB-202 Unnamed	Walter Marine Florida Limestone Reef (10)	25	8	76	29° 55.085' N	85° 36.315' W
120	BA0367	Bay	11/11/2016	MB-193 Unnamed	Walter Marine Ecosystem on Pedestal (2)	4	5	69	29° 55.066' N	85° 34.134' W
121	BA0368	Bay	11/11/2016	MB-194 Unnamed	Walter Marine Ecosystem on Pedestal (2)	4	5	73	29° 55.088' N	85° 35.253' W
122	BA0338	Bay	11/11/2016	MB-210 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	22	29° 56.205' N	85° 29.457' W
123	BA0343	Bay	11/12/2016	MB-214 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	21	29° 55.800' N	85° 29.164' W
124	BA0344	Bay	11/12/2016	MB-215 Unnamed	Walter Marine Florida Limestone Reef (10)	25	8	20	29° 55.895' N	85° 28.897' W
125	BA0345	Bay	11/12/2016	MB-10 Bill Cranford Reef	Walter Marine Florida Limestone Reef (5)	13	8	23	29° 55.589' N	85° 29.167' W
126	BA0346	Bay	11/12/2016	MB-216 Unnamed	Walter Marine Florida Limestone Reef (4)	10	8	20	29° 55.687' N	85° 28.747' W
127	BA0347	Bay	11/12/2016	MB-11 Unnamed	Walter Marine Florida Limestone Reef (5)	13	8	23	29° 55.352' N	85° 29.087' W
128	BA0348	Bay	11/12/2016	MB-217 Unnamed	Walter Marine Florida Limestone Reef (12)	30	8	20	29° 55.480' N	85° 28.597' W
129	BA0349	Bay	11/12/2016	MB-9 Gordy's Memorial Reef	Walter Marine Florida Limestone Reef (5)	13	8	23	29° 55.147' N	85° 28.812' W
130	BA0350	Bay	11/12/2016	MB-218 Unnamed	Walter Marine Florida Limestone Reef (8)	20	8	20	29° 55.280' N	85° 28.436' W
131	ST0087	Sarasota	11/23/2016	Fallen Heroes Reef 2016	Reef Ball Goliath (50)	126	5	60	27° 12.520' N	82° 48.112' W
132	DA0224	Miami-Dade	11/28/2016	Dock & Marine - 2016	Slabs (16'-8' X 3'-6' X 1'-3'), Pilings (16'-8' X 1' X 1'), F	48	7	24	25° 48.799' N	80° 10.049' W
133	WK0016	Wakulla	12/03/2016	St. Marks Reef B1	Bay Reef Ball (2)	1	3	21	30° 0.167' N	84° 9.152' W
134	WK0017	Wakulla	12/03/2016	St. Marks Reef D1	Lindberg Cube (4)	4	3	21	30° 0.173' N	84° 9.082' W
135	WK0055	Wakulla	12/03/2016	St. Marks Reef C2	Lindberg Cube (4)	4	3	21	30° 0.141' N	84° 9.115' W
136	WK0056	Wakulla	12/03/2016	St. Marks Reef E2	Lindberg Cube (4)	4	3	21	30° 0.148' N	84° 9.048' W
137	WK0057	Wakulla	12/03/2016	St. Marks Reef D3	Lindberg Cube (4)	4	3	21	30° 0.116' N	84° 9.083' W
138	WK0058	Wakulla	12/03/2016	St. Marks Reef A4	Lindberg Cube (4)	4	3	21	30° 0.098' N	84° 9.181' W
139	WK0059	Wakulla	12/03/2016	St. Marks Reef C4	Lindberg Cube (4)	4	3	21	30° 0.089' N	84° 9.116' W
140	WK0060	Wakulla	12/03/2016	St. Marks Reef B5	Lindberg Cube (4)	4	3	21	30° 0.069' N	84° 9.152' W
141	WK0061	Wakulla	12/03/2016	St. Marks Reef D5	Lindberg Cube (4)	4	3	21	30° 0.071' N	84° 9.088' W
142	WK0062	Wakulla	12/03/2016	St. Marks Reef A6	Lindberg Cube (4)	4	3	21	30° 0.043' N	84° 9.180' W
143	WK0063	Wakulla	12/03/2016	St. Marks Reef E6	Lindberg Cube w/ Topper (4)	4	3	21	30° 0.047' N	84° 9.052' W
144	WK0064	Wakulla	12/03/2016	St. Marks Reef A9	Lindberg Cube w/ Topper (4)	4	3	21	29° 59.978' N	84° 9.184' W
145	WK0065	Wakulla	12/03/2016	St. Marks Reef B8	Lindberg Cube w/ Topper (4)	4	3	21	30° 0.001' N	84° 9.167' W
146	WK0066	Wakulla	12/03/2016	St. Marks Reef E8	Lindberg Cube w/ Topper (4)	4	3	21	30° 0.005' N	84° 9.048' W
147	WK0067	Wakulla	12/03/2016	St. Marks Reef D8	Lindberg Cube w/ Topper (8)	8	3	21	30° 0.004' N	84° 9.086' W

