USCRTF Handbook on Coral Reef Impacts: Avoidance, Minimization, Compensatory Mitigation and Restoration

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USCRTF Handbook on Coral Reef Impacts:
Avoidance, Minimization, Compensatory Mitigation, and Restoration

- Handbook was adopted December 22nd, 2016
- User-friendly PDF created
- Frequently Asked Questions (FAQs) prepared
- Hard copy and brief to USCRTF principals at meeting
- PDF and FAQs available at:

  http://www.coralreef.gov/mitigation_handbook.html

Working Group Members

- EPA
- DOD
- DOI (FWS, NPS)
- DOJ
- NOAA (CRCP, NMFS, Restoration Center, Sanctuaries)
- USACE (Planning & Regulatory)
- USCG
- State of Florida (FDEP, FFWC)
- State of Hawaii (DAR)

Process toward the Handbook

2002 – Puerto Rico Meeting Resolution 8.4

- Formed interagency Coral Reef Mitigation Working Group
- Mitigation reports for Pacific (Bentivoglio, 2003) and Atlantic/Caribbean regions (Yoshioka, 2004)

2006 – USVI Meeting Resolution 16.7

- Workshop on coral reef injuries
- Combined Coral Injury & Mitigation Working Groups

2010 – Guam/CNMI Meeting

- USCRTF mitigation workshop
- Initial mitigation options summary document

2011 – D.C. Meeting Resolution 25.1

- USCRTF activities in support of National Ocean Policy
- Issue of coral injuries and mitigation prioritized

2014 – DOI-OIA funding to facilitate Handbook development

2015 – DRAFT Handbook

2016 – Adoption of USCRTF Handbook on Coral Reef Impacts

USCRTF Handbook on Coral Reef Impacts: Avoidance, Minimization, Compensatory Mitigation, and Restoration

- **Promotes avoidance and minimization**
- What the Handbook is:
  - Compilation of what we do now
  - Summary of authorities
  - Collection of coral reef mitigation and restoration options (BMPs*)
  - Case studies and lessons learned
  - Challenges and obstacles

* BMP = Best Management Practice

USCRTF Handbook on Coral Reef Impacts: Avoidance, Minimization, Compensatory Mitigation, and Restoration

- What the Handbook is **not**:

This document is not official agency guidance, nor does it represent a comprehensive policy statement, or replace requirements contained within statute, codified in regulation or agency guidance documents.

- Target audience – Proponents, Responsible Parties, Managers
- Deliverable under USCRTF Resolutions 16.7 and 25.1, and National Ocean Policy Implementation Plan

Challenges to Handbook Development

- Primary WG Objective – Mitigation streamlining and predictability
- Collaborative, stepwise process – necessary in order to overcome challenges
- Process took time – communicating agency differences, understanding technical and scientific challenges, and obtaining technical editing resources

Abbreviated Table of Contents

1. Background
2. Evaluation Framework for Planned Impacts to CRE
3. Framework for Responding to Unplanned Coral Reef Impacts (groundings/spills)
4. Coral Reef Compensatory Mitigation and Restoration Options
5. Performance Standards and Monitoring
6. References
7. Recommendations and Next Steps
8. Appendices

* Case studies and lessons-learned are included throughout the chapters

1.2 Definitions

Condition: The relative state of an aquatic resource to support and maintain a community of organisms characterized by its species composition, diversity, and functional organization comparable to reference aquatic resources in the region (33 CFR 332.2 and 40 CFR 230). For the purpose of this document, as discussed in Section 2.1.4, condition assessments are used as an alternative to assess coral reef function.

Coral: Species of the phylum Cnidaria, including all species of the orders Antipatharia (black corals), Scleractinia (stony corals), Gorgonacea (horny corals), Stolonifera (organpipe corals and others), Alcyonacea (soft corals), and Helioporacea (blue coral) of the class Anthozoa; and all species of the families Milleporidea (fire corals) and Stylastreridae (stylasterid hydrocorals) of the class Hydrozoa.

Coral Reef: Limestone structures composed in whole, or in part, of living coral, skeletal remains, and including other corals, sessile marine animals, and plants. Reefs greatly vary in size from a few meters to several kilometers. Several individual reefs can form large reef complexes like the Great Barrier Reef of Australia, Papahānaumokuākea National Marine Monument, Great Bahama Bank, and the Florida Reef Tract.

