



MANAGEMENT NEEDS IDENTIFIED BY THE NORTH CAROLINA COASTAL HABITAT PROTECTION PLAN

BY

North Carolina Division of Marine Fisheries
Department of Environment and Natural Resources
3441 Arendell Street, Morehead City, NC 28557

2010 Update



CHPP Management Needs Report (2010 Update)

With passage of the Fisheries Reform Act of 1997, the North Carolina General Assembly established the Coastal Habitat Protection Plan (CHPP) program within the North Carolina Department of Environment and Natural Resources (DENR). The Act (General Statute 143B-279.8) requires preparation of a Coastal Habitat Protection Plan, the goal of which is “long-term enhancement of coastal fisheries associated with each coastal habitat.” The divisions of Marine Fisheries (DMF), Water Quality (DWQ), and Coastal Management (DCM) were designated as the lead agencies for the development of the CHPP document. Specifically, the CHPP is to:

- Describe fisheries habitats and their biological systems;
- Evaluate the functions, fisheries’ values, status, and trends in the habitats;
- Identify existing and potential threats to the habitats and impacts on coastal fishing; and
- Recommend actions to protect and restore the habitats.

To fully attain the CHPP goal, numerous management needs were identified by the CHPP Development Team and suggested in the 2010 update of the CHPP (Deaton et al. 2010). The management needs noted by italics in the 2005 CHPP (Street et al. 2005) were addressed to some degree during 2005-2010. Some needs were considered accomplished (omitted in this report), whereas others were considered ongoing with or without progress. Emerging management needs were new or significantly modified from their 2005 versions and may or may not be refined and adopted as actions in subsequent CHPP implementation plans. Discontinued needs included those recommendations from Street et al. (2005) that were omitted from the chapter update for various reasons (i.e., included in another chapter as part of primary discussion, need discontinued, considered minor, redundant, or too general). The needs are organized by the following topic areas, with page number references.

STATUS AND TRENDS

Designations

1. *Dystrophic waters should be classified as “swamp water” for the purpose of water quality standards.* **The DWQ continues to evaluate coastal streams for swamp water classification (see Section 2.1.1. “[Creeks and rivers](#)” for context).**
2. *Identify and designate Anadromous Fish Nursery Areas for consideration in permit decisions.* See Section 2.3.5. “[Designations](#)” for context.
3. *Designate hard bottom within State Natural Heritage Areas as Strategic Habitat Areas for consideration of additional protection under the recent federal Executive Order 13158, which calls for strengthening and expansion of Marine Protected Areas in the United States or through additional state actions specifically designed to protect those sites (Street et al. 2005).* **Strategic Habitat Area assessments have not progressed to regions with significant hard bottom resources. The SAFMC identified several Marine Protected Areas (MPAs) in offshore federal waters through Amendment 14 to the South Atlantic Snapper Grouper Fishery Management Plan. The NMFS issued a final rule to implement Amendment 14 officially creating eight Type II MPAs in which fishing for or possession of snapper-grouper species are prohibited, but other types of fishing, such as trolling, are allowed. No specific progress with regard to state action. However, the MFC has the authority to establish no-take areas over nearshore hard bottom in North Carolina state waters. See Section 7.3.4. “[Designated areas](#)” for more information.**

Distribution and status of habitat

1. *There is also a need to increase the coverage of continuous water quality monitoring stations.* **Some progress has been made on deployment of continuous water quality monitoring stations by state authorities (see Section 2.3. “[Status and trends](#)” for more information).**