Florida's 2016 Artificial Reef Deployments
(January 1 - December 31 2016)

Florida Fish and Wildlife Conservation Commission
Division of Marine Fisheries Management
Artificial Reef Program

Count	DeployID	County	DeployDate	Deployment Name	Primary Material	Tons	Relief	Depth	Lat (DM)	Long (DM)
148	WK0068	Wakulla	12/03/2016	St. Marks Reef E9	Reef Ball Ultra (4)	6	4	21	29° 59.975' N	84° 9.043' W
149	WK0069	Wakulla	12/03/2016	St. Marks Reef E10	Reef Ball Ultra Layer Cake (6)	10	4	21	29° 59.938' N	84° 9.050' W
150	WK0070	Wakulla	12/03/2016	St. Marks Reef E11	Reef Ball Ultra Layer Cake (6)	10	4	21	29° 59.916' N	84° 9.053' W
151	WK0071	Wakulla	12/03/2016	St. Marks Reef D10	Reef Ball Ultra Layer Cake (6)	10	4	21	29° 59.936' N	84° 9.086' W
152	WK0072	Wakulla	12/03/2016	St. Marks Reef C8	Lindberg Cube w/ Topper (4)	4	4	21	30° 0.005' N	84° 9.114' W
153	WK0073	Wakulla	12/03/2016	St. Marks Reef C10	Reef Ball Ultra (2)	3	4	21	29° 59.939' N	84° 9.122' W
154	WK0074	Wakulla	12/03/2016	St. Marks Reef D9	Reef Ball Ultra (2)	3	4	21	29° 59.971' N	84° 9.094' W
155	WK0075	Wakulla	12/03/2016	St. Marks Reef C11	Reef Ball Ultra (2)	4	4	21	29° 59.920' N	84° 9.117' W

JOINT GSMFC and ASMFC REEF SUBCOMMITTEES

TEXAS ARTIFICIAL REEF PROGRAM 2016 OVERVIEW

J. Dale Shively
TX Artificial Reef Program Leader

7-8 February 2017
Jacksonville, FL

This annual report highlights reefing operations and activities conducted by the Texas Artificial Reef Program (Program) from January 2016 to January 2017. The Program was formally established in 1990 and is self-funded through donations to the Rigs-to-Reefs program, private donations and grants. To date, there are 86 permitted reef sites with 1 additional site pending approval, enhancing over 7,000 acres of marine habitat. Reef sites range in size from 31 acres to 1,650 acres. The majority of reefs are part of the Rigs-to-Reefs program and are located in Federal waters (typically 40 acre sites).

Artificial Reef Sites in Texas Waters of the Gulf of Mexico		
Reef Type	**Number Permitted**	**Number Pending Approval**
Nearshore	11	0
Ships-to-Reefs	7	0
Rigs-to-Reefs	68	1
TOTAL	86	1

The Program is comprised of several subprograms which are discussed below.

1. RIGS-TO-REEFS (R2R) PROGRAM:

A. Background: This subprogram is the main source of funding for the Program. As petroleum production decreases or ceases at offshore platforms in federal waters off Texas, petroleum companies are obligated through the Bureau of Safety and Environmental Enforcement (BSEE) and Bureau of Ocean Energy Management (BOEM) to remove the platform, take it into shore for scrapping, and cleanup the ocean bottom to some state similar to what it was before the platform was installed. (These two Bureaus are descendants of the U.S. Minerals Management Service which was reorganized after the Deepwater Horizon Oil Spill (aka BP oil spill and Macondo Blowout) in April 2010).