Coral Reef Ecosystem: The system of coral reefs and geographically and ecologically-associated species, habitats, and environment, and the processes that control its dynamics. Often, other nearshore habitats such as seagrass, algae, and mangroves are part of the coral reef ecosystem.

Coral Relocation: Moving a coral from a site not associated with an impact (e.g., a nursery location) to another site (e.g., a proposed compensatory mitigation site) (see Section 4.3, Option 3).

Coral Transplantation (Translocation): Moving a coral from one site proposed for impact to another site, typically associated as an action to minimize impacts from a planned activity (see Section 2.2.3.2).

Credit: A unit of measure (e.g., a functional or areal measure or other suitable metric) representing the accrual or attainment of aquatic functions at a compensatory mitigation site. The measure of aquatic functions is based on the resources restored, established, enhanced, or preserved (33 CFR 332.2).

p.6 – definitions of common terms

Table 2: A summary of definitions for the terms "coral reef" and "coral reef ecosystem" across regulatory and management agency mandates.

Law, Statute, Regulation, or Agency	Definition of Coral Reef	Definition of Coral Ecosystem
Coral Reef Conservation Act (CRCA) of 2000 *16 U.S.C. §§6401-6409*	Any reefs or shoals composed primarily of corals.	Coral and other species of reef organisms (including reef plants) associated with coral reefs, and the nonliving environment factors that directly affect coral reefs, that together function as an ecological unit in nature.
EO 13089 Executive Order *63 Federal Register (FR) 32701 (June 11, 1998).*		U.S. coral reef ecosystems means those species, habitats, and other natural resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the U.S. (e.g., federal, state, territorial, or commonwealth waters); including reef systems in the south Atlantic, Caribbean, Gulf of Mexico, and Pacific Ocean.
CWA §404(b)(1) Guidelines *40 CFR 230*	Coral reefs consist of the skeletal deposit, usually of calcareous or siliceous materials, produced by the vital activities of anthozoan polyps or other invertebrate organisms present in growing portions of the reef.	
South Atlantic Fishery	Hardbottoms, nearshore	

p.18 – terms ‘coral reef’ and ‘coral reef ecosystem’ as used in various mandates

1.4 Roles & Responsibilities

- Summary of agency roles and responsibilities
- Includes Federal, State, and Territorial Agencies
- Legal authorities and activities for both planned and unplanned impacts