2. *Given adequate monitoring, there remains a need to develop water quality standards that more accurately reflect conditions necessary for supporting fishery species and communities (refer to the “Water quality degradation” subsections of the threats section for more discussion). See Section 2.3.1.3. [“Assessment needs relative to aquatic life”](#) for context.*
3. *New technology should be investigated that will further reduce time of mapping and enhance mapping products. See Section 3.3.1. [“Status of shell bottom habitat”](#) for context.*
1. *Re-mapping of the bottom to accurately evaluate changes in distribution and density of oysters. In the future, change analysis in a subset of areas remapped by DMF, particularly where major changes are suspected, is needed to assess trends in this habitat. **Neither base map nor repeat mapping is complete. However, the bottom mapping program has made significant progress (see Section 3.1.4. [“Distribution”](#) for context).** Although there has been no reported decline in spatfall in the southern coastal region of North Carolina (R. Carpenter/DMF, pers. com., 2002), more information is needed to determine trends in spatfall in this area over time. See Section 3.3.1. [“Status of shell bottom habitat”](#) for context.*
4. *Local and regional monitoring programs should eventually be coordinated with a comprehensive SAV monitoring program. See Section 4.3. [“Status and trends”](#) for more information. Conduct regular monitoring of SAV beds to assess their changing distribution and condition (Street et al. 2005). The mapping was coordinated through the Albemarle-Pamlico National Estuary Program (APNEP), in partnership with multiple agencies. A multi-agency MOU was signed in 2006; state and federal funds were allocated for SAV aerial photography in 2007; sampling protocols were developed in 2006-2007, and image acquisition was completed in 2007-2008. However, the imagery has not been classified due to loss of staff position. See Section 4.1.4. [“Distribution”](#) for more information. The DMF and NERR will initiate SAV monitoring of sentinel sites. Initial concepts have been discussed at the APNEP SAV Partners meetings. Monitoring activities are dependent on identification of funding; a multi-agency team of SAV researchers (NOAA, ECU, and NCSU) submitted a CRFL proposal for testing long term field monitoring of SAV in August 2008, but no SAV monitoring plan has been established. NC-NERR sites may be included in monitoring sites if the project is selected for funding. See Section 4.3. [“Status and trends”](#) for more information. The results of this new SAV monitoring research should be evaluated for broader application in the estuary as a whole. See Section 4.3. [“Status and trends”](#) for more information. Monitoring should focus on SAV in the most vulnerable locations (close to land where water quality degradation and shoreline development impacts greatest, edge of southern and western distribution range) and in areas of current or former importance to bay scallops. See Section 4.3.1. [“Status of submerged aquatic vegetation habitat”](#) for more information.*
2. *Accurate and up-to-date mapping of DCM wetland types is needed for North Carolina. Refer to Section 5.1.4. [“Distribution”](#) for a discussion of the current mapping available and potential improvements. The re-mapping of headwater streams should be used to identify headwater wetlands as a new category for tracking impacts and restoration work. See Section 5.3.4.2. [“Non-regulatory”](#) for context.*
5. *An extensive and regular survey of nearshore hard bottom distribution and quality is needed to better evaluate status and trends. See Section 7.3.1. [“Status of hard bottom habitat”](#) for context.*

Restoration, enhancement, and mitigation

1. *The CHPP agencies (DMF, DCM, DWQ, WRC) and EEP should meet to determine how SHA and Local Watershed Planning (LWP) methodologies complement and contribute to complementary goals of the North Carolina Department of Natural Resources. See Section 2.3.4. [“Water column restoration and enhancement”](#) for context. Location of Strategic Habitat Areas should also be coordinated with*

LWPs to facilitate the linkage between watershed improvement efforts and management of sensitive aquatic habitats (i.e., SAV, oysters) downstream. See Section 5.3.3.3. "[Evaluating mitigation/restoration efforts](#)" for context.

2. *More incentives are needed to generate conservation/restoration opportunities in areas with the most ecological benefit of restoration. See Section 2.3.5. "[Designations](#)" for context.*
3. *An improved mitigation policy for shell bottom is needed to identify mitigation needs, increase mitigation efficiency, and reduce project timelines. See Section 3.3.3.3. "[For mitigation](#)" for context. Require compensatory mitigation where impacts to shell bottom or SAV are unavoidable. Initiate restoration programs to recoup and/or enhance lost shell bottom or SAV habitat (Street et al. 2005). DWQ worked with DOT on a SAV habitat restoration and mitigation project in the Currituck Sound. Restoration work has been completed and monitoring continues to assess the success of the project. The EEP is developing a non-traditional crediting system that could be employed in mitigating the permitted loss of shell bottom or SAV to water-dependent development. EEP has initiated internal research to determine the functional value of SAV restoration. EEP will review the DCM permitting requirements involving impacts to SAV. EEP will incorporate SAV restoration recommendations into the non-traditional mitigation strategy to be proposed to the PACG in the following year. See Section 3.3.3.3. "[For mitigation](#)" and 4.3.3. "[Submerged aquatic vegetation restoration and enhancement](#)."*
4. *Appropriate DENR staff should continue to participate in collaborative efforts to plan, develop, and monitor the biological effectiveness of oyster, SAV, and wetland enhancement and restoration activities. See Section 3.3.3.4. "[Planning efforts](#)," Section 4.3.3. "[Submerged aquatic vegetation restoration and enhancement](#)," and Section 5.3.4.2. "[Non-regulatory](#)" for context. Studies show the importance of considering optimal locations for habitat restoration/creation projects. See Section 5.4.2.5. "[Corridor and connectivity](#)" for context.*
 - a. *Developing an overall strategy for shell bottom restoration as the effort expands. There is no overall strategy for shell bottom restoration. However, there are somewhat coordinated planning efforts directing oyster restoration activities (see Section 3.3.3.4. "[Planning efforts](#)"). Creation of additional Shellfish Management Areas to reduce habitat damage and enhance spatfall of oysters and clams in areas where hand-harvesting activity is intense. Additional Research Sanctuaries have been created south of Cape Lookout (see "Section 3.3.3.2. "[For ecosystem enhancement](#)").*
 - b. *The APNEP SAV Partnership is developing an action plan for SAV restoration activities in North Carolina and southeastern Virginia, with guidance from the Chesapeake Bay experience (Orth et al. 2002). The plan for SAV restoration should also be coordinated with other habitat restoration plans and activities. The SAV restoration action plan should include restoration goals based on potential habitat maps and projected water quality improvements. See Section 4.3.3. "[Submerged aquatic vegetation restoration and enhancement](#)" for more information.*
 - c. *Implement comprehensive planning for wetland preservation and restoration that includes dechannelization of streams, restoration of wetland hydrology, use of alternative drainage techniques, on-site BMPs, and outreach to private owners of wetland resources (Street et al. 2005). No specific progress. However, there are projects conducting comprehensive and proactive watershed restoration on lands managed for conservation (see Section 5.3.4.2. "[Non-regulatory](#)"). Restoring altered wetland areas within conservation lands would be more readily compatible with existing uses than analogous efforts on other private lands. See Section 5.3.4.2. "[Non-regulatory](#)" for context.*
5. *Headwater wetlands restoration should be tracked separately from other riparian wetlands because of their vulnerability and relative importance in denitrification. See Section 5.2.1. "[Ecosystem enhancement](#)" for context. Give higher priority for headwater wetlands in preservation/restoration*