Since many of these platforms have been in production for 30 years or more, there is a tremendous amount of marine life growing on the platform legs and conductor lines. The R2R program was sanctioned by the former U.S. Minerals Management Service to allow petroleum companies to donate their obsolete platforms to state governments as artificial reefs instead of scrapping them. There are various methods of reefing these

platforms; toppling in place, towing them to an existing reef site, and partial removal (which involves removing the upper portion and placing it on the ocean bottom next to the base which is left standing in place). In all operations now, the production decks above water are removed and taken into shore for reuse or scrapping.

Conductor lines traditionally have been left in place after being severed from the wells or removed and scrapped. In the last year, some directors of BOEM/BSEE have pushed to inforce a guideline where conductors are to be removed 15ft below mud line (BML) or, in a worse case, extend no higher than 15ft above mud line (AML). By doing this, a significant amount of hard structure (habitat) is lost. TPWD was successful in getting waivers on 2 R2R projects to keep the conductors in place in 2016. However, future R2R projects may be subject to the removal of conductors.

The preferred method of reefing in Texas is through partial removal when a platform is large (8-piles/legs or larger) and conductors cut at the same height as the platform base. Once a platform donation is arranged with a petroleum company, all work is performed by the company including all surveys, and the Texas Artificial Reef Program receives one-half of the estimated realized savings calculated from complete removal costs versus reefing costs. In the majority of cases, petroleum companies can pay the Program the donation amount and still save money, making the R2R a win-win for the petroleum company, Texas, and the marine environment.

B. 2016 Projects Completed:

Petroleum Platforms Reefed in 2016						
Platform	**Outer Continental Shelf Region**	**Size**	**Reefing Method**	**Company**	**Date Reefed**	**Donation Received**
HI-A-334A	High Island	8-pile	Partial Removal	Fieldwood Energy	8/4/16	$205,471.04
HI-A-334B	High Island	8-pile	Partial Removal	Fieldwood Energy	8/1/16	$284,800.00
HI-A-334B-AUX	High Island	4-pile	Tow to HI-A-334	Fieldwood Energy	6/29/16	$64,568.58
HI-A-334C	High Island	4-pile	Tow to HI-A-334	Fieldwood Energy	7/22/16	$83,615.63

C. Special Concerns:

C.1 Deep water Platforms: The Program considers deep water platforms to be those in water depths greater than 500ft. To date we have one platform scheduled for reefing in 2017 and two others under negotiation.

C1.1 EB-110: TPWD has a Material Donation Agreement with Fieldwood Energy to reef their East Breaks 110 (EB-110) 8-pile petroleum platform in 660ft of water. Fieldwood had problems with plugging wells in 2016 and now is predicting to reef the structure in 2017. A donation amount of $2.5m was agreed upon. The base will remain standing in place and the upper portion cut at 90ft. The deck and upper portion will be taken into shore for scrapping. Conductors will be cut between -90 and -100ft. Placing the upper portion on the bottom next to the base (as in a partial removal operation) was deemed not to be productive since there is no light at that depth. The Program currently has the reef permit and USCG clearance authorization for this reefing.

C1.2 Other Fieldwood Energy Platforms: Fieldwood Energy owns two other deep water platforms which are in discussion to be reefed: 8-pile East Breaks 159 (924ft) and 8-pile East Breaks 160 (935ft). The USACOE permits were approved in 2016. No Material Donation Agreements have been finalized to date.

C1.3 Garden Banks Platforms: The Program has reef site permits for two Garden Banks deep water platforms: GB-142B (542ft) which is owned by Sojitz, and Chevron platform GB-189A (730ft). TPWD is negotiating the Material Donation Agreement for GB-142 and preliminary discussions have taken place with Chevron for GB-189. We hope to have these structures in our R2R program in 2017.

C2. High Island 389A: This 8-pile platform is owned by W&T Offshore and located within the boundary of the Flower Gardens Banks National Marine Sanctuary (FGBNMS) in 410ft. It is important to note that the platform has been in its current location since 1981, prior to the designation of the area as a Sanctuary in 1992. Local constituents and the Flower Gardens Banks Reef Advisory Board have worked to save the platform in its current condition for years, as it is important habitat to the ecosystem. Many corals and tropical fish species are seen on the platform and it is frequently visited by sea turtles and manta rays.