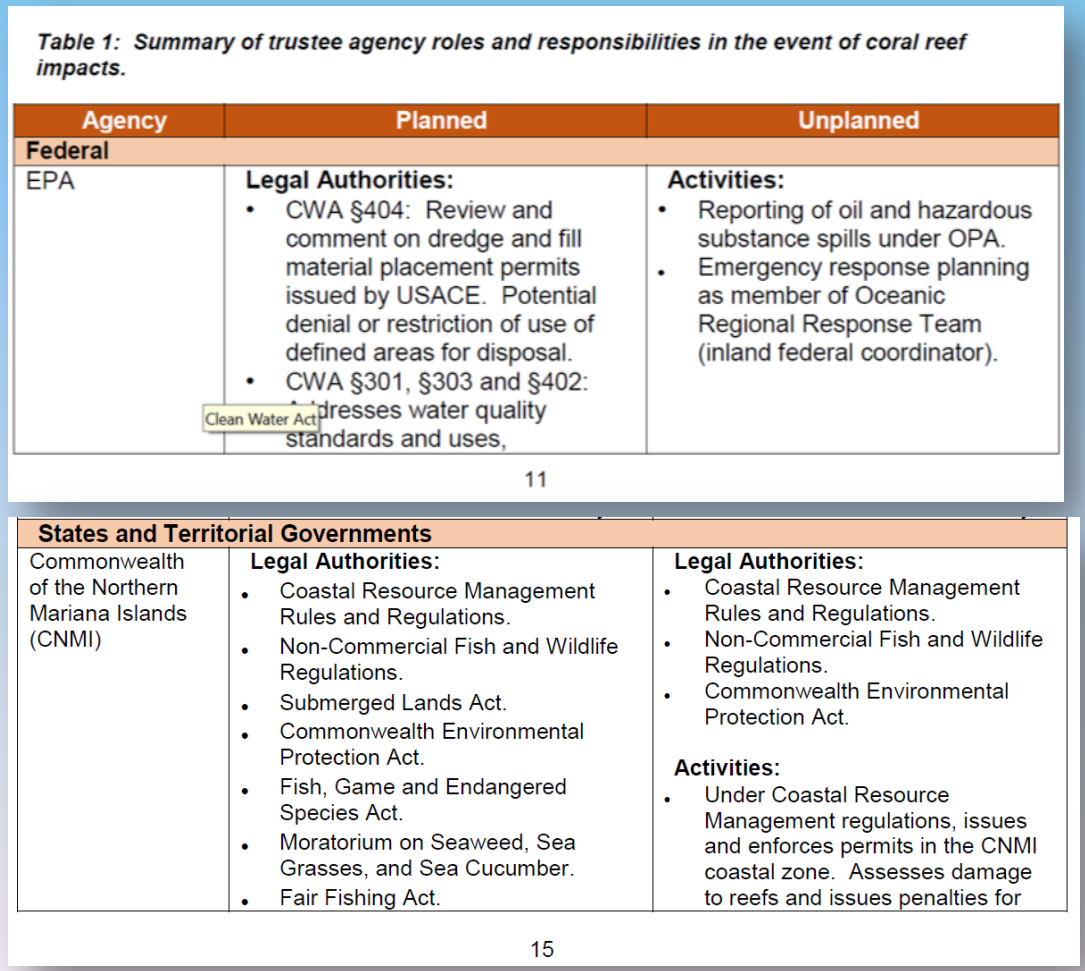

Table 1: Summary of trustee agency roles and responsibilities in the event of coral reef impacts.

Agency	Planned	Unplanned
Federal		
EPA	**Legal Authorities:** • CWA §404: Review and comment on dredge and fill material placement permits issued by USACE. Potential denial or restriction of use of defined areas for disposal. • CWA §301, §303 and §402: Addresses water quality standards and uses,	**Activities:** • Reporting of oil and hazardous substance spills under OPA. • Emergency response planning as member of Oceanic Regional Response Team (inland federal coordinator).
States and Territorial Governments		
Commonwealth of the Northern Mariana Islands (CNMI)	**Legal Authorities:** • Coastal Resource Management Rules and Regulations. • Non-Commercial Fish and Wildlife Regulations. • Submerged Lands Act. • Commonwealth Environmental Protection Act. • Fish, Game and Endangered Species Act. • Moratorium on Seaweed, Sea Grasses, and Sea Cucumber. • Fair Fishing Act.	**Legal Authorities:** • Coastal Resource Management Rules and Regulations. • Non-Commercial Fish and Wildlife Regulations. • Commonwealth Environmental Protection Act. **Activities:** • Under Coastal Resource Management regulations, issues and enforces permits in the CNMI coastal zone. Assesses damage to reefs and issues penalties for

2.0 Evaluation Framework for Planned Impacts

- Process puts emphasis on avoidance, minimization and BMPs first
- Generalized step-wise process to assess planned impacts to coral reefs
- Chapter 2 narrative walks reader through the process and provides more detail for each step