efforts (Street et al. 2005). The coastal headwater stream mitigation guidance has been modified and finalized by the Corps of Engineers and DWQ and is now being implemented across the outer coastal plain. In addition, including headwater wetlands as an “in-kind” mitigation type will put this hydrogeomorphic class in the accounting system (see Section 5.3.3.3. “[Evaluating mitigation/restoration efforts](#)”).

6. Construct artificial refugia (no-take artificial reefs) or designate existing artificial reefs as refugia (no-take, Marine Protected Areas) to enhance fisheries productivity (Street et al. 2005). **No specific progress.** See Section 7.3.3. “[Hard bottom enhancement](#)” for more information. Construct numerous small complex sites surrounded by open areas to mimic natural nearshore hard bottoms and maximize habitat utilization at a shallow, nearshore site near Cape Lookout (Street et al. 2005). **No specific progress.** See Section 7.3.4. “[Designated areas](#)” for more information.

Status of associated fishery species

1. Fishery-independent sampling on oyster reefs using appropriate sampling gear to monitor juvenile and adult fish abundance in shell bottom. **No specific progress.** However, the DMF Resource Enhancement Section is planning a sampling program to track juvenile fish abundance in and around oyster sanctuaries (G. Bodnar/DMF, pers. com., February 2009). See Section 3.3.2. “[Status of associated fishery stocks](#)” for context. Need more information on the status of hard clams, black drum, and other fishery and resident non-fishery species (i.e., oyster toadfish) as indicators of shell bottom conditions. Due to the limitations of using fisheries-dependent data (landings data) to indicate stock trends, fisheries-independent data should be collected for these species to develop independent indices. **No specific progress.** However, the aforementioned DMF sampling program will address this management need as well. See Section 3.3.2. “[Status of associated fishery stocks](#)” for context.
2. Conduct additional juvenile fish sampling stations in SAV habitat (Street et al. 2005). **No specific progress.** However, the DMF Resource Enhancement Section is planning a sampling program to track juvenile fish abundance in and around oyster sanctuaries (G. Bodnar/DMF, pers. com., February 2009). The sampling will be conducted in SAV, shell bottom, and soft bottom habitats.
3. More data is needed for evaluating the stock status of species in the reef fish complex off North Carolina. See Section 7.3.2. “[Status of associated fishery stocks](#)” for context.
4. Expanding temporal and spatial sampling of juvenile fish to provide additional information on trends in juvenile fish utilization of soft bottom and other habitats, especially summer and fall spawning species, which are generally not present at existing sampling stations during May and June. See section 6.2.5.3. “[Nursery](#)” for context.

THREATS AND MANAGEMENT NEEDS

Boating and other off-road activities

1. Clearly marked navigation channels, boater training/licensing, and SAV education materials would help boaters avoid SAV beds. See Section 4.4.1.2. “[Boating activity](#)” for more information. Periodically assess the level of prop scar damage on SAV habitats. In areas where boating activity is found to cause significant SAV impacts, navigational markers should be installed to clearly delineate navigational channels to be used or persistent SAV beds to avoid (Street et al. 2005). **No specific progress.** See Section 4.4.1.2. “[Boating activity](#)” for more information.
2. Increase public awareness of boat wakes on wetland shoreline (Street et al. 2005). **No specific progress** (see Section 5.4.1.7. “[Boating activity](#)”). Amend “No Wake” zone authority to include consideration for erosion along normally low-energy shorelines (Street et al. 2005). **No specific**

progress (see Section 5.4.1.7. "[Boating activity](#)").