TPWD continues to work with W&T Offshore, FGBNMS, and the US Army Corps of Engineers to obtain the reef permit for a 20ac site. Only the base will remain and the upper portion above 65ft and the deck will be scrapped. The last conference call to discuss the status was held 23 JAN 2017. At this point, the USACOE must finish drafting their Environmental Assessment, after which it will be reviewed by the FGBNMS. If no additional concerns are noted, the USACOE will issue the permit to TPWD. TPWD will simultaneously be working through a Memorandum of Agreement with the FGBNMS for approval for reefing. Once approved, W&T Offshore will begin the decommissioning work. We look for permit approval in early spring 2017 with reefing to begin by late summer 2017.

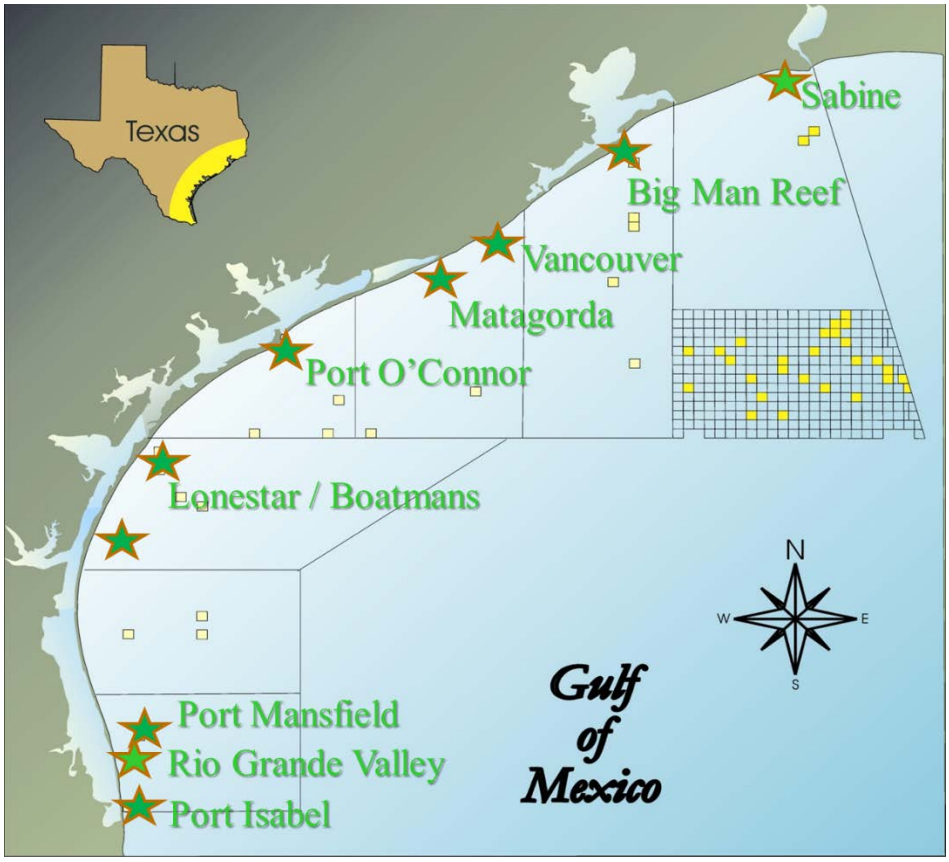
D. <u>Current Status to date</u>:

- Total Petroleum Platforms reefed: 148

- Other Components reefed (e.g. net guards, decks, Mobile Offshore Drilling Unit legs, etc.): 11
- Total funds deposited into R2R account since program inception: $26m
- Material Donation Agreements signed but not reefed: 10
- Donations in various stages of completion (e.g. inquiries, donation amounts calculated, waiting on contract signatures, etc.): 57

2. NEARSHORE REEFS PROGRAM:

A. Background: The Nearshore Reef Program was initiated to provide reef sites closer to major ports and located in Texas state waters (9nm). The public had expressed interest in having fishing (and limited diving) opportunities closer to shore without having to travel 30nm or more offshore. While several nearshore reef sites were already permitted, it was not until 2006 that the Program made a concerted effort to provide nearshore reefs. Currently, TPWD has nearshore reefs permitted out of each major coastal metropolitan center. Reefs range in size from 31ac at Boatman's/Lonestar reefs off Corpus Christi to the 1,650ac reef in South Padre (PS-1105 Rio Grande Valley Reef). Water depths range from 38ft to 73ft. Due to the shallow nature of these reefs, reef materials consist of low-relief concrete culvert, 1-ton quarry rock, prefabricated concrete pyramids, and some larger items such as petroleum platforms and vessels as water depths allow. Nearshore reef locations noted below:



