

**Florida Keys National Marine Sanctuary
Marine Zoning & Regulatory Review
Artificial Habitat
July 7 & 8, 2015**

Working Group Workshop Summary

Workshop Goal

Convene user groups, researchers, and Sanctuary managers to discuss and clarify the interests, research needs, and policies surrounding the use of artificial habitats in the Florida Keys National Marine Sanctuary.

Meeting Objectives

- Review the history and current status of artificial habitat permitting, placement, use, and monitoring in the Florida Keys.
- Share area agencies' definitions of artificial habitat/reefs, and clarify how Sanctuary regulations and mandates apply to artificial habitat/reefs.
- Discuss how the interests of the Sanctuary and of user groups intersect with the issue of artificial habitats, exploring how both potential benefits and impacts connect to those interests.
- Review a science synthesis completed in 2012, and identify and prioritize remaining research needed to assess the benefits and impacts of artificial habitat use in the Sanctuary.
- Discuss strategies for addressing research needs using the existing artificial habitats in the Sanctuary.
- Discuss leveraging partnerships, outside expertise, and other sources of external funding to support artificial habitat research and planning in FKNMS, given the Sanctuary's resource limitations and mandates to protect natural habitats.
- Brainstorm potential approaches and actions the Sanctuary and user groups can pursue both to clarify the permit process and to improve permit compliance
- Explore considerations for the future of artificial habitat in the Sanctuary
- Identify how the Sanctuary, researchers, and user groups can continue to share information on artificial habitats to inform research and management in the Sanctuary and beyond.

Meeting Summary

Tuesday, July 7th

Initial Questions/Areas of Interest from Working Group

Working group members identified the following issues and/or questions of interest related to artificial habitats that they would like discussed over the course of the two-day workshop:

- Explore opportunities to streamline the permit process and potential to consolidate regulatory requirements across the agencies.
- Identify the primary desired purposes to accomplish through use of artificial habitats, noting that artificial habitats can be misused.
- Discuss role that artificial habitat can play for sea level rise and habitat change protection.
- Determine if artificial habitats take the pressure off of natural reefs.

- Explore opportunities to use existing artificial habitats in FKNMS to answer research questions that may not be possible in other parts of the state that have fishing pressure (e.g. Is it possible to use artificial habitats as a component of fisheries independent monitoring or to gain insight into stock assessment?).
- Explore use of artificial habitats relative to FKNMS in a holistic way rather than as individual sites or projects.
- Identify specific categories, types, and purposes of artificial habitat that are suitable for use in the Sanctuary.
- Gain an understanding of the sense of urgency to develop a policy for use of artificial habitats in the Sanctuary.
- Identify opportunities to tighten up specifications for contractor selection process for artificial habitat deployment.
- Request that underwater archaeology sector be represented in further discussions.
- Interest and opportunity to embrace alternative funding for coral restoration and artificial habitats.
- Questions benefit of artificial habitat to the environment or fish populations and interest in funding restoration and research of the natural environment.
- Identify ways to address issue of permit compliance and fulfilling outstanding monitoring and research requirements of existing artificial habitat projects.
- Discuss opportunity for artificial habitat and restoration to work together and potential use of technology for active coral reef restoration.

History and Current Status of Artificial Habitat Permitting, Placement, Use, and Monitoring in the Florida Keys

Joanne Delaney, FKNMS Permit Coordinator, gave a presentation on the history of artificial habitat use in the Sanctuary. The presentation can be viewed here:

<http://floridakeys.noaa.gov/review/documents/20150707ahfknmsbackground.pdf>

Working Group Discussion

- Noted the importance of ensuring permit holders comply with permit requirements and do not abandon sites. To date FKNMS has addressed this on a case by case basis, which has included the following: letter to permit holder, consultation with attorneys, no further permits issued to those not in compliance with permit conditions and implementing specific permit conditions including bonding requirements.
- In discussing cost of artificial habitat projects and associated permit requirements, the following issues were raised:
 - Recognize the need for research and monitoring of deployed artificial habitat sites, suggest that a certain percentage of project cost required to be applied to these activities; and
 - Concern that if artificial habitat removal is required for experimental research projects, removal costs could make the project cost prohibitive.
- Considered value of conducting the outstanding monitoring and research activities on the big ship artificial habitats (i.e. Are there still valid data and information that can be gathered from existing projects?).