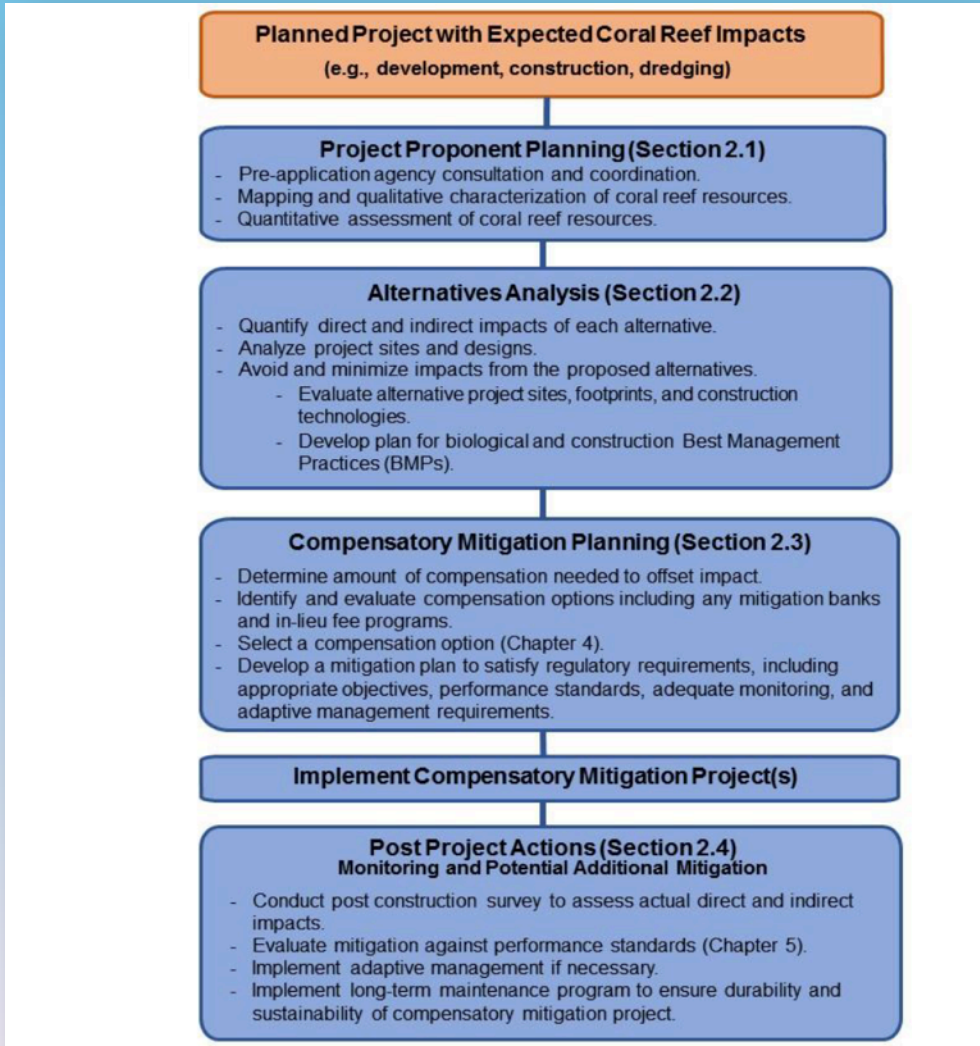

Figure 2: A generalized process for addressing planned impacts to coral reefs.

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3.0 Framework for Responding to Unplanned Impacts

- Responses are joint state and federal process
- Generalized step-wise process to assess unplanned impacts
- Walks reader through:
  - Damage Assessment and Restoration
  - Response and Resource Protection
  - Emergency Actions
  - Impact Assessment
  - Scaling Compensation
  - Reef Restoration

3.3 Emergency Stabilization and Triage

Often, it is possible to act to protect or save damaged corals and other organisms from additional impacts and mortality through site stabilization and biological triage.

3.3.1 Substrate Stabilization

Fractured substrate and loose rubble is of concern in large reef injuries associated with vessel groundings and commercial anchor drags. Unless fractured substrate is repaired, it may continue to erode the reef framework. Un-stabilized rubble may roll around and cause additional damage to the site and/or previously un-impacted areas if it is not removed. Rubble may need to be stabilized and/or incorporated into reef framework repair. However, rubble not used in those processes may need to be disposed of appropriately. Depending on the size and severity of the injury, substrate stabilization may be incorporated into the larger primary restoration plan.

3.3.2 Biological Triage

Biological triage activities should occur as soon as possible following an injury. Fractured, dislodged, and overturned corals have a short window of opportunity in which they can be salvaged and stabilized. The goal of biological triage is to save those organisms that are at risk of mortality and/or loss from fragmentation or dislodgment from the reef. Biological triage may occur simultaneously with the initial site assessment, and should consist of saving as many at-risk corals as possible. Any biological triage activities that are conducted should be coordinated so as not to interfere with any response activities and evidence or data collection.

3.4 Assessing Impacts

During this phase, quantitative surveys are conducted to identify and quantify the negative impacts of the incident, including those resulting from cleanup or other actions taken as part of a response. Ecological studies are conducted to evaluate how, and to what degree, natural resources may have been injured. Morphological and geological studies may be conducted to evaluate the impacts to the substrate. Economic studies are used to determine how recreational activities, such as fishing and swimming, have been affected. If other resources such as infrastructure or cultural/historical resources have been impacted, the assessment will

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4.0 Compensatory Mitigation & Restoration Options

- Compilation of mitigation action and BMP references
- Options described range from actions to improve water quality, marine debris removal, and active coral habitat enhancement
- Included are potential activities, special considerations, and opportunities/challenges with each option

OPTION 11: Active coral population enhancement (propagation and outplanting)
Propagation of corals in a nursery setting using best husbandry practices. Corals can be used for mitigation or restoration activities.

Case Study Examples: Coral nurseries in FL, Puerto Rico, USVI; HI (in progress).

Possible Activities:

- In-water coral propagation (nurseries).
- Land-based propagation (aquaria).
- Corals of opportunity/caching.
- Outplanting of coral colonies into restoration locations.
- Remove corallivores (snails).