B. 2016 Nearshore Reef Site Development:

Nearshore Reef Permit Projects in 2016						
Reef Name	**Outer Continental Shelf Block**	**Water Depth (FT)**	**Acres**	**USACOE Permit**	**TX GLO Surface Lease**	**USCG Clearance**
Sabine	HI-20	38	160	8/17/16	3/28/16	30ft - Approved
Rio Grande Valley	PS-1105	64	1,650	7/18/16	6/30/16	30ft - Approved

C. Nearshore Reefing Highlights:

C1. 2015 Grant: In late 2015, Program staff Chief Scientist Dr. Brooke Shipley was awarded a $400,000 grant (with a $400,000 match from the reef Program) for a Texas General Land Office Coastal Management Plan (Cycle 21) Grant. The grant is to create low and mid-relief habitat in the new Rio Grande Valley Nearshore Reef Site (PS-1105). Those funds became available in Fall 2016 and a Request for Proposals is being drafted for bid in early spring 2017. The project will reef 250 concrete pyramids interspersed with 250 low relief (6ft x 6ft x 1ft) concrete plats containing cinder blocks to compare the impacts of high vs. low relief structure on juvenile red snapper. The study will be conducted by Dr. Rick Kline (UT-Rio Grande Valley University).

C2. 2017 Grant: As of 27 JAN 2017, Dr. Shipley was also awarded a $300,000 Coastal Management Plan (Cycle 22) grant (with TPWD matching $300,000) for similar reefing and study at Big Man Reef GA-220 offshore of Galveston. Funds will be available in Fall 2017 and work is expected to begin in spring 2018.

C3. Rio Grande Valley Nearshore Reef PS-1105 (Cameron County): In SEP 2016, the first materials were reefed at the Rio Grande Valley Nearshore reef off South Padre by a volunteer group, Friends of Rio Grande Valley Reef. An obsolete tug and shrimp boat were reefed.

C4. George Vancouver/Freeport BA-336 Nearshore Reef (Brazoria County): A total of $2.2m in Natural Resource Damage Assessment funds was used to award a reefing project to Callan Marine LTD (Galveston, TX) in June 2015. This project was designed to increase the amount of reef materials in the George Vancouver (Liberty Ship) Artificial Reef, approximately 6 miles from Freeport, by placing 800 concrete pyramids at a water depth of 55 feet. The site contains the Liberty Ship and other low relief materials previously reefed. All pyramids were constructed and reefed in Fall 2016. This reef site is now considered complete.

C5. Matagorda Nearshore Reef BA-439 (Brazoria County): A total of $3.6m in Natural Resource Damage Assessment funds was used to award a reefing project to Callan Marine LTD (Galveston, TX) in June 2015. This project will create a new artificial reef site approximately 10 miles offshore of Matagorda County, Texas, through deployment of 1,600 concrete pyramids at a water depth of 60 feet. The pyramids were constructed in the summer of 2016 and reefing began in JAN 2017. To date, 400 pyramids have been reefed. The project is expected to be completed by April 2017.

C6. Port O'Connor Nearshore Reef MI-562 (Calhoun County): In August 2016, the reef program received $600,000 from the TPWD Foundation, the Coastal Conservation Association (CCA), and the Building Conservation Trust (CCA's National Habitat Program). With a match of $400,000 from the TPWD Artificial Reef fund, Callan Marine LTD was awarded a contract to reef 500 concrete pyramids in a section of the reef, designated "Keeping it Wild Reef." All pyramids have been constructed and will be reefed in summer 2017.

In addition, Shell Oil Company donated $400,000 to reef 200 pyramids in an area of the reef designated as "Shell Oil Reef." Callan Marine is constructing the pyramids now and is scheduled to deploy them in summer 2017.

D. Current Status:

- Total Nearshore Reefs to date: 11
- Reef sizes: 31 acres to 1,650 acres

4. SHIPS-TO-REEFS PROGRAM:

A. Background: This program is designed specifically for the benefit of recreational diving, while enhancing marine habitat. Diving interest in Texas is subject to water conditions. Clear water is rarely found within 3-4 miles of the coast and most diving is directed to standing petroleum platforms over 30 miles offshore or to the Flower Gardens Banks National Marine Sanctuary located over 100 miles off the coast.