Science Synthesis and Recent Research

Beth Dieveney, FKNMS Deputy Superintendent for Science and Policy, provided highlights of the Office of National Marine Sanctuaries Artificial Habitat Science Review. The presentation can be viewed here:

<http://floridakeys.noaa.gov/review/documents/20150707ahscience.pdf>

The full document can be found here:

http://sanctuaries.noaa.gov/science/conservation/artificial_reef12.html

Working Group Discussion

Working group members were asked to identify additional research topics not included in the 2012 Office of National Marine Sanctuaries Science Review of Artificial Reefs. The following general studies and research were shared.

- Work in Dubai comparing species colonization of breakwaters with natural habitats;
- Artificial habitat performance in relation to fish and other attributes including colonization and water quality (i.e. oyster reefs);
- Increase of productivity shown on oil rigs including reef building corals and the role that structure and relief in the habitat play to provide opportunity for colonization benthic and fish species (Dr. Jeremy Claisse);
- Lionfish abundance showing nine times higher on artificial habitats than on natural habitat; important to address potential unintended consequences of artificial habitat use (Robert Turpin and Will Paterson). Also consider the introduction and spread of orange cup coral;
- Recent study looking at visitation by vessels shows substantially higher at artificial habitats which could result in potential higher fishing pressures (Chris Stallings and Peter Simard, USF);
- Long time period for coral community to reach its natural state on ship wrecks and other artificial habitat. Monitoring programs are insufficient for understanding process of reef building corals;
- Need to account for demographic bottlenecks and structural complexity of different life history stages and consider unintended consequences of other species filling niches;
- In reference to work underway in the Middle-East, areas where habitat is very limited, therefore seeing a high level of coral recruitment. Noted the importance of selecting artificial habitat material type based on the region where work is conducted. Substrate and placement needed to enhance coral recruitment. Goal of project should inform material, size, and placement of material. Not every type of structure works in every environment;
- Noted increase of artificial reefs and fish aggregation devices use in Japan and Korea with a subsequent higher level of fishing and take in these areas;
- Noted role that artificial habitat can provide in the face of sea level rise;
- Discussed issue of storm events and structural integrity of artificial habitats – are the impacts to natural reefs also being studied and compared with artificial habitats? Noted that natural reefs show more impact to species present, not to structure;
- Highlighted work on isotope analysis for different trophic levels on both artificial habitats and natural reefs (Will Patterson and Amy Pirons, NOVA Southeastern);
- Research from artificial habitat required for mitigation projects include long-term studies that might have more data than recreational placed reefs (Harold Hudson work noted); and
- Important to note that there is often a bias against reporting failures; examples include the placement of tires and invasive species spread.

Interests, Benefits, and Impacts

Working group members discussed how the interests of the Sanctuary and of user groups intersect with the issue of artificial habitats and explored how both potential benefits and impacts connect to those interests.

