

SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

4055 FABER PLACE DRIVE, SUITE 201 NORTH CHARLESTON, SOUTH CAROLINA 29405 TEL 843/571-4366 FAX 843/769-4520

Toll Free 1-866-SAFMC-10 email: safmc@safmc.net web page: www.safmc.net

Dr. Michelle Duval, Chairman Charlie Phillips, Vice Chairman Robert K. Mahood, Executive Director Gregg T. Waugh, Deputy Executive Director

Summary Report: Habitat Protection and Ecosystem-Based Management Advisory Panel Meeting FWRI, November 17-18, 2015

The Habitat and Environmental Protection Advisory Panel met November 17-18, 2015 at FWRI in St. Petersburg, Florida. Issues addressed during the meeting included: 1) FEP II EFH Development; 2) Developing an Artificial Reef Policy Statement; 3) South Atlantic Alternative Energy Activities; 4) SAFMC Policy Statement on Energy Exploration and Development; 5) Online Tools Access and Training and State Sub-Panel Break-Out Sessions; 6) Panel Member Working Session – Updating Volume V FEP II Research Programs and Data Needs; 7) NMFS Ecosystem Based Management Policy; South Atlantic Climate Variability and Fisheries; and 8) South Atlantic Landscape Conservation Cooperative Regional Conservation Blueprint Development and Ecosystem Modeling.

Status Report on FEP II Development

Roger Pugliese provided a status report on the development of FEP II and EFH Update to be completed 2016, and the facilitated Webinars and in-person meetings supporting the process.

Developing a South Atlantic EFH Policy Statement on Artificial Reefs

Keith Mille and Jon Dodrill, FWC presented a review of the Florida Artificial Reef Program to complete program overviews provided previously for the States of North Carolina, South Carolina and Georgia. In combination these reviews set the stage for development of an outline and a subsequent Council EFH Policy Statement for use in FEP II.

RECOMMENDATION: Sub-Panel Chairs provided the following names to serve on the core drafting team many of which are members of the FEP II Artificial Reef Habitat Section writing team: NC: Jason Peters, SC: Robert M. Martore, GA: Eddie Leonard, FL: Keith Millie, and AP member Brian Hooker, BOEM.

South Atlantic Alternative Energy Activities

Brian Hooker BOEM representative on the Panel, provided an update and timeline for Atlantic coast Alternative Energy activities with a focus on South Atlantic States.

Energy Exploration and Development and Transportation Policy Statement

The Panel reviewed, revised and are providing for Council consideration and approval a redrafted EFH Policy Statement on Energy Exploration and Development. The initial redraft was provided by a team led by Jocelyn Karazsia, NMFS Habitat Conservation Division and Sub-Panel Chairs. This effort represents a significant refinement better addressing emerging energy related issues to ensure

conservation of EFH is considered in all stages of energy exploration, development and transportation in the South Atlantic region.

RECOMMENDATION:

Approve Redrafted EFH Policy Statement on Energy Exploration and Development (See Appendix 1).

Online Tools Access and Training and State Sub-Panel Break-Out Sessions

Tina Udouj led training sessions accessing SAFMC and regional partner ecosystem management and habitat conservation tools and online services. Concurrent sessions were conducted covering: identifying state priorities fishing and non-fishing activities impacting habitat and fisheries; State observations and priorities climate variability/Impact on Habitat and Fisheries; and state activities and opportunities for advancing citizen science

Panel Member Working Session – Updating Volume V FEP II Research Programs and Data Needs

Marcel Reichert, SCDNR set the stage for the FEP II Volume V development by providing an update and review of regional fishery independent research programs and data collection activities. Roger Pugliese reviewed research needs for council managed areas highlighting Resource and Monitoring Needs highlighted in the developing System Management Plans for Snapper Grouper MPAs and proposed Spawning SMZs. Pugliese also provided an overview of priority needs working with SECOORA to address linking oceanography and managed species, Essential Fish Habitat and Fisheries.

NMFS Ecosystem Based Management Policy

Jason Link, NMFS Senior Scientist for Ecosystem Management provided the Panel a review of the recently released NMFS Ecosystem-Based Management Policy.

South Atlantic Climate Variability and Fisheries

Jason Link, NMFS Senior Scientist for Ecosystem Management provided the Panel a review of the recently released final NOAA NMFS Climate Science Strategy. As a follow-up to the Strategy NMFS regions are engaging the Council in providing priorities for integration into a developing regional implementation plan.