3. *The National Park Service should continue to restrict ORV beach access to areas that will not negatively influence soft bottom fauna. See section 6.4.1.3. "[Off-road vehicles](#)" for context.*

Channelization

1. *Canals classified as fish nursery habitat should receive the same consideration in permit decisions as naturally occurring designated areas. See Section 2.4.1.3. "[Channelization and drainage](#)" for context.*
2. *De-snagging of woody debris in AFSAs should be conducted in accordance with, "Stream Obstruction Removal Guidelines," published by the American Fisheries Society in 1983. Guidelines for woody debris removal in streams are also provided at http://www.americanwhitewater.org/content/Wiki/stewardship:woody_debris. See Section 2.4.1.3. "[Channelization and drainage](#)" for context.*
3. *Modify EMC regulations to discourage or prevent maintenance of previously un-navigable and re-naturalized channels in Anadromous Fish Spawning Areas and Primary Nursery Areas. See Section 5.4.1.4. "[Channelization and drainage](#)" for context.*

Cumulative impacts

6. *To facilitate cumulative impacts assessment, there should be a central database for recording 404, 401 permits similar to the CDAITS database being developed for CAMA permits. Necessary fields for the database would include accurate geographic coordinates for impacts and parcel identification numbers. See Section 5.3.1.3. "[Recent loss of wetland habitat \(1994-present\)](#)" for context.*
7. *Other issues hampering management of cumulative impacts include the development of threshold values (for shoreline development) similar to the impervious surface limits in EMC's new stormwater rules. There must also be a means to limit impacts at larger than parcel scales. See Section 5.3.1.3. "[Recent loss of wetland habitat \(1994-present\)](#)" for context.*

Diseases and microbial stressors

1. *Maintaining high profile Oyster Sanctuaries and restoration sites and seeding them with disease resistant oysters in an effort to enhance oyster survivability and provide disease resistant broodstock for repopulating highly impacted areas. The Oyster Sanctuary program develops and maintains high profile reefs. The production of disease-resistant oysters may come about with construction and operation of a state oyster hatchery (see "[Emerging management needs](#)" subsection of 3.4.6.2. "Management needs and progress (2005-2010)"). See Section 3.4.3. "[Diseases and microbial stressors](#)" for context. Additional funding is needed to staff and operate the oyster hatchery facility. See Section 3.3.3.2. "[For ecosystem enhancement](#)" for context.*
2. *Evaluating the relationship between channel deepening, saltwater intrusion, flushing rates, and oyster mortality in order to determine appropriate management action. No specific progress. See Section 3.4.3. "[Diseases and microbial stressors](#)" for context.*
3. *Conduct regular monitoring of submerged grasses for wasting disease and its association with human-induced stresses (Street et al. 2005). No specific progress. See Section 4.4.4. "[Diseases and microbial stressors](#)" for more information.*

Dredging (navigation channels and boat basin)

1. *New dredging in shallow, nearshore areas with fine sediment and low flushing should be discouraged. CAMA rules restrict new dredging in MFC-designated Primary Nursery Areas. However, similar yet undesignated areas are not specifically protected (see Section 2.4.1.4. “[Dredging \(navigation channels and boat basins\)](#)” for more information). Permitting agencies should avoid or minimize dredging projects in Anadromous Fish Spawning Areas and undesignated but important associated anadromous fish nursery areas. See the “[Dredging \(navigation channels and boat basins\)](#)” subsection of section 6.4.1.1. “Water-dependent development” for context. Commenting and permitting agencies should continue using their existing authorities to a) minimize new dredging of shallow soft bottom habitat, b) prevent direct impacts from dredge and fill projects, and c) limit as much as possible indirect impacts to shallow soft bottom or other habitats. Ongoing (see the “[Dredging \(navigation channels and boat basins\)](#)” subsection in section 6.4.1.1. “Water-dependent development” and Section 4.3.3. “[Dredging \(navigation channels and boat basins\)](#)” for more information).*
2. *More research to assess direct and indirect dredging impacts on blue crabs and other inlet spawning species. See the “[Dredging \(navigation channels and boat basins\)](#)” subsection in section 6.4.1.1. “Water-dependent development” for context.*
3. *Developing a state policy on dredge material management, that a) minimizes impacts to coastal fish habitat, including soft bottom habitat, and b) is consistent with federal existing guidelines. See the “[Dredge material disposal on subtidal bottom](#)” subsection in section 6.4.1.1. “Water-dependent development for context.*

Estuarine shoreline stabilization

1. *Conduct an assessment of where and how much of the estuarine shoreline is hardened (Street et al. 2005). The DCM is currently delineating shoreline types for the entire estuarine system of North Carolina (see the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development”).*
2. *Maintain a natural proportion and relative position of wetland and non-wetland shorelines. Wherever possible, sections of estuarine, non-vegetated shoreline with very little hard stabilization should remain unaltered to provide “new” sediment for shallow water habitats (Street et al. 2005). No specific progress (see the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development”).*
3. *Use of native vegetation in the 30-foot buffer along the estuarine shoreline AEC would minimize stormwater runoff and erosion landward of shoreline stabilization structures, and would be consistent with the Neuse and Tar-Pamlico River Basin Nutrient Sensitive Waters management strategies [EMC rules 15A NCAC 02B .0233 and 15A NCAC 02B .0259]. See the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development” for context.*
4. *There is a need for 1) the regulatory and resource management agencies to consider and acknowledge through the permit review process the long-term benefits of alternative non-vertical stabilization methods, 2) an assessment of the ecological impacts of vertical structures, and 3) incentives to use non-vertical structures where appropriate. In 2009, the NC Division of Soil and Water Conservation - Community Conservation Assistance Program (CCAP) added Marsh Sills as one of their supported BMPs. The CHPP Steering Committee is in the discussion phase of dealing with this issue but no significant improvement has occurred yet. DCM has produced a brochure/website key to assist property owners in matching the appropriate shoreline stabilization technique to their shoreline type (see the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development”). There is also a need to inform managers and the public on the hydrological, biogeochemical,*