- One of the main points raised is the need to ensure that future artificial habitat deployments are coordinated with management needs and all projects have clear goals, expectations, and objectives. Additional points made on this theme include:
 - Conduct any deployments within constraints of sound science and ensure best available science is available for decision-making;
 - Design to achieve goals, including benefits/impacts to the natural environment and the economy;
 - Develop deployment criteria to better achieve desired goals;
 - Use rigorous peer review to assess how projects will meet environmental objectives through peer review;
 - Develop clarity of what constitutes artificial habitat and develop categories, and then for each category or type identify what the objectives/process/requirements could be; Create a punch list of requirements (i.e., if placing x material as artificial habitat, then do x; if placing y then do this, etc.);
 - Ensure project managers have capabilities (administration, financial, technical) to achieve goals; and
 - Consider the suite of values artificial habitats can affect: economic, environmental, and social.
- Funding considerations:
 - Ensure responsible expenditure of State and Federal funds and make sure when public funds are used, they are in the public interest;
 - Invest some of the money gained from diving artificial habitats back into research and monitoring activities; fund and conduct the research prior to additional artificial habitat deployments (analogy given of a company investing back into itself);
 - Explore alternative sources of funding:
 - Memorial gardens;
 - Create a Research Education Enforcement Fund and a requirement that if artificial reefs are to be placed, they should contribute funds back in some way to support research, education or enforcement; and
 - Explore adding a voluntary choice to donate/contribute to reef restoration or research when renewing your fishing license.
- Explore opportunities to use artificial habitats as a tool to address other long-term issues:
 - Coastal habitat restoration;
 - Protect natural habitat and promote active coral reef restoration;
 - Coastal defense and mitigation and doing so in a more environmentally beneficial way;
 - Coastal construction mitigation to offset environmental services. Structure, substrate effects ecology – facilitate redevelopment of reef. Monitoring should have value. Just counting fish on ship does not tell us much. Regulators should work with scientific community;
 - Reduce pressure on the natural reef; and
 - Noted that in the Florida Keys artificial habitats are not a tool for fishery enhancement.
- Potential to enhance coral restoration through memorial gardens to restore areas where coral once thrived;
- Promote educational opportunities of shipwreck history, marine biology, and new diver sites;
- Consider that the use of artificial habitats is only one tool of many that can be used to restore, conserve, and ensure the health of our ecosystem;

- Noted that in a climate of very limited resources, funds could be better spent towards understanding and restoring the natural systems; and
- Above all do no harm to the environment.

The working group quickly brainstormed a list of items that could be considered an artificial habitat to help them better determine what should or should not constitute artificial habitat for use in the Sanctuary. Their list included both materials and purposes for artificial habitat: ships, coral restoration, shoreline protection/mitigation, art projects (statues), disposal option for concrete including bridge rubble, decommissioning structures, oil rigs, memorial reefs, fish aggregating devices, research, education, hotels, casitas, and designed reef materials and second use reef materials. The working group discussed this further on day two. See below for more details.

Potential benefits provided by artificial habitats could include:

- Opportunities for messaging about what we are doing in the face of challenges to the environment;
- Structure that can promote increase of biological component; provide enhanced water filtering opportunities;
- Potential to enhance spawning sites and potential for increase in overall production;
- Opportunity for citizen science;
- Creates a range and diversity of socio-economic opportunity;
- Reduced risk from storms and flooding; alternative to shoreline hardening, living shorelines have good applications that should be explored as a benefit;
- Redirection of use away from natural reefs and therefore less impact on natural reefs;
- Opportunity to manage use and educate divers; novice divers visit artificial habitats, have less impact on natural reefs; and
- Range expansion of native species.

Potential impacts could include:

- Concentrate top predators or breeding stock (e.g., black grouper) resulting in higher potential for take;
- False understanding that placing artificial habitat in sand environment does not impact ecology; sand provides role in the ecosystem;
- Avoid the potential for Florida Keys to be over-run by artificial habitat (i.e. become huge rubble pile); need to be some control and have a plan for artificial habitat use;
- Loss of natural habitat availability;
- Project maintenance costs;
- Impact to aesthetic nature and value of environment;
- Impacts to navigation;
- Loss of funds for use to restore natural habitats due to funds being used on developing artificial habitats; and
- Range expansion of invasive species.

Remaining Research Needs

The working group then identified and prioritized remaining research needed to assess the benefits and impacts of artificial habitat use in the Sanctuary. Their top priority research questions are highlighted in bold.