South Atlantic Landscape Conservation Cooperative Regional Conservation Blueprint Development and Ecosystem Modeling

Roger Pugliese presented the Panel with an overview developed in cooperation with Rua Mordecai SALCC Science Director highlighting the latest activities on the Conservation Blueprint and SALCC support for developing an Ecosystem Modeling Suite for the South Atlantic region. Model efforts will support Council activities for ECBM and FEP II development and better represent the estuarine and marine systems necessary to refine the Conservation Blueprint.



SOUTH ATLANTIC FISHERY MANAGEMENT COUNCIL

4055 FABER PLACE DRIVE, SUITE 201 NORTH CHARLESTON, SOUTH CAROLINA 29405 TEL 843/571-4366 FAX 843/769-4520

Toll Free 1-866-SAFMC-10 email: safmc@safmc.net web page: www.safmc.net

Dr. Michelle Duval Charlie Phillips, Vice Chair Robert K. Mahood, Executive Director Gregg T. Waugh, Deputy Executive Director

POLICY FOR THE PROTECTION AND RESTORATION OF ESSENTIAL FISH HABITATS FROM ENERGY EXPLORATION AND DEVELOPMENT ACTIVITIES (Re-Draft November 30, 2015)

Introduction

This document provides guidance from the South Atlantic Fishery Management Council (SAFMC) regarding the protection of Essential Fish Habitat (EFH) and Habitat Areas of Particular Concern (EFH-HAPCs) from impacts associated with energy exploration and development activities as described in the "Threats to Marine and Estuarine Resources" section of this policy. This document also provides guidance regarding mitigation of those impacts, including avoidance, minimization and compensatory mitigation. The guidance is consistent with the overall habitat protection policies of the SAFMC as formulated and adopted in the Habitat Plan (SAFMC 1998a), the Comprehensive EFH Amendment (SAFMC 1998b), the Fishery Ecosystem Plan of the South Atlantic Region (SAFMC 2009a), Comprehensive Ecosystem-Based Amendment 2 (SAFMC 2011), and the various Fishery Management Plans (FMPs) of the Council.

For the purposes of policy development, the types of activities within the scope of this document include wind; oil and gas; methane hydrate mining; estuarine and marine hydrokinetic; liquefied natural gas (LNG) regasification, pipelines, and offshore and onshore facilities; and onshore power plants. The findings assess potential impacts to EFH and EFH-HAPCs posed by activities related to energy exploration and development in offshore and coastal waters, riverine systems and adjacent wetland habitats, and the processes that could improve those resources or place them at risk. The policies and recommendations established in this document are designed to avoid and minimize impacts and optimize benefits from these activities, in accordance with the general habitat policies of the SAFMC as mandated by law. The SAMFC may revise this guidance in response to changes in the types and location of energy exploration and development on habitat.

EFH At Risk from Energy Exploration and Development Activities

The SAFMC finds that:

- 1. Energy exploration or development has the potential to occur within or in proximity to EFH including but not limited to coral, coral reefs, and live/hardbottom habitat at all depths in the Exclusive Economic Zone (EEZ); EFH-HAPCs; or other special biological resources essential to commercial and recreational fisheries under SAFMC jurisdiction.
- 2. Energy development activities have the potential to cause impacts to a variety of habitats across the shelf and to nearshore, estuarine, and riverine systems and wetlands, including:
 - a) waters and benthic habitats in or near drilling and disposal sites, including those potentially affected by sediment movement and by physical disturbance associated with drilling activities and site development;
 - b) waters and benthic habitats in or near LNG processing facilities or other energy development sites,
 - c) exposed hardbottom (e.g. reefs, live bottom, deepwater *Lophelia* mounds) in shallow and deep waters,
 - d) coastal wetlands
 - e) coastal inlets and
 - f) riverine systems and associated wetlands; and
 - g) Intertidal oyster reefs
- 3. Certain offshore, nearshore, and riverine habitats are particularly important to the long-term viability of commercial and recreational fisheries under SAFMC management, and potentially threatened by oil, gas, wind and other energy exploration and development activities:
 - a) coral, coral reef and live/hardbottom habitat, including deepwater coral communities,
 - b) marine and estuarine water column habitat,
 - c) estuarine wetlands, including mangroves and marshes,
 - d) submerged aquatic vegetation (including seagrass),
 - e) waters that support diadromous fishes, and their spawning habitats
 - f) waters hydrologically and ecologically connected to waters that support EFH.
- 4. Siting and design of onshore receiving, holding, and transport facilities could have impacts on wetlands, shallow habitats such as oyster reefs and submerged aquatic vegetation, and endangered species' habitats if they are not properly located.
- 5. Sections of South Atlantic waters potentially affected by these projects, both individually and collectively, have been identified as EFH or EFH-HAPC by the SAFMC. Potentially affected species and their EFH under federal management include (SAFMC, 1998b):