Considerations:

- ***Targeted resource/habitat being restored/mitigated:*** Coral reef habitat and structure.
- ***Primary objective:*** Improve coral reef ecosystem condition by increasing rugosity, habitat complexity, and live coral cover.
- ***Specific functions or services provided:*** Coral reef habitat, structure, function, species diversity, and recreational and coastal protection human use services.
- Using local corals that have been identified as, or cultured to be more resistant and/or resilient to climate change, ocean acidification, and/or disease, can maximize success.

Opportunities:

- Successful examples in Atlantic/Caribbean.
- Recent advances in scaling the mitigation requirement could inform planning.
- Growing list of successes and protocols developed (e.g., for staghorn coral *Acropora cervicornis*).
- Result in net gain of coral colonies.
- Genetic bank to safeguard against extreme events.
- Corals from coastal construction project impact areas could be used for propagation.
- Potential to enhance coral reproduction.
- For land-based propagation, ability to control conditions and relatively easy to monitor growth.
- Could enhance recovery strategies for ESA listed corals.
- Predator removal can expedite settlement and survivorship.

Challenges:

- Need to have multiple in-water sites to minimize risk of impact from mortality events and weather events.
- May have to increase capacity of existing nurseries or build new nurseries for large-scale projects.
- Outplanting site selection criteria are needed (with consideration of relative resilience assessment in this process).
- Requires maintenance (e.g., predator removal).
- As compensatory mitigation, may require federal/state mechanism to meet site protection requirements (e.g., Fisheries Management Area designation).
- May require additional regulatory reviews/approvals to place structures or outplantings within waters regulated by federal, state, or territorial governments.
- Predator removal can be labor-intensive.

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5.0 Performance Standards & Monitoring

- Types of recommended performance standards
- Standards should be observable, measurable, and trackable
- Hypothetical examples provided
- Discussion of monitoring and reporting project performance

5.0 PERFORMANCE STANDARDS AND MONITORING

Effective compensatory mitigation or restoration is the replacement or improvement of ecosystem functions and services by achieving the objectives of compensatory mitigation or restoration projects. Objective and verifiable performance standards are critical for assessing the success of a compensatory mitigation or restoration project in meeting those objectives. Since each compensatory mitigation activity has its own unique conditions and requirements, performance standards define what success looks like for that specific project—clarifying for the project proponent and the permit authorities when the compensatory mitigation activity will be considered completed. Performance standards are benchmarks for evaluating the attainment of project objectives, and allow project evaluators to determine if the site is developing into the desired resource type and providing the expected functions. Performance standards are normally established prior to implementing a compensatory mitigation or restoration project, and the standards should be based on attributes that are observable or measurable. Performance standards will usually be tailored to the objectives that are specific to the individual project, because each site and its restoration potential will likely be different. Since there have only been a limited number of coral reef compensatory mitigation activities implemented, and site conditions for each are unique, hypothetical performance standards are provided in this section to provide examples for a project proponent to consider when developing performance standards.

It is generally recommended that each project have performance standards in three categories. All three are observable, measurable, trackable, and necessary for the sustainability of the site. Performance measures are needed to better ensure successful and sustainable compensatory mitigation and restoration activities given the uncertainty inherent in coral reef restoration projects. The categories are:

- Administrative Measures.
- Ecological Performance Standards.
- Adaptive Management Measures.

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5.3 Adaptive Management Measures

Adaptive management measures are typically considered as an aspect of administrative measures. However, adaptive management measures may also apply to ecological performance standards. If an existing ecological performance standard were not adequate to evaluate the performance, it may need to be modified to better evaluate the success of the compensatory mitigation activity. For example, the performance standard may have defined an acceptable level of sediment or turbidity in the water that is too large of a range to distinguish a difference in coral recovery; that performance standard may need to be modified to better distinguish the changes in sediment and turbidity to evaluate if the compensatory mitigation activity is on the desired trajectory. For compensatory mitigation activities that may have a high risk or uncertainty of success in part of the performance, it is a good practice to develop an adaptive management plan to identify when and what type of corrective actions may be needed if the activity is not meeting the performance standards. USACE developed "The application of adaptive management to ecosystem restoration projects" (Fischenich et al., 2012). This report is a good resource for understanding how to develop adaptive management plans for restoration and compensatory mitigation actions. Following are hypothetical examples of adaptive management standards.