ecological, and aesthetic benefits of alternative stabilization methods. See the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development” for context.

5. *If {indirect degradation} or loss of shallow/intertidal habitats {with shoreline stabilization} is allowed, agencies should consider requiring mitigation. The EEP is developing an out-of-kind crediting system that could be employed in mitigating the permitted loss of shallow/intertidal habitats to bulkhead construction and associated impacts. See the “[Shoreline stabilization](#)” subsection of Section 5.4.1.1. “Water-dependent development” for context.*
6. *Due to the toxic sediment contamination associated with pressure treated wood, revised shoreline stabilization rules should require or encourage use of non-wood materials or wood that is not toxic to benthic organisms. Any new wood preservative products should be evaluated for toxicity to marine benthic organisms and juvenile fish. See the “[Estuarine and riverine shoreline stabilization](#)” subsection in section 6.4.1.1. “Water-dependent development” for context.*

Fishing gear impacts

1. Certain sized gill nets can unintentionally capture larger non-targeted species. DMF data has found that the large mesh gill net fishery in certain locations and times was resulting in sea turtle deaths. The gill nets in these cases are impeding the function of the water column as a corridor for migration of protected species. DMF is actively working to address this situation and should develop a comprehensive plan to minimize impacts to protected species. See Section 2.4.1.8. “[Fishing gear impacts](#)” for context.
2. Ensure that areas open to bottom disturbing fishing gear minimize overlap with structured habitats and/or strategic habitat areas.
 - a. *Once shell bottom mapping for the Pamlico Sound is complete, the portion of high (oyster) density, subtidal shell bottom open and closed to trawling and dredging should be determined. See “[Mobile bottom disturbing fishing gear](#)” subsection of Section 3.4.1.2. “Fishing gear impacts” for context.*
 - b. *As a part of CHPP implementation, the clam kicking area was modified by proclamation to clearly avoid all SAV and oysters beds and establish a buffer of 50-100 feet between the gear and habitat. If this buffer appears inadequate, DMF should modify it to an effective and scientifically based distance. See Section 4.4.1.3. “[Fishing gear impacts](#)” for more information.*
 - c. *Reducing the area available to mechanical clam harvesting is another means to protect clam stocks and provide additional habitat protection. Ongoing DMF effort to adjust boundaries with expansion of SAV (see section 6.3.2. “[Status of associated fishery stocks](#)” for more context.*
 - d. *Re-examining shallow areas where trawling is currently allowed to determine if additional restrictions are necessary. Some areas were re-examined for the 2004 shrimp FMP <http://www.ncdmf.net/download/shrimpfmp2004final.pdf>. See section 6.4.3.1. “[Mobile bottom disturbing gear](#)” for context.*
 - e. *Because less habitat damaging methods are available for harvesting crabs, MFC should consider if prohibition of crab dredging is advisable. See section 6.4.3.1. “[Mobile bottom disturbing gear](#)” for context.*
 - f. *Protection of “recruitment bottlenecks” from trawling or other impacts is very important for estuarine dependent fish and invertebrates. See the “[Bottom trawling](#)” subsection of section 6.4.3.1. “[Mobile bottom disturbing gear](#)” for context.*
3. *Monitor hard bottom to assess the level of impact from hook and line fishing. Educating anglers on the impacts of anchor damage, lost fishing gear, and discarded litter to hard bottom habitat and*

associated species would be helpful in reducing those impacts (Street et al. 2005). No specific progress. However, there are some monitoring results from other states on the prevalence of marine debris in marine protected areas. See Section 7.4.3.3. “[Rod and reel](#)” for more information.