- a) Summer Flounder (various nearshore waters, including the surf zone and inlets; certain offshore waters),
- b) Bluefish (various nearshore waters, including the surf zone and inlets),
- c) many snapper and grouper species (live hardbottom from shore to 600 feet, and for estuarine-dependent species such as gag grouper and gray snapper unconsolidated bottoms and live hardbottoms in the estuaries,
- d) Black Sea Bass (various nearshore waters, including unconsolidated bottom and live hardbottom to to 600 feet),
- e) penaeid shrimp (estuarine emergent habitat, offshore habitats used for spawning and growth to maturity, and waters connecting to inshore nursery areas, including the surf zone and inlets, hardbottom),
- f) coastal migratory pelagics (e.g., King Mackerel, Spanish mackerel) (sandy shoals of capes and bars, barrier island ocean-side waters from the surf zone to the shelf break inshore of the Gulf Stream; all coastal inlets),
- g) corals of various types and associated organisms (on hard substrates in shallow, mid-shelf, and deepwater),
- h) royal red shrimp (upper regions of the continental slope from 180 meters (590 feet) to about 730 meters (2,395 feet), with concentrations found at depths of between 250 meters (820 feet) and 475 meters (1,558 feet) over blue/black mud, sand, muddy sand, or white calcareous mud),
- i) rock shrimp (offshore terrigenous and biogenic sand bottom habitats from 18 to 182 meters in depth with highest concentrations occurring between 34 and 55 meters. This applies for all areas from North Carolina through the Florida Keys. Essential fish habitat includes the shelf current systems near Cape Canaveral, Florida which provide major transport mechanisms affecting planktonic larval rock shrimp),
- j) golden crab (a flat foraminferan ooze habitat; distinct mounds, primarily of dead coral; ripple habitat; dunes; black pebble habitat; low outcrop; and soft-bioturbated habitat),
- k) Pennatulacea (sea pens and sea pansies) muddy, silt bottoms from the subtidal to the shelf break, and deepwater corals and associated communities,
- Highly Migratory Species (areas identified as EFH for managed by the Secretary of Commerce (e.g., inlets and nearshore waters, including shark pupping and nursery grounds), and
- m) Diadromous species (riverine areas that support, including important prey species such as shad, herring and other alosines in addition to shortnose and Atlantic sturgeon).
- 6. Many of the habitats potentially affected by these activities have been identified as EFH-HAPCs by the SAFMC. Each EFH-HAPC, type of activity posing a potential threat and FMP is provided as follows:

EFH-HAPC	Activity	FMP
Nearshore hardbottom	LNG regasification, pipelines and power plants	Snapper Grouper
Coastal inlets	estuarine hydrokinetic; LNG regasification, pipelines,	Shrimp, Snapper Grouper
Spawning sites	estuarine hydrokinetic; LNG	Shrimp, Snapper Grouper