Hypothetical examples of Adaptive Management Standards:

- In the event that >50% of outplanted staghorn coral die or are lost within the first five years, an equal number of nubs >5 cm will be outplanted to Polypy Bay within three months of the mortality.
- In the case that an unforeseen event severely damages the Polypy Bay restoration project and impedes recovery, Coral Lovers Forever shall convene a meeting within one month of the event with Department of Coral Protection to determine how to proceed with this or an alternative restoration project. Coral Lovers Forever shall be prepared to present options for consideration.

Case Studies & Lessons-Learned

EXAMPLE: COLLABORATIVE ALTERNATIVES ANALYSIS PROCESS

The Mā'alaea Harbor navigation improvement project on the island of Maui, Hawaii, proposed expanding the existing breakwater to improve access to a small boat harbor during certain wave conditions. Between 1982 and 1998, public comments on the environmental impact statement (EIS) raised concerns regarding potential impacts to coral reef habitats and other issues. Due to funding constraints encountered when addressing the complex issues around coral reef mitigation, it took until 2012 for the project proponents—State of Hawaii and USACE—to make a final decision on the project.

As a result of public comment, the project proponents modified the alternatives analysis approach, to be a more collaborative process with resource agencies and community groups. When updating models to better scale the breakwater, USACE engaged with federal resource agencies to improve understanding of the resource, and communicate navigational and engineering constraints and technical issues for the project. In re-evaluating potential alternatives, USACE engaged FWS and NMFS in a phased approach to impact assessment, first mapping the extent of the coral reef habitat and rating areas of higher quality that would benefit from protection (i.e., avoidance). Based on the initial mapping, the potential alternatives were overlaid and re-evaluated to see where the best opportunity to maximize avoidance and minimization was. Through collaboration with community groups and users in 2010, USACE and the State of Hawaii developed a better understanding of the navigational constraints for the harbor, and how users were adapting to the conditions.

Based on the input of the users, resource agencies, and the expertise of the coastal engineers, it was determined that the best solution for the State of Hawaii was to terminate the proposed breakwater expansion and instead focus on facility improvements to better protect the vessels while moored. This avoidance and minimization measure was decided in large part by comparing the potential costs of coral reef compensatory mitigation along with construction costs versus the potential benefits derived by the users of Mā'alaea Harbor.

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THE EVOLUTION OF MITIGATION SCIENCE IN SOUTHEAST FLORIDA p. 45

EXAMPLE: DETERMINING THE BEST OPTION FOR "COMBINATION STRATEGIES"

With large activities that may have unavoidable impacts to complex coral reef ecosystems, it is often difficult to identify one type of compensatory mitigation action that would be adequate to address all of the lost functions and services resulting from the unavoidable impacts. Often "combination strategies" may be required. An example of how to determine the best "combination strategy" can be found in the USACE Cost Effectiveness/Incremental Cost Analysis requirements for ecosystem restoration and compensatory mitigation in the Civil Works Planning program. Under the USACE Civil Works planning process, after all avoidance and minimization measures are incorporated to the extent practicable, USACE determines—with consultation with resource agencies—the targeted compensatory mitigation requirements for the unavoidable impacts in terms of functional improvement to the habitat. Through an incremental analysis focusing on how different compensatory mitigation strategies or combinations of strategies at the same site or multiple sites improve the habitat, USACE first determines which individual strategies are acceptable to address different functional losses. Then USACE looks at what combination of the acceptable strategies provide the best return on investment in terms of habitat created.

For example, a project that results in both biological and structural losses will likely require a combination of biological and structural mitigation. If multiple sites are proposed, USACE also evaluates and consults with other federal and state agencies to determine if the site locations are acceptable to address the functional losses from a perspective of a large coral reef system. In such an example, available alternatives may include increasing herbivore populations, improving water quality through removal of introduced sediments and nutrients, and removal of a nuisance algal species at Site A, and enhancement of coral structure to increase fish refugia and shore protection at Site B. These four activities would be compared individually, and in combination, to see which would provide the best option to address the individual functions that are needed to meet the compensatory mitigation requirement or target.

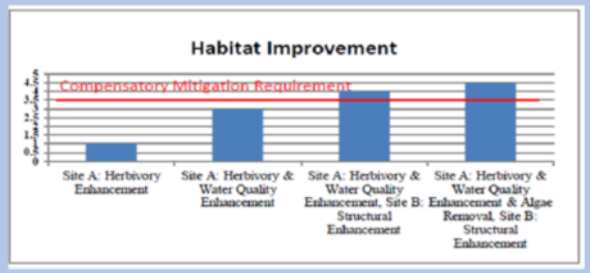

Figure 4: Example of Incremental Analysis comparison of compensatory mitigation alternatives. p. 70

Appendix I – Legal & Policy Summary

Table 5: Collection of federal laws and regulations that govern activities that may impact coral reefs.