B. M/V *Kraken* Ship Reef (HI-A-424): As part of the Natural Resource Damage Assessment approved projects from 2015, a Request for Proposals (RFP) was submitted to the public on 10 December 2015 for a turn-key project to acquire, clean, and reef a large vessel offshore Texas as a diving and fishing attraction. Bids closed on March 2016, and the project was awarded to Cahaba Disaster Recovery (Tuscaloosa, Alabama).

The SCM *Fedra*, a 371ft general cargo carrier/tween deck was located and towed from Trinidad to Brownsville, TX for remediation and modification. The ship was built in Japan in 1987 as an ice class ship. Before the ship was towed, the title needed to be changed which required a new name for the vessel. Dr. Brooke Shipley (TPWD), in a

creative spur-of-the-moment thought, worked with the contractor to rename the ship M/V *Kraken*.

The *Kraken* was remediated at the Port of Brownsville during summer of 2016 and was cleared for reefing by the US Environmental Protection Agency on 21 NOV 2016. Being a more modern ship, there was no asbestos or PCB materials on board. Overall, cleanup was restricted to removing 125,585 gallons of hydrocarbons (and associated waste water), 390 cubic yards of debris and floatables, and 9,000 lbs of ammonium sulfate (urea) that was stored onboard.

The sink plan originally called for the use of explosives to open 4 holes in the stern engine compartment for flooding, but after complications getting US Coast Guard approval to move ACE (Advanced Cutting Explosive) charges onto a boat to transport to the ship, the contractor decided to use controlled flooding without explosives. More than 2,200 tons of concrete was poured into the hold to facilitate landing the ship in an upright position.

As weather worsened through DEC 2016 and into 2017, the contractor found a small weather window from 17-20 JAN 2017. A tugboat towed the *Kraken* over 200nm from Brownsville, TX to the HI-A-424 reef site, arriving on 20 JAN. Once on site, wood paneling was removed over 4 pre-cut holes and 4 semi-cut holes over the stern were opened with cutting torches. Flooding was initiated by opening 2 10-inch valves near the stern. The stern sank first, followed by the bow. Once the valves were opened, the ship took over one hour to sink. The *Kraken* landed in an upright position on the ocean bottom in 141ft of water with zero degrees list.

The project cost $3.9m (using $1.9 million of Natural Resource Damage Assessment funds).

C. <u>Current Status</u>:

- 12 World War II Liberty Ships were reefed at 5 sites in the mid-1970s, which later became under the management of the TPWD Artificial Reef Program;
- *VA Fogg*, a cargo ship carrying xylene, explodes in 1972, creating the original reef site for the Freeport Liberty Ships;
- USTS *Texas Clipper*, a 473ft passenger liner, reefed in South Padre Island reef PS-1122 on 17 NOV 2007;
- M/V *Kinta*, a 150ft intracoastal tanker, reefed at Corpus Christi Nearshore Reef MU-775 in 17 SEP 2014;
- M/V *Kraken*, a 371ft general cargo carrier/tween deck, reefed at HI-A-424 on 20 JAN 2017;
- 16 ships are in the Ships-to-Reefs program, not including smaller vessels such as several barges, tugboats, shrimp boats.

5. BIOLOGICAL MONITORING AND RESEARCH PROGRAM:

A. Background: Biological monitoring of TPWD reef sites is mandated through the Program's management plan and TPWD legal code. Since the Program was established in 1990, monitoring has taken on several evolutions. Staff began making underwater observations and conducting fish counts through the use of SCUBA early in the program. With only three staff members, the use of volunteer divers was imperative. A formal diving program was established through membership in the American Academy of Underwater Sciences and the development of the TPWD Artificial Reef Diving Safety Guidelines in 1996. Over the years, the Program has expanded its monitoring to include datasondes, vertical long lines, underwater video and lasers, ROVs, fish collection traps, and other methods. In addition, the Program began subcontracting collaborative monitoring with local universities and funding ancillary research projects conducted by university and federal agency staff and graduate students. Currently, the Program holds a 2-day Texas Artificial Reef Program Consortium where contractors come together to discuss research and monitoring. It also provides a forum for the presentation of research findings, many of which are published in peer reviewed journals.

B. Research Contracts: Biological monitoring and research was conducted with four universities and the U.S. Geological Survey. Periods of contracts are in parentheses.

B1. Texas A&M University – Galveston: Biomass and community structure of reef fishes on TPWD artificial reefs in north Texas (2011-2017).