	regasification and pipelines; and power plants	
Manganese outcroppings on the Blake Plateau	oil and gas; methane hydrate mining; marine hydrokinetic; LNG regasification and pipelines	Snapper Grouper, Golden Crab
Pelagic and benthic Sargassum	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Snapper Grouper, Dolphin Wahoo
Inshore and nearshore areas to the ends of the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras, North Carolina; Hurl Rocks, South Carolina; and <i>Phragmatopoma</i> (worm reefs) reefs off the central coast of Florida and near shore hardbottom south of Cape Canaveral	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Coastal Migratory Pelagics
Atlantic coast estuaries with high numbers of Spanish mackerel and cobia from ELMR, to include Bogue Sound, New River, North Carolina; Broad River, South Carolina	estuarine hydrokinetic; LNG on- shore facilities; and power plants	Coastal Migratory Pelagics
Florida Bay, Biscayne Bay, Card Sound, and coral hardbottom habitat from Jupiter Inlet through the Dry Tortugas, Florida	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Spiny Lobster
Hurl Rocks (South Carolina); The <i>Phragmatopoma</i> (worm reefs) off central east coast of Florida; nearshore (0-4 meters; 0-12 feet) hardbottom off the east coast of Florida from Cape Canaveral to Broward County; offshore (5-30 meters; 15-90 feet) hardbottom off the east coast of Florida from Palm Beach County to Fowey Rocks; Biscayne Bay, Florida; Biscayne National Park, Florida; and the Florida Keys National Marine Sanctuary	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Coral, Coral Reef, and Live Hard/bottom
Council-designated Artificial Reef Special Management Zones (SMZs)	wind; oil and gas; methane hydrate mining; marine hydrokinetic; LNG regasification and pipelines	Snapper Grouper, Coastal Migratory Pelagics, Coral, Coral Reef, and Live Hard/bottom Habitat
Troughs and terraces intermingled with sand, mud, or shell hash at depths of 150 to 300 meters	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Snapper-grouper [golden tilefish]
Rock overhangs, rock outcrops, manganese-phosphorite rock slab formations, and rocky reefs	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	Snapper-grouper [blueline tilefish]
HAPCs designated for HMS species (e.g., sharks) in the South Atlantic region – exploration and development	wind; oil and gas; marine hydrokinetic; LNG regasification and pipelines	(NMFS FMP)
Deepwater Coral HAPCs are designated as Snapper Grouper EFH-HAPCs: Cape Lookout	wind; oil and gas; marine hydrokinetic; methane hydrate mining, LNG regasification and	Coral, Coral Reef, and Live Hard/bottom Habitat

Coral HAPC, Cape Fear Coral HAPC, Blake Ridge Diapir Coral HAPC, Stetson-Miami Terrace Coral HAPC, and Pourtalés Terrace Coral HAPC	pipelines	
Estuarine emergent and mangrove wetlands	estuarine hydrokinetic; LNG on- shore facilities; and power plants	Shrimp, Snapper Grouper
Seagrass	estuarine hydrokinetic; LNG on- shore facilities; and power plants	Shrimp, Snapper Grouper
State-designated nursery habitats (e.g., Florida Aquatic Preserves)	estuarine hydrokinetic; LNG on- shore facilities; and power plants	Shrimp, Snapper Grouper

7. Habitats likely to be affected by energy activities include many recognized in state level fishery management plans. Examples of these habitats include Strategic Habitat Areas (SHAs) such as those established by the State Marine Fisheries Commissions via FMPs, coastal habitat protection plans, or other management provisions. North Carolina SHAs, are a "subset of the overall system that includes a representative portion of each unique habitat so that overall biodiversity and ecological functions are maintained." NCMFC has established 20 units for Region 1; 67 units for Region 2; and 48 units for Region 3.

<u>Threats to Marine and Estuarine Resources from Energy Exploration and</u> <u>Development Activities</u>

The SAFMC finds that energy exploration and development activities threaten or potentially threaten EFH through the following mechanisms:

- 1. Direct mortality and displacement of organisms at and near dredging (Clarke et al. 2000), drilling or trenching sites , in addition to the installation of facilities and operation of such facilities .
- 2. Deposition of fine sediments (sedimentation) and drilling muds down-current from drilling, dredging, trenching, and/or backfilling sites. In a review of over 77 published studies that examine the effects of sedimentation and turbidity with 89 coral species, Erftemeijer et al. (2012) concluded increased sedimentation cause smothering and burial of coral polyps, shading, tissue necrosis, and unhealthy high concentrations of bacteria in coral mucus. Turbidity and sedimentation also reduce the recruitment, survival, and settlement of coral larvae.
- 3. Chronic elevated turbidity in and near drilling, dredging, trenching, and/or backfilling sites, which can interfere with foraging by fish and shrimp and abrade their gills and other soft tissues (Lindeman and Snyder 1999).
- 4. Direct mortality of eggs and larvae of marine organisms from water intake (Gallaway et al. 2007); post-larvae, juveniles and adults of marine and estuarine organisms due to spills from pipelines, or from vessels in transit near or close to inlet areas.