Infrastructure (i.e., wind turbines, oil rigs)

1. *Infrastructure projects that require SAV impacts should be avoided. Where impacts are unavoidable, SAV losses should be minimized and adequately compensated through mitigation, using methods recommended by NMFS for SAV restoration or creation. Such projects should be monitored over time to determine persistence of restored SAV beds (Street et al. 2005). Ongoing need with the placement and replacement of bridges in coastal North Carolina. See the “[Infrastructure](#)” subsection of Section 4.4.1.1. “Water-dependent development” for more information. Should the State consider locating a wind facility in state or federal waters, proper placement of energy infrastructure is necessary to minimize potential impacts to SAV habitat and minimize conflicts with existing activities. See the “[Infrastructure](#)” subsections of Section 4.4.1.1., 5.4.1.1., and 6.4.1.1. “Water-dependent development” for more information. The need was also repeated in Section 7.4.1.3. “[Energy infrastructure.](#)”*
2. *Develop and implement a state policy to prohibit oil and gas drilling in North Carolina’s coastal waters to ensure protection of hard bottom and water column habitats (Street et al. 2005). During 2008, a federal moratorium on offshore drilling for oil and natural gas, which covered much of the OCS in the Atlantic and Pacific oceans, was lifted. This opened the majority of federal waters, including those off the coast of North Carolina, to future oil and natural gas exploration, development, and production. There are emerging management needs related to lifting moratorium. Drilling on or in the vicinity of hard bottom resources on the Outer Continental Shelf (OCS) of North Carolina should be prohibited to minimize potential impacts to ecologically productive hard bottoms. See Section 7.4.1.3. “[Energy infrastructure](#)” for context. North Carolina should continue to be engaged in the Minerals Management Service 5-year Lease Program and any proposed OCS energy development project. See Section 7.4.1.3. “[Energy infrastructure](#)” for context.*
3. *Ensure state cooperation with ASMFC, other states, and the communications companies to manage the placement of fiber optic cables in North Carolina offshore waters in a manner that minimizes impact to hard bottom and minimizes conflicts with existing activities (Street et al. 2005). No specific progress. Current CRC rules prohibit structures, such as cables and pipelines, from coming onshore on oceanfront beaches. See Section 7.4.1.3. “[Energy infrastructure](#)” for more information.*

Jetties and groins

1. *Environmental outreach regarding the effect of inlet stabilization on coastal fish habitat and ecosystem processes is needed to educate public stakeholders (fishing communities and coastal property owners) on this issue and gain support for maintaining natural barrier island processes. No specific progress (see Section 2.4.1.6. “[Jetties and groins](#)” for more information).*
2. *Because there is strong evidence available on the potential ecological impacts of hardened structures, large uncertainty on the environmental impacts of terminal groins specifically, and no clear economic benefit from inlet stabilization, North Carolina should not reverse its position or policies on ocean shoreline hardening. Overall, the scientific evidence does not support changing North Carolina’s policy on prohibition of shoreline hardening structures on the oceanfront. See the “[Oceanfront shoreline hardening](#)” subsection of section 6.4.3.1. “Mobile bottom disturbing gear” for context.*

Land-use and non-point sources

1. *Efforts to reduce fecal coliform levels should target pollution sources upstream of significant shell bottom resources in conditionally approved open (i.e., less degraded) areas (see “Microbial contamination” section of “Shell bottom” chapter for more information) in order to maximize the probability of successful restoration. See “[Studies comparing land use and water quality](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
2. *The need still exists for DWQ to educate permittees about the proper construction, maintenance, and installation time of stormwater ponds to help control run-off from construction sites. See “[Coastal stormwater program](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
3. *The Community Conservation Assistance Program should be fully utilized in addressing the issue of stormwater pollution from existing development. See “[Coastal stormwater program](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
4. *Recommendations of the Compliance Coordination report should be a high priority for CHPP implementation. See “[Coastal stormwater program](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
5. *If lower nutrient concentrations allow greater sprayfield application, there should be corresponding groundwater monitoring to verify nutrient levels are not increasing (T. Spruill/USGS, pers. com., March 2010). See “[Nutrient reduction strategies](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
6. *Increased monitoring of runoff, both groundwater and surface water, will be needed to evaluate effectiveness of BMPS or any management procedure implemented. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
7. *Create an online GIS-based preharvest planning tool that would allow users to gain access to volumes of data related to soils, water resources, aerial imagery and other information that would be worthwhile for planning their harvest. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
8. *Create and implement a Forest Watershed Assistance Program that would provide enhanced water resource technical assistance to forestland owners in targeted watersheds. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
9. *Create and implement an Urban Forest Watershed Management Program that would explore and implement opportunities to incorporate forestry-related management practices with low-impact development (LID), green infrastructure, and traditional nonpoint source stormwater control measures. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
10. *Pursue opportunities for regulatory reform that would standardize the SMZ and/or riparian buffer requirements for forestry activities, in an effort to enhance performance on the ground and streamline the regulatory framework that governs forestry in the state. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
11. *Develop threshold criteria for determining at what point a non-compliant forestry operation directly contributes to a degradation or loss of in-stream aquatic habitat that is sufficient to warrant restoration or remediation of the impacted water resource. See “[Best Management Practices](#)”*

subsection of Section 2.4.2.3. “Land use and non-point sources” for context.