Statutes, Regulations, and Policies	Implementing Agencies	Description
Abandoned Shipwreck Act 43 U.S.C. §§2101-2106	NPS	Requires states to protect and preserve abandoned shipwrecks in their waters for recreational and historical purposes, encouraging the creation of underwater parks to provide additional protection.
Antiquities Act/National Monuments 54 U.S.C. §320301	U.S. President	Authorizes the President to designate landmarks, structures, and "other objects of historic or scientific interest" as national monuments.
Clean Water Act 33 U.S.C. §§1251-1387 and it's implementing regulations.	EPA, USACE, and States/Territories (S/T)	The CWA prohibits the unauthorized discharge of pollutants into U.S. waters in an effort to restore and maintain physical, chemical and biological integrity of waters. Particular sections of note include: • CWA §301, the prohibition against unauthorized discharge, technology-based pollutant reduction requirements for industrial and municipal permittees. • CWA §303 water quality standards (WQS) program. States, tribes, and territories establish designated uses, water quality criteria, and an anti-degradation policy for waters within their jurisdictions, which are then submitted to EPA for review and approval or disapproval. Water quality standards are not "effective" for Clean Water Act purposes until approved or established by EPA. • CWA §309, EPA authority to initiate administrative and judicial enforcement of the prohibition against unpermitted discharge, and violations of discharge permits and dredged material permits.

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Table 6: Summary of state and territorial laws and regulations that govern activities that may impact coral reefs.[6]

Statutes, Regulations, and Policies	Implementing Agencies	Description
Commonwealth of the Northern Mariana Islands (CNMI)		
Coastal Resource Management Rules and Regulations (NMIAC 15-10)	Division of Coastal Resources Management	Chapter 15-10 primarily outlines permitting criteria and enforcement of permitting for projects in the coastal zone. The law states that "significant adverse impacts to reefs and corals shall be prevented" and there shall be no "destruction of reefs and corals not associated with permitted projects." (a) Lagoon and Reef Area of Particular Concern (APC); Management Standards. (b) Lagoon and Reef APC; Use Priorities. (1) General Lagoon and Reef APCs. (2) Lagoon and Reef APC; Managaha. (3) Lagoon and Reef APC; Anjota Island. (4) Lagoon and Reef APC; Coral Reefs. (f) Mitigation of Adverse Impact. Wherever practicable, adverse impact of the proposed project on the environment shall be mitigated. **http://www.cnmilaw.org/admincode/Title15/T15.html**
Coastal Resources Management Act of 1983 (2 CMC §§1501 et seq).	Division of Coastal Resources Management	This law established DCRM and outlines its purpose, including: manage ecologically significant resource areas for their contribution to marine productivity and value as wildlife habitats, and preserve the functions and integrity of reefs, marine meadows, salt ponds, mangroves, and other significant natural areas. **http://www.cnmilaw.org/pdf/public_laws/03/pl03-47.pdf**

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Appendix IV – Example Coral Transplantation Protocol (FWC)

Florida Fish and Wildlife Conservation Commission (FWC)
Coral and Octocoral Mitigation Relocation Recommendations

FWC Authorization Required

A Stock Collection and Release, Special Activity License (SAL) is required for all marine species relocation activities statewide, including but not limited to mitigation relocation activities. Information on the SAL Program and applications are available here: http://myfwc.com/license/saltwater/special-activities/

Definitions

For purposes of these Recommendations:

1) "Coral" is a fragment or colony of any species of the Order **Scleractinia**, Order **Antipitharia,** and Genus ***Millepora.***
2) "Interior waterways" are aquatic areas that have experienced physical restructuring of the shoreline (e.g., inner port harbors, marinas), or naturally occurring areas of low flushing (e.g., shallow bays, seawalls.)
3) "Listed or Proposed" are species that are state-listed pursuant to 68A-27, F.A.C., federally-listed pursuant to the Endangered Species Act, or proposed to be federally-listed pursuant to the Endangered Species Act.
4) "Octocoral" is a colony of any species of the Subclass **Octocorallia,** excluding encrusting octocorals (e.g., *Erythropodium caribaeorum, Briareum asbestinum*).
5) "Relocation" includes all activities that move coral or octocoral fragments or colonies from one place to another (e.g., transplanting, outplanting), including but not limited to moving them into and out of temporary holding locations (e.g., cache, staging, acclimation locations) or nurseries.