- 5. Alteration of long-term shoreline migration patterns with complex ecological consequences due to the placement of facilities (nearshore/offshore.)
- 6. One of the risks associated with horizontal directional drilling (HDD) is the escape of drilling mud into the environment as a result of a spill, collapse of the drill hole or the rupture of mud to the surface, which is commonly known as a "frac-out". A frac-out is caused when excessive drilling pressure results in drilling mud leaching vertically toward the surface. Because HDD activities occur in proximity to sensitive habitats (e.g., seagrass, coral), burial of habitat could result from "frac-outs" associated with HDD.
- 7. Permanent conversion of soft bottom habitat to artificial hardbottom habitat through installing a hard linear structure (i.e., a pipe covered in articulated concrete mats) can occur and the ecological effects of this habitat conversion are not well-understood.
- 8. Impacts to benthic resources from placement and shifting of anchors (Rogers and Garrison 2001), cables (Messing 2011; Gilliam and Walker 2012), pipelines, and other types of direct mechanical damage such as damage from deployment of instrumentation (e.g., Acoustic Doppler Current Profiles).
- 9. Alterations in amount and timing of riverflow and significant blockage or reduction in area of critical spawning habitat resulting from damming or diverting rivers
- 10. Alteration of community diversity, composition, food webs and energy flow due to addition of structure. (Sammarco, Paul W. 2014; Claisse et al. 2014)
- Fish behaviour and health may be negatively impacted by anthropogenic sound depending on sound pressure levels and the duration of the sound producing activity. (Popper et al 2014)
- 12. Operation of power plants can alter water quality The greatest risk to aquatic and estuarine ecosystems posed by power plant cooling systems is continuous exposure to sublethal stressors, such as changes in water quality, rather than the abrupt mortality of large numbers of organisms due to impingement and entrainment (Clark and Brownell 1973; Laws 2000; Kulkarni et al. 2011). Water quality (inclusive of temperature and salinity) is known to be a driver of fine scale spatial variation in nearshore fish communities, e.g., in Biscayne Bay (Serafy et al. 1997; 2003; 2005; Faunce and Serafy 2007).
- 13. The interactions among all effects (including lethal and sub-lethal; direct and indirect; short-term, long-term, and cumulative) affect the magnitude of the overall impacts. Such interactions may result in a scale of effect that is

multiplicative rather than additive. The effects of those interactions are largely unstudied and almost completely unknown.

SAFMC Policies for Energy Exploration and Development Activities

The SAFMC establishes the following policies and best management practices (BMPs) related to energy exploration and development activities and related projects, to clarify and augment the general policies already adopted in the Habitat Plan and Comprehensive Habitat Amendment (SAFMC 1998a; SAFMC 1998b; SAFMC 2009a). The following is intended to include existing relevant guidance documents (e.g., *Alternative Energy Environmental Information Needs* (USDOI, MMS 2007a):

General Policies:

- 1. Projects should avoid, minimize, and where possible offset damage to EFH, EFH-HAPCs, and SHAs. This should be accomplished, in part, by integrating the best available and least damaging technologies into the project design.
- 2. Projects should avoid intersection or overlap with Allowable Fishing Areas within the Deepwater Coral HAPCs.
- 3. All facilities associated with energy exploration and development, should be designed to avoid or minimize to the maximum extent practicable impacts on coastal ecosystems and sharing systems.
- 4. Projects shall comply with existing standards and requirements regulating domestic and international transportation of energy products including regulated waste disposal and emissions which are intended to minimize negative impacts on and preserve the quality of the marine environment.
- 5. Open-loop LNG processing facilities should be avoided in favor of closed-loop systems. Water intake associated with closed-loop should be minimized and the effects to fishery resources should be determined through baseline studies and project monitoring.
- 6. Pilot scale projects should not occur in areas where full-scale efforts are predicted to be environmentally unacceptable (e.g., MPAs, CHAPCs, Spawning SMZs).

EFH Review, Administrative Policies, Licensing Policies and Best Management Practices:

- 1. EFH Assessments prepared for energy-related projects include the mandatory components set forth in 50 CFR Part 600, Subpart K:
 - A description of the proposed action;