12. *Continue to pursue the establishment of a Water Quality Forester position in areas of the state that do not have such a position. For eastern North Carolina, the gaps in coverage are the Fayetteville District (middle Cape Fear area), and the Fairfield District (Albemarle-Pamlico peninsula area). In western North Carolina, the gaps in coverage are the Asheville District and Sylva District. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
13. *Develop BMPs related to water handling and the use of water resources for the purposes of suppressing and controlling peat-fueled wildfires based upon the lessons learned from the 2008 Evans Road Fire and similar wildfires in recent years. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
14. *Continue periodic BMP implementation surveys and monitoring of BMP effectiveness to ascertain trends in forest harvest activities, especially with questions concerning the harvesting of forest biomass, as well as evaluate the BMPs that were revised in 2006. See “[Best Management Practices](#)” subsection of Section 2.4.2.3. “Land use and non-point sources” for context.*
15. *Require an NPDES permit for ditching activities resulting in excess pollutant discharge to coastal North Carolina waters (Street et al. 2005). No specific progress (see Section 5.3.1.4. “[Regulatory response to recent losses](#)”).*

Marinas and multi-slip docking facilities

1. *To protect designated AFSAs and IPNAs from marina impacts, dredging for new marina construction and other marina-related activities should be managed to minimize alteration of these important functional areas. No specific progress (see Section 2.4.2.2. “[Marinas and multi-slip docking facilities](#)” for more information).*
2. *Funding should be secured for a Clean Marina Coordinator in order to maintain this voluntary initiative. See Section 2.4.2.2. “[Marinas and multi-slip docking facilities](#)” for context.*
3. *The report recommended that wastewater generated from marinas, boatyards, and manufacturers should be addressed, to prevent process wastewater from mixing with storm event water by:*
 - a. *Elimination of the waste stream*
 - b. *The use of other medias (sanding, sand blasting—provided the dry product is captured)*
 - c. *Recycle systems*
 - d. *Industrial pretreatment and connection to a publicly owned treatment works (POTW)*
 - e. *Development of a non-discharge waste system for hand washing operations*
 - f. *Development of new service industry designed to collect, treat, perhaps recycle residual metals, and/or to use these process waters in other industrial production processes.**See Section 2.4.2.2. “[Marinas and multi-slip docking facilities](#)” for context.*
4. *DWQ should continue to strive to reach compliance with stormwater and wastewater regulations at marinas and boatyards, through regulatory and nonregulatory measures. See Section 2.4.2.2. “[Marinas and multi-slip docking facilities](#)” for context.*
5. *A Sea Grant study assessing impacts of multi-slip docking facilities recommended the following:*
 - a. *Once additional information is obtained, development standards for MSDFs, such as limiting in shallow ecologically sensitive waters, may be considered.*
 - b. *Develop educational materials for property owners, developers, and realtors on ecological*

concerns of docking facility construction

See Section 2.4.2.2. "[Marinas and multi-slip docking facilities](#)" for context.

6. *Where SAV habitat is evident, additional permit conditions regarding dock design should be considered on a case by case basis to maximize light penetration below docks. See "[Marinas and docks](#)" subsection of Section 4.4.1.1. "Water-dependent development" for more information.*
7. *Including minimum water depth criteria for siting docks in shallow nursery habitats. Minimum water depth included for dock GP over structured habitat and PNAs (see the "[Marinas and docks](#)" subsection of section 6.4.1.1. "Water-dependent development" for context).*
8. *Dock siting criteria should include a minimum water depth over all habitats to prevent boats or floating docks from sitting directly on shallow soft bottom. See the "[Marinas and docks](#)" subsection of section 6.4.1.1. "Water-dependent development" for context.*

Marine debris

1. *Education and incentives are needed to encourage removal and proper disposal of derelict fishing gear and other debris from water-dependent activities. No specific progress (see "[Marine debris](#)" subsection of Section 2.4.3.4. "Other causes of water quality degradation" for context).*

Microbial contamination

1. *Evaluating the value of closed shellfishing waters as oyster sanctuaries. An assessment of shellfish resources in growing areas (including closed waters) was summarized in Haines (2004). See Section 3.4.2.3. "[Microbial contamination](#)" for context.*
2. *Identifying oyster beds in closed shellfish harvesting areas with robust oyster populations will help permit reviewers evaluate marina projects in shellfish harvesting waters. Protecting oyster beds in closed harvesting area may also be more acceptable to oyster harvesters who have seen a growing area of closures over the years. See Section 3.4.2.3. "[Microbial contamination](#)" for context.*

Mining

1. *Although mining was the source implicated in only 0.5% of impaired streams in coastal draining river basins in the DWQ (2006) Integrated 305(b)/303(d) report, if more resources could be applied to required monitoring, checking for compliance, or incorporating monitoring results in the BIMS, then perhaps the impacts from mining would be traceable. See Section 2.4.1.5. "[Mining](#)" for context.*