Coral and Octocoral Removal and Relocation

Removal and relocation of corals and octocorals to suitable sites in regionally appropriate densities (current or historical) should occur on all coastal projects where complete avoidance is not possible. These coral and octocoral removal and relocation activities should be considered as minimization of project impacts and not as compensatory mitigation. Coral and octocoral removal and relocation activities conducted to minimize project impacts can be accommodated in both Florida Uniform Mitigation Assessment Method (UMAM) and Habitat Equivalency Analysis (HEA) mitigation assessment methodologies, and would result in lower amounts of compensatory mitigation required for the project relative to the amount of mitigation that would be required if coral and octocoral removal and relocation was not performed. Compensatory mitigation should be required for all corals and octocorals that will not be removed and relocated.

Coral Removal and Relocation Activities

For purposes of these Recommendations, the FWC has determined corals that are ≥ 5 cm (measured as live tissue diameter - continuous live tissue patch with a diameter of 5 cm or greater) to be adult, although corals < 5 cm have been observed to be reproductive (Soong 1993, Lazar et al. 2011, Coastal Eco-Group Inc., 2015.) The FWC determination of adult coral size was not solely based on reproductive capabilities and additionally considered:

1) At the 5 cm size, corals have a sufficient number of polyps and colony structure to obtain a positive identification using standard surveying methodologies. Corals below this size would require different surveying methodologies.
2) Corals ≥ 5 cm are generally considered to be adults (Bak and Engel 1979, Miller et al. 2000), based on average growth rates (Vaughn 1915) and estimated age of sexual maturity (Connell 1973.)

The FWC recommends removal and relocation of all listed or proposed species of corals regardless of size, unless a coral displays signs of disease pursuant to the attached "FWC Coral and Octocoral Visual Health Assessment Protocols." The species that are currently listed or proposed are as follows:

- *Acropora cervicornis* (ESA and state listed as Threatened)
- *Acropora palmata* (ESA and state listed as Threatened)
- *Dendrogyra cylindrus* (ESA and state listed as Threatened)
- *Mycetophyllia ferox* (ESA and state listed as Threatened)
- *Orbicella annularis* (ESA and state listed as Threatened, formerly *Montastraea*)
- *Orbicella faveolata* (ESA and state listed as Threatened, formerly *Montastraea*)
- *Orbicella franksi* (ESA and state listed as Threatened, formerly *Montastraea*)

For coral species that are not listed or proposed, the FWC recommends removal and relocation of all adult corals (corals ≥ 5 cm in diameter), unless a coral displays signs of disease pursuant to the attached "FWC Coral and Octocoral Visual Health Assessment Protocols." Corals ≥ 5 cm in diameter can be successfully relocated. Brownlee (2010) successfully transplanted small corals (*Siderastrea siderea, Dichocoenia stokesii,* and *Porites porites*) with greater than 80 percent survivorship after 13 months. Monty et al. (2006)

What Have We Learned?

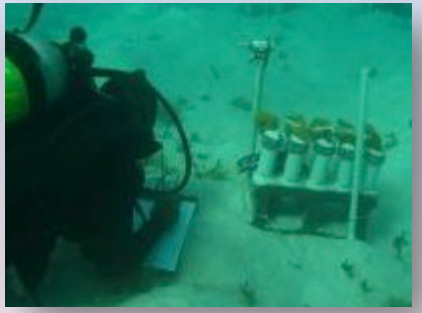
- Best Practice – **AVOID, AVOID, AVOID**
- Best Practice – coordinate early and often with all appropriate agencies
- Approaches to coral reef impacts have been case- by-case
- Variable successes – both in process, and ecological outcomes
- The Handbook is a useful tool for informing users, and has facilitated inter-agency communication
- Handbook process created a better understanding of the constraints and practices of different agencies

- USCRTF will continue to work toward a target of improved collaboration on consistent and practicable approaches

What's Next?

- USCRTF agencies sharing Handbook internally and externally
- Regional representatives encouraged to incorporate Handbook into outreach materials
- Living document – 5-year retrospective review/update; opportunity to add info, and changes
- WG will evaluate future steps and regional initiatives for USCRTF awareness and involvement



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