- An analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage;
- The Federal agency's views regarding the effects of the action on EFH; and
- Proposed mitigation
- 2. Projects requiring expanded EFH consultation should provide a full range of alternatives, along with assessments of the relative impacts of each on each type of EFH, EFH-HAPC, and SHAs. Expanded EFH consultations allow NMFS and a Federal action agency the maximum opportunity to work together in the review of an activity's impact on EFH and the development of EFH conservation recommendations. Expanded consultation procedures must be used for Federal actions that would result in substantial adverse effects to EFH. Federal action agencies are encouraged to contact NMFS at the earliest opportunity to discuss whether the adverse effect of a proposed action makes expanded consultation appropriate.
- 3. Impact evaluations should include quantitative assessments for each habitat based on recent scientific studies, habitat characterizations, and the best available information. All EFH assessments should be based upon the best available science, be conservative, and follow precautionary principles as developed for various Federal and State policies. EFH Assessments are produced with information gathered from the best available technologies to map and characterize project sites (e.g., see Vinick et al. 2012). The methods used for habitat mapping and characterization work should reflect input from resource trustees and be performed with experienced personnel.
- 4. Existing transportation infrastructure (e.g., existing cables or pipelines) should be utilized wherever practicable in order to avoid or minimize environmental impacts.
- 5. The effects of sound from proposed projects on fish behaviour and health should be considered in EFH Assessments.
- 6. Compensatory mitigation should not be considered until avoidance and minimization measures have been duly demonstrated. Compensatory mitigation should be required to offset losses to EFH, including losses associated with temporary impacts, and should take into account uncertainty and the risk of the chosen mitigation measures inadequately offsetting the impacts. Mitigation should be local, "up-front," and "in-kind," and include long-term monitoring to assess and ensure the efficacy of the mitigation program selected.
- 7. Modelling efforts should fully characterize assumptions applied and disclose any potential biases that may affect results

- 8. Determination of the physical and chemical oceanographic and meteorological characteristics of the area should be done through field studies by lead action agencies, cooperating agencies, academics, or the applicant. These characteriztics include but are not limited to, on-site direction and velocity of currents and tides, sea states, temperature, salinity, water quality, wind storms frequencies, and intensities and icing conditions. Studies should also include a detailed characterization of seasonal surface currents and likely spill trajectories. Such studies must be conducted prior to approval of any Exploration Plan or Development and Production Plan in order to have adequate information upon which to base decisions related to site-specific proposed activities.
- 9. The Environmental Impact Statement (EIS), Environmental Assessment (EA) or EFH Assessment for any outer continental shelf oil and gas ILease sSale should address impacts, if any, from activities specifically related to natural gas production, safety precautions required in the event of the discovery of "sour gas" or hydrogen sulfide reserves and the potential for cross-shelf transport of hydrocarbons to nearshore and inshore estuarine habitats by Gulf Stream spin-off eddies. The EIS, EA, or EFH Assessment should also address the development of contingency plans to be implemented if problems arise due to oceanographic conditions or bottom topography, the need for and availability of onshore support facilities in coastal areas, and an analysis of existing facilities and community services in light of existing major coastal developments.
- 10. License or permit decisions for construction projects that penetrate or attach to the seabed should be based on geotechnical studies completed to ensure that the geology of the area is appropriate for the construction method and that geological risks are appropriately mitigated.
- 11. Adequate spill containment and clean-up equipment shall be maintained for all development facilities, and, the equipment shall be available on-site or located so as to be on-site within the landing time trajectory.
- 12. Bonds must be required and must be adequate to assure that resources will be available for unanticipated environmental impacts, spill response, clean-up and environmental impact assessment.
- 13. Exploration and development activities shall not disrupt or impede known migratory patterns of endangered and threated species, nor shall they disrupt or impede the breeding or nesting seasons of endangered and threatened species. This may necessitate the imposition of seasonal, spatial, or other constraints on exploration and development activities.
- 14. Licenses and permits clearly should describe required monitoring before, during and after the project in sufficient detail to document pre-project conditions and the initial, long-term, and cumulative impacts of the project on EFH. Monitoring and,

if nessary, for adaptive management shall be required for the life of the project . The monitoring methods should reflect input from resource trustees and be conducted by experienced personnel.

- 15. Third party environmental inspectors shall be required on all projects to provide for independent monitoring and permit compliance.
- 16. Hydrotest chemicals that may be harmful to fish and wildlife resources shall not be discharged into waters of the United States.
- 17. Licenses or permits shall require all project-related work vessels that traverse any reef system or sensitive habitat to be equipped with standard navigation aids, safety lighting and communication equipment. Equipment such as tow lines should be secured during transit. U.S. Coast Guard automated identification system (AIS) requirements must be followed.
- 18. Any anchor placement should completely avoid corals and be visually verified by diver or remote camera. In addition, measures to avoid anchor sweep should be developed and implemented.
- 19. Appropriate buffers should be designated around sensitive marine habitats.
- 20. A contingency plan should be required to address catastrophic blowouts or more chronic material losses from LNG facilities, including trajectory and other impact analyses and remediation measures and responsibilities.
- 21. Licenses and permits shall require the development of resource sensitivity training modules specific to each project, construction procedures, and habitat types found within the project impact area. This training should be provided to all contractors and sub-contractors that are anticipated to work in or adjacent to areas that support sensitive habitats.