- General:
 - Identify acceptable materials and types, prioritize locations, and number;

- Identify the range and type of long-term monitoring needed;
- Assess how mitigation and restoration projects have worked and apply lessons learned (examples from Broward County);
- Use spatial planning to determine if there are sufficient existing artificial habitats (e.g. size, locations, etc.) to determine if there is a need for more artificial habitats;
- **Compile base maps of currents, geology, physical oceanography to set priorities for artificial habitat location; need for high resolution accurate bathymetry data (e.g. LIDAR) to inform scientifically robust decision making;**
- Develop BACI (Before-After-Control-Impact) designs, to allow comparison studies between area with artificial habitat and area without;
- Develop a decision support tool to predict and inform different artificial habitat modeling designs, including scenarios of different project objectives, locations and materials; and
- **Identify funding sources.**
- Biological/Ecological:
 - **Determine if artificial habitats are a good tool to jump-start natural restoration;**
 - Noted that algal communities are an essential component of shallow reefs and other types of fleshy macroalgae are an important aspect to enhance long term ecological outcomes; and
 - **Identify habitat footprint of FKNMS (high relief, hard-bottom, sand, etc.) to help determine role artificial habitats may play in enhancing habitats. Potential opportunity to increase ecological value and increase utilization by fish and other organisms.**
- Socio-Economic:
 - Determine number of divers attracted to Florida Keys artificial vs. natural reefs;
 - Assess shift of diving activity from natural reefs to artificial habitats, and if this is a goal identify means to promote that behavior change;
 - Recognize value of artificial habitat for shoreline protection; noted that economically this will dwarf even fisheries and tourism;
 - Determine willingness to pay and why customers come to the Florida Keys; and
 - Explore opportunity to allow and target particular fishery uses on artificial habitats (e.g. baitfishing).

Addressing Priority Research Gaps using Existing Artificial Habitats in the Sanctuary

In two break-out groups, the working group discussed strategies for addressing research needs using the existing artificial habitats in the Sanctuary. The following specific questions were addressed:

1. How can partnerships, external funding, and external science expertise be leveraged to address these priority research needs?
2. How do we tackle some of these individual priorities? Which existing habitats would be good for studying which priorities? What kind of expertise is needed and who has this?

Report out from the break-out groups highlighted the following:

- Opportunity to use artificial habitat to jump-start natural reef development;
- Use of artificial habitat should include clear and simple research design;
- Opportunities to leverage partnership for existing data and/or to fund additional data collection for high resolution LIDAR maps (Navy, NASA, FEMA);
- Need to pull together existing data and synthesize;
- Determine what “value” means for future use of artificial habitat in the Sanctuary: social, economic, ecological, resource protection vs. habitat enhancement;

- Noted that if Florida Keys had healthy reefs, artificial reefs would not be considered for use in the Sanctuary;
- Explore opportunity to engage graduate students and academic institutions to help answer some of the outstanding research questions. Noted that sinking another ship is not a pre-requisite to answering research questions; and
- Explore opportunities to tap existing programs for funds (e.g., fishing licenses, state parks and land acquisition, Amendment 1).

Strategies for Clarifying the Permit Process and Improving Permit Compliance

The working group then discussed how the permitting process and compliance with permits could be improved.

General Planning:

- Develop a master plan for artificial habitat development for Monroe County and/or specifically FKNMS; strategy developed in concert with other regulatory agencies and DEP. Such a plan could help inform some of the criteria for permitting and include required monitoring and research that is standardized;
- Develop a decision support tool (GIS) for existing and future artificial habitat deployment and use; and
- Need for high resolution maps to inform decision making.