B2. Texas A&M University – Corpus Christi: 1). South Texas artificial reef research (STARR) program: fish community assessment and reef site evaluations (2011-2017) 2.) Socio-economic study of SCUBA diving on Texas artificial reefs (2014-2016).

B3. University of Texas – Rio Grande Valley: 1.) Artificial reef biological monitoring and research program: FY 2015 – 2017 (2007-2017). 2.) Rio Grande Valley reefing site pre- and post- deployment monitoring FY 2016-2017 (2015-2017).

B4. U.S. Geological Survey: Water quality monitoring of offshore (Texas) artificial reefs (2013-2017).

C. Diving:

C.1. Diving: The Program has increased its dive locker equipment and maintenance, and diver training over the years and has been a member of the American Academy of Underwater Sciences (AAUS) since 1996, with the approval of its Diving Safety Manual. The Program's Diving Safety Officer (DSO), Chris Ledford, has been instrumental in running the dive program over the years and highlights in 2016 include:

- Beginning a new AAUS Scientific Diver class with TPWD employees from the Habitat Mapping Team, Ecosystem Resource Program and Fisheries Management;
- Chris began his two year term as Secretary to the Executive Board of Directors of the AAUS;
- Chris presented a paper on the Program's use of dual laser photogrammetry in biological monitoring at the TPWD Coastal Fisheries Meeting held in February 2016;
- Chris was asked to serve on the Diving Control Boards for TAMU Galveston and the Texas Historical Commission;
- Weather prohibited some of the dive biological monitoring trips from occurring. However, 61 dive hours were completed by staff and volunteer scientific divers during 2016.

D. TPWD Artificial Reef Consortium: The Program began holding an Artificial Reef Consortium for its interagency contractors in 2014. This is an opportunity for those who hold research contracts and conduct biological monitoring to present findings and discuss monitoring results and problems. It is also an opportunity to discuss future monitoring needs, methods, and direction.

The 3rd Annual Texas Artificial Reef Program Consortium was held at the TAMU-Corpus Christi Harte Institute on FEB 11-12, 2016 and the 4th on FEB 26-27, 2017. While restricted to the Program's contractors and other interested people, the event grows larger each year. Typically, over 50 contractors, professors, graduate students, and others attend.

A listing of presentations made for 2016-2017 is seen below:

Presentation Title	**Authors and Presenters**	**Month / Year**	**Agency**
Reef fish associated with artificial reefs and the feeding ecology of two model predators	Dance, Kaylan, Jay Rooker, Brooke Shipley, David Wells	Feb-16	TAMUG
Reproductive biology of Red Snapper, *Lutjanus campechanus*, on natural and artificial reefs in the western Gulf of Mexico	Downey, Charles H., R.A. Brewton, J. J. Wetz, M.J. Ajemian, and G. W. Stunz	Feb-16	TAMUCC
Reproductive capacity of nearshore and offshore red snapper (*Lutjanus campechanus* Poey, 1860) on four artificial reefs in the northwestern Gulf of Mexico	Alexander, Ricky and Carlos Cintra Buenrostro	Feb-16	UTRGV
Relative abundance, age, and growth of Red Snapper: A comparison between artificial and natural habitats in the western Gulf of Mexico	Streich, Matthew, M.J. Ajemian, J.J. Wetz, and G.W. Stunz	Feb-16	TAMUCC