References

- Azila, A., and Chong, V. 2010. Multispecies impingement in a tropical power plant, Straits of Malacca. Marine Environmental Research, 70, 12.
- Bamber, R. and Turnpenny, A. 2012. Entrainment of organisms through power station cooling water systems. *In* S. Rajagopal, H. A. Jenner, & V. P. Venugopalan (Eds.), Operational and Environmental Consequences of Large Industrial Cooling Water Systems. London: Dordrecht Heidelberg.
- Bedri, Z., Bruen, M., Dowley, A., and Masterson, B. 2013. Environmental consequences of a power plant shut-down: A three-dimensional water quality model of Dublin Bay. Marine Pollution Bulletin, 71, 9.
- Claisse, Jeremy T., Daniel J. Pondella II, Milton Love, Laurel A. Zahn, Chelsea M. Williams, Jonathan P. Williams, and Ann S. Bull. 2014. Oil platforms off California are among the most productive marine fish habitats globally. PNAS 111(43): 15462–15467.
- Clark, J., and Brownell, W. 1973. Electric power plants in the coastal zone: environmental issues. Special Publication (Vol. No. 7): American Littoral Society.
- Clarke, D., Engler, R., and Wilber, D. 2000. Assessment of potential impacts of dredging operations due to sediment resuspension. U.S. Army Corps of Engineers, Engineering Research and Development Center ERDC TN-DOER-E9. 14pp.
- Dolan, T. 2012. A case study of Turkey Point Nuclear Generating Station: Perception and Power in Environmental Assessment. University of Miami, Miami, FL.
- Erftemeijer, P.L.A., B. Riegle, B.W. Hoeksems, and P.A. Todd. 2012. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64:1737—1765.
- Faunce, C., and Serafy, J. 2007. Nearshore habitat use by gray snapper (*Lutjanus griseus*) and bluestriped grunt (*Haemulon sciurus*): environmental gradients and ontogenetic shifts. Bulletin of Marine Science, 80(3), 17.
- Gallaway, B., Gazey, W., Cole, J., and Fechhelm, R. 2007. Estimation of potential impacts from offshore liquefied natural gas terminals on red snapper and red drum fisheries in the Gulf of Mexico: An alternative approach. Transactions of the American Fisheries Society 136: 355-677.
- Gilliam, D.S., and Walker, B.K. 2012. Shallow-water Benthic Habitat Characterization and Cable/Benthic Activity Impact Assessment for the SFOMF, 75pp. (Prepared for the Department of the Navy)

- Khamis, I., and Kavvadias, K. 2012. Trends and challenges toward efficient water management in nuclear power plants. Nuclear Engineering and Design, 248, 6.
- Kulkarni, V., Naidu, V., and Jagtap, T. 2011. Marine ecological habitat: A case study on projected thermal power plant around Dharamtar creek, India. Journal of Environmental Biology, 32, 6.
- Laws, E. 2000. Aquatic pollution: an introductory text (3rd ed.). New York, NY: John Wiley & Sons Inc.
- Lindeman, K., and Snyder, D. 1999. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial by dredging. Fishery Bulletin 97:508-525.
- Madden, N., Lewis, A., and Davis, M. 2013. Thermal effluent from the power sector: an analysis of once-through cooling system impacts on surface water temperature. Environmental Research Letters 8, 8.
- Mayhew, D., Jensen, L., Hanson, D., and Muessig, P. 2000. A comparative review of entrainment survival studies at power plants in estuarine environments. Environmental Science & Policy, 3, 6.
- Messing, C.G. 2011. Qualitative Assessment of the Gateway Cable Route. Nova Southeastern University Oceanographic Center. Dania Beach, Florida. 7pp. (Prepared for the Department of the Navy
- Rago, P., Fritz, E. and Murarka, I. 1983. Assessing impacts of power plants on fish populations: a general strategy. Environmental Monitoring and Assessment 3, 16.
- Rogers, C. and V. Harrison. Ten years after the crime: lasting effects of damage from a cruise ship anchor on a coral reef in St John, U.S. Virgin Islands. Bulletin of Marine Science 69(2): 793-803.
- SAFMC. 1998a. Final Habitat Plan for the South Atlantic region: Essential Fish Habitat requirements for fishery management plans of the South Atlantic Fishery Management Council. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, SC 29407-4699. 457 pp. plus appendices.
- SAFMC. 1998b. Final Comprehensive Amendment Addressing Essential Fish Habitat in Fishery Management Plans of the South Atlantic Region. Including a Final Environmental Impact Statement /Supplemental Environmental Impact Statement, Initial Regulatory Flexibility Analysis, Regulatory Impact Review, and Social Impact Assessment/Fishery Impact Statement. South Atlantic Fishery Management Council, 1 Southpark Cir., Ste 306, Charleston, SC 29407-4699. 136pp.