Streamline the permit process:

- Promote applicant do advance work, pre-consultation;
- Consider creating a guideline for permit processes, which could include information about/ requirements of other permitting entities (FKNMS, USACE, EPA, Florida); potential for one-stop shop for permit requirements (e.g., Southeast Florida Coral Reef Initiative has a flow chart for permit process); conduct coordinated cross-agency permit review process (e.g., canal restoration projects reviewed by team to make the process streamlined and efficient); and
- Use a long-form and a short-form determined by project type.

Permit Compliance:

- Develop financial and technical expertise requirements for project contractors;
- Require a documented plan for deployment;
- Include permit conditions that identify research required for permit compliance and require a research model, design, budget and proof of funding; note that this may reduce the number of applications, but is the best way to resolve permit compliance issues;
- Increase site visits to and oversight of existing artificial habitat sites; and
- Require funding commitment to remove the artificial habitat if not meeting performance criteria or addressing issues with accountability and permit compliance.

Permit Requirements:

- Recognize importance of research but consider setting a limit (percent of cost of project) spent on research/monitoring;
- Ensure distribution of required permit research and monitoring reports; ensure permittee and public see that the research is valued and deliverables are used and distributed; and
- Require minimum monitoring guidelines in advance so permittee knows expectations and can build these into a business plan.

Wednesday, July 8th

Considerations for the Future of Artificial Habitat Use in the Sanctuary

The working group discussed considerations for the future of artificial habitat use in the Sanctuary. To guide this discussion, the following questions were posed:

1. What is(are) the purposes of artificial habitat?
2. What do we want artificial habitats to accomplish within the Sanctuary that natural habitats and/or existing artificial habitats cannot?

A working group member clarified that the discussion should be narrowed to focus on the purpose of artificial habitats in the Sanctuary, which will be different than considerations for use of artificial habitats generally in other places.

- Provide habitat and build biomass;
- Relieve pressure from natural reefs;
- Promote reestablishment of the natural ecosystem, not just for opportunities to increase harvest;
- Provide ecological function associated with physical complexity of natural coral;
- Provide mitigation or direct restoration for damages;
- Provide recreational boating opportunities of all types;
- Increase habitat and recreational opportunities, and tourism;
- Promoting structure in and of itself can have some ecological benefits in addition to social benefits (tourism, etc.); increasing rugosity can increase growth rates, opportunities for spawning, etc.;
- Create a memorial reef area which can increase interest/ownership and stewardship of the area;
- Concentrate use;
- Identify priority areas where innovative technology could be used to restore natural ecological function and structural complexity;
- Explore opportunity for artificial habitats to support and enhance areas already protected through Sanctuary marine zones (e.g. artificial habitat could be placed down-current of an existing marine zone to further benefit and advance the goals of those zoned areas);
- Concern raised about going forward with artificial habitats that have unknown long-term value and potential impact; support funds going toward ecosystem-wide recovery efforts and using available substrate to support coral restoration rather than artificial habitats; and
- Invest resources on natural reefs; however, funds to do that can be generated through use of artificial habitats.

In two break-out groups, the working group further discussed considerations for the future of artificial habitat in the Sanctuary. The following questions were posed:

1. What we do not want related to use of artificial habitats?
2. What are the economic vs. environmental considerations of artificial habitats?
3. How do we address costs/funding and liability challenges given history of artificial habitats in FKNMS and agency requirements?
4. What has been and should be the role of education and research on artificial habitats? How do we address those roles?

Report out from the break-out groups highlighted the following:

1. What we do not want related to use of artificial habitats?
 - Unintended consequences (e.g. lionfish colonization);
 - Net loss of species;