Good, Better, Best. A comparison of SCUBA and ROV fish community surveys	Wetz, Jennifer J., M.J. Ajemian, and G.W. Stunz	Feb-16	TAMUCC
The use of side scan sonar in artificial reef research	Kline, Richard and M.A. Bollinger	Feb-16	UTRGV
ARIS sonar surveys of fish associated with artificial reefs	Wells, David, Tom Tinhan, Jay Rooker, Kaylan Dance, Mike Dance, Brooke Shipley	Feb-16	TAMUG
Assessing connectivity of black corals (Antipatharia) and octocorals (Octocorallia) on artificial reefs along the Texas coast	Otte, Heather, M.T. Cooksey, and D.W. Hicks	Feb-16	UTRGV
USGS 2015 Artificial Reef Water Quality Monitoring Update	Lee, Mike and Lee Bodkin	Feb-16	USGS
A Brief Overview of Offshore Oil and Gas Decommissioning Cost Estimation and Potential Federal Exposure to Decommissioning Liabilities in the Gulf of Mexico	Kobrinski, Elena	Feb-16	TAMUCC
Fine-Scale Movements of Juvenile Red Snapper at the Corpus Christi Nearshore Reef	Gibson, Kesley, Judson M. Curtis, Jason A. Williams, Jennifer J. Wetz, Gregory W. Stunz	Jan-17	TAMUCC
Utility of rapid recompression devices in the Gulf of Mexico Red Snapper Fishery	Tompkins, Alex T., Judson M. Curtis, Gregory W. Stunz	Jan-17	TAMUCC
A regulatory update on decommissioning bonding requirements and industry response – will this affect rigs-to-reefs programs?	Kobrinski-Keen, Elena	Jan-17	TAMUCC
Comparison of high and low relief structure to reef fishes utilizing artificial reefs along the northern Texas coast	Plumlee, Jeff	Jan-17	TAMUG
Habitat-scale movement patterns of red snapper in an artificial reef area	Dance, Mike	Jan-17	TAMUG
Use of dietary tracers to examine feeding patterns of Red Snapper and Gray Triggerfish at Texas artificial reefs	Dance, Kaylan	Jan-17	TAMUG
Update of 2016 USGS Water Quality Monitoring Activities	Lee, Mike	Jan-17	USGS
Juvenile Reef Fish Recruitment in Relation to Low-Profile Artificial Reef Deployment at PS-1047	Alder, Alex, Richard Kline	Jan-17	UTRGV
A Comparison of Three Reef Structural Types Using Accelerometer Tags to Monitor Movements of Red Snapper (Lutjanus campechanus)	Getz; Ethan, Richard Kline	Jan-17	UTRGV
Monitoring Artificial Reef Fish Communities Using ROV and High Frequency Sonar	Figueroa-Downing, Robert, David Hicks, Laura Kracker	Jan-17	UTRGV
Morphometric and Histological Characterization of Grey Triggerfish (Balistes capriscus) on Artificial Reefs in the Northwest Gulf of Mexico	Lee, Adam, Carlos Cintra-Buenrostro	Jan-17	UTRGV

Black Coral (Antipatharia) Population Genetics as an Indirect Means of Assessing Connectivity Among Artificial and Natural Reefs	Otte, Heather, Nicole Figueroa, David Hicks	Jan-17	UTRGV

E. Reports, Publications, and Presentations:

Ajemian, M.J., J.J. Wetz, R.A. Brewton, M.K. Streich, C.H. Downey, and G.W. Stunz. 2016. Relative value of Rigs-to-Reefs habitats to Red Snapper (Lutjanus campechanus) stock building in the western Gulf of Mexico. Benthic Ecology Meeting. Portland, Maine.

Bollinger, M. A. and R.J. Kline. 2016. Validating side scan sonar as a fish survey tool over artificial reefs. University of Texas Rio Grande Valley. PLOS One, in review.

Brady, S., and D. Yoskowitz. 2016. Economic Impacts of Recreational Scuba Diving on Texas' Local Economy. TAMU-Corpus Christi Harte Research Institute. Report prepared for Texas Artificial Reef Program, Austin. August.

Downey, C.H., R.A. Brewton, J.J. Wetz, M.J. Ajemian, and G.W. Stunz. 2016. Reproductive biology of Red Snapper, Lutjanus campechanus, on natural and artificial reefs in the western Gulf of Mexico. Southern Division – American Fisheries Society. Wheeling, West Virginia.

Downey, C.H., R.A. Brewton, J.J. Wetz, M.J. Ajemian, and G.W. Stunz. 2016. Diet analysis of Red Snapper, Lutjanus campechanus, on natural and artificial reefs in the western Gulf of Mexico. Texas Bays and Estuaries Meeting. Port Aransas, Texas.

Lee, M.T. 2016. Water Quality Monitoring and Assessment of Artificial Reefs, Presentation, ACWI 10th National Monitoring Conference, May 2-6, 2016, Tampa Florida.

Lee, M.T. 2016. Water Quality Monitoring and Assessment of Artificial Reefs, Texas Gulf Coast. Presentation. Gulf States Marine Fisheries Commission 66th Annual Spring Meeting, March 14-17, 2016, San Antonio Texas

Lee, M.T., Bodkin, L.J. 2016. Water Quality Monitoring of Texas Offshore Artificial Reefs, Poster, 2016 AGU/ASLO/TOS Ocean Sciences Meeting, February 21-26, New Orleans, Louisiana

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