- SAFMC. 2009a. Fishery Ecosystem Plan of the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Ste 201, North Charleston, SC 29405.
- SAFMC (South Atlantic Fishery Management Council). 2009b. Comprehensive Ecosystem-Based Amendment 1 for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201; North Charleston, SC 29405.
- SAFMC (South Atlantic Fishery Management Council). 2011. Comprehensive Ecosystem-Based Amendment 2 for the South Atlantic Region. South Atlantic Fishery Management Council, 4055 Faber Place Drive, Suite 201; North Charleston, SC 29405.
- Sammarco, Paul W. 2014. New Invasive Marine Species Colonizing Energy Platforms in the Northern Gulf of Mexico: Verification, and Examination of Spread. US Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2015-005. 72 pp
- Serafy, J., Faunce, C., & Lorenz, J. 2003. Mangrove shoreline fishes of Biscayne Bay, Florida. Bulletin of Marine Science, 72(1), 19.
- Serafy, J., Lindeman, K., Hopkins, T., and Ault, J. 1997. Effects of freshwater canal discharge on fish assemblages in a subtropical bay: field and laboratory observations. Marine Ecology Progress Series, 160, 11.
- Serafy, J., Luo, J., Valle, M., Faunce, C., Teare, B., D'Alessandro, E., et al. 2005. Shoreline Fish Community Visual Assessment: First Cumulative Report. Shoreline Fish Community Visual Assessment (pp. 49). Miami, FL: NOAA/NMFS/SEFSC.
- Roffman, A., and Roffman, H. 1973. Effects of salt water cooling tower drift on water bodies and soil. Water Air and Soil Pollution(2), 14.
- Safari, I., Walker, M. E., Hsieh, M., Dzombak, D., Liu, W., Vidic, R. D., et al. 2013. Utilization of municipal wastewater for cooling in thermoelectric power plants. Fuel, 111, 10.
- Sovacool, B and Sovacool, K. 2009. Identifying future electricity-water tradeoffs in the United States. Energy Policy, 37, 10.
- Talbot, J. 1979. A review of potential biological impacts of cooling tower salt drift. Atmospheric Environment, 13, 10.
- Vinick, C., Messing, C., Walker, B., Reed, J., and Rogers, S. 2012. Siting study for a hydrokinetic energy project located offshore southeastern Florida: Protocols for

survey methodology for offshore marine hydrokinetic energy projects. 100pp. http://nsuworks.nova.edu/occ_facreports/37

- USDOI, MMS. 1990. Atlantic Outer Continental Shelf, Final Environmental Report on Proposed Exploratory Drilling Offshore North Carolina, Vols. I-III.
- USDOI, MMS. 1993a. North Carolina Physical Oceanography Literature Study. Contract No. 14-35- 0001-30594.
- USDOI, MMS. 1993b. Benthic Study of the Continental Slope Off Cape Hatteras, North Carolina. Vols. I-III. MMS 93-0014, -0015, -0016.
- USDOI, MMS. 1993c. Coastal North Carolina Socioeconomic Study. Vols. I-V. MMS 93-0052, -0053, -0054, -0055, and -0056.
- USDOI, MMS. 1994. North Carolina Physical Oceanographic Field Study. MMS 94-0047.
- USDOI, MMS. 2007a. Michel, J., Dunagan, H., Boring, C., Healy, E., Evans, W., Dean, J.M., McGillis, A. and Hain, J. 2007. Worldwide Synthesis and Analysis of Existing Information Regarding Environmental Effects of Alternative Energy Uses on the Outer Continental Shelf. U.S. Department of the Interior, Minerals Management Service, Herndon, VA, MMS OCS Report 2007-038. 254 pp.
- USDOI, MMS 2007b. Michel, J. and Burkhard, E. 2007. Workshop to Identify Alternative Energy Environmental Information Needs: Workshop Summary. U.S. Department of the Interior, Minerals Management Service, Herndon, VA, MMS OCS Report 2007-057. 50 pp. + appendices.