- Decrease aesthetic value of Sanctuary (i.e. no artificial habitat Disneyland that affects personality of the marine Sanctuary);
 - Avoid abandonment;
 - No automobiles, tires, casitas, or hazardous materials; and
 - Avoid diver hazards.
2. What are the economic vs. environmental considerations of artificial habitats?
 - Build cost-benefit decision making criteria for projects into the permitting process;
 - Conduct life-cycle analysis of certain species to ensure no cumulative change in species/ecological function;
 - Consider have artificial habitat closed to use and changing closed status over time depending on research questions answered and goals and performance;
 - Partner with dive industry early on in design of artificial habitat structures;
 - Consider increasing visitor pressure over time due to likelihood of a lot more people coming to South Florida; and
 - Promote concept of stepping with a lighter footprint, and potential for less impact on the environment using artificial reefs.
 3. How do we address costs/funding and liability challenges given history of artificial habitats in FKNMS and agency requirements?
 - Build in education and maintenance costs (e.g. Spiegel Grove medallion program, user fees);
 - Develop an artificial reef trust fund to cover research and monitoring fees;
 - Work to redirect funding at state and federal level, to support not only deployment but also long-term maintenance and research costs;
 - Consider corporate sponsorships; however, recognized challenges with corporate sponsors; and
 - Consider if artificial habitats are where effort and limited resources should be expended or if those resources are better used for natural seagrass and coral protection and restoration.
 4. What has been and should be the role of education and research on artificial habitats? How do we address those roles?
 - Implement adaptive management to assess performance over time and provide a feedback loop for learning and education;
 - Use of artificial habitats to reinforce education and research in relation to existing marine zones; and
 - Explore strategic partnerships with research and education institutions and promote requirement that artificial habitat plans include opportunity/requirement for education and research.

Public Comment

Public comment was provided by one individual.

- Lad Akins, Reef Environmental Education Foundation
 When we were looking earlier this morning at purposes, just one thing that I did not see on the list but looks like it has been woven through a lot of the discussion, is the potential to utilize artificial structures in research, to address research questions. Natural reefs, no two are the same, and it's always difficult to tease out the differences between natural reefs when comparing and contrasting results, but artificial reefs can be effectively the same, so they are great for answering specific research questions. A lot of the discussion has been about big ships and large structures attractive

to the dive community; I think there is also great opportunity for using artificial reefs and structures to answer some key research questions. Just didn't want that to get missed under the purposes discussion.

Take-Homes, Next Steps on Filling Research Gaps, and Ways to Continue the Dialog

The workshop closed with a final discussion about next steps and development of a recommendation for advisory council consideration.

- Desired objectives for artificial habitat in Sanctuary:
 - Help make up for natural system losses;
 - Reduce impacts to natural system;
 - Provide economic benefits; and
 - Implement any future artificial habitat projects in a responsible way that avoids negative impacts.
- Ensure clear objectives/purpose and monitoring, and enforcement of that monitoring;
- Recognize a need for holistic planning and development of an artificial habitat management plan for planning, funding, permitting and monitoring artificial habitat; this should include cost-benefit analysis (economic and environmental costs and benefits);
- Facilitate economic benefits from artificial habitats contributing to environmental priorities (e.g. trust fund);
- Explore the potential that artificial habitats could be placed in areas where they will complement/augment Sanctuary goals; explore how existing artificial habitats could be enhanced and utilized to a great degree;
- Need to address permit compliance and accountability; enforcement is a problem in general;
- Consolidate permit requirements;
- Interest in growing corals and doing restoration on artificial habitats;
- Recognize value of natural reefs and ensure protection of those; and
- Question related to NOAA policy and how urgent action related to artificial habitat planning and implementation may be.

Recommendations for Sanctuary Advisory Council Consideration

The following was voted on by working group participants – 19 in favor and 2 abstentions.

The artificial habitat working group of the FKNMS advisory council states that there is the potential for value to the placement of artificial habitat within the FKNMS. Notably there are costs and benefits to the approval and appropriate placement of such structures. The working group recommends the conservative development of an action plan to be placed in the FKNMS management plan. Said action plan should be further developed in concept based on a consideration of all points made during the working group effort July 7-8, 2015, as well as existing body of knowledge, by the members of the working group to be presented to the SAC and to be fully developed by FKNMS staff.