Non-native, invasive, or nuisance species

1. *DENR should work with the U.S. Coast Guard to encourage support for these proposed rules. See Section 2.4.4. "[Non-native, invasive, or nuisance species](#)" for context.*
2. *The MFC should continue to support the use of native Oyster Sanctuaries, cultch plantings, and other restoration efforts rather than non-native introductions to enhance oyster resources until appropriate scientific and socioeconomic data are available that strongly support other actions. See Section 3.4.4. "[Non-native, invasive, or nuisance species](#)" for context.*
3. *Include replacement of Eurasian watermilfoil with native species as an objective in SAV management and restoration plans. No specific progress. The need is predicated on research demonstrating the value of milfoil as fish habitat. See Section 4.4.3. "[Non-native, invasive, or nuisance species](#)" for more information.*

4. The Weed Control Program also posts signs at boat ramps warning of the danger in spreading noxious weeds to other systems. *Signs could also be posted to educate the public on the value of native aquatic plants.* See Section 4.4.3. “[Non-native, invasive, or nuisance species](#)” for more information.
5. *Legislation is needed to prohibit chemical treatment of native vegetation in estuarine waters, due to its high value as fish habitat.* See Section 4.4.3. “[Non-native, invasive, or nuisance species](#)” for more information.

Nutrients and eutrophication

1. *North Carolina’s shorelines should be evaluated to identify potential hot spots of nutrient inputs from eroding shorelines. Additional education is also needed on proper application of fertilizers to reduce runoff of nutrients into coastal waters, targeting homeowners, golf course owners, and landscape businesses (Mallin and Wheeler 2000).* No specific progress (see Section 2.4.3.1. “[Eutrophication and oxygen depletion](#)” for context).
2. *BMPs, including vegetated buffers, detention ponds, and wetland areas, should be required on all new and existing golf courses draining to coastal waters to help reduce nutrient concentrations.* No specific progress (see Section 2.4.3.1. “[Eutrophication and oxygen depletion](#)” for context).
3. *Comprehensive water quality monitoring is needed in other tidal creeks that are highly important nursery and shellfish areas.* No specific progress (see Section 2.4.3.1. “[Eutrophication and oxygen depletion](#)” for context).
4. *The authors suggested stronger waste management and emission standards for CAFOs in certain areas of the Coastal Plains.* See “[Sources of nutrient enrichment](#)” subsection” of Section 2.4.3.1. “[Eutrophication and oxygen depletion](#)” for context.
5. *In an effort to reduce the amount of run-off from farming and animal feed operations, the EMC approved a rule [15A NCAC 02T .1310-.1311] in 2008 designed to increase monitoring of the Nitrogen, Ammonia, fecal coli form, and chlorine. Long-term monitoring is required, in combination with management actions that reduce discharge concentrations, to determine effectiveness and future management needs.* See Section 2.4.3.1. “[Eutrophication and oxygen depletion](#)” section for context.

Obstructions (dams, culverts, locks)

1. *Restoration efforts through removal or modification of dam structures that impede migration of anadromous fish should remain a high priority to continue in North Carolina, focusing on the lowermost structures in rivers or streams, and advancing upstream. In particular, the Cape Fear system (i.e., Lock and Dam #1) should be a high priority, since striped bass, shortnose sturgeon, and Atlantic sturgeon have not recovered.¹ Removing unnecessary dams should be undertaken with consideration for both upstream and downstream impacts. Some dams have been removed after the reporting in Street et al. (2005) (see “[Dams/impoundments](#)” subsection of Section 2.4.1.1. “Flow regulation” for more information. Compile a prioritized list of dams for removal or modification that would benefit recovery of anadromous species. The next highest priority for dam removal could be removal of the remaining dam on the Little River near Goldsboro, in the Neuse subregion (M. Wicker/USFWS, pers. com., March 2010). See “[Dams/impoundments](#)” subsection of Section 2.4.1.1.*

¹ Refer to Soft bottom chapter for more information on sturgeon.

“Flow regulation” for context.

2. *Through the EEP process, additional focus on restoring stream flow and fish habitat through the replacement of culverts with bridges should be accelerated. Funding should be allocated for replacing filled channels and streams with “fish friendly” culverts or bridges and upgrading existing culverts to “fish friendly” structures, prioritizing structures that are known to impede anadromous fish migration to spawning grounds, or have been found to be particularly problematic to the natural hydrology of a system. Partnering with resource agencies, NGOs, and regional conservation groups such as AP3C, Cape Fear Arch, and Onslow Bight Partners to assist with any associated costs should be considered. Progress has been made (see Section 2.4.1.2. [“Road fill and culverts”](#) for more information). The results of the EDF study and DMF field surveys should be used to determine priorities for culvert removal. See Section 2.4.1.2. [“Road fill and culverts”](#) for context.*
3. *Additionally, new dam construction should be avoided whenever possible or designed and sited to minimize impacts to anadromous fish use and to maintain appropriate flow conditions. Flow alterations that may significantly change the temporal and spatial features of inflow and circulation that are required for successful spawning of anadromous fish should be prohibited. A process that fully evaluates cumulative impacts from water withdrawals and other hydrological modifications should be developed and implemented. No major dams have been constructed on North Carolina coastal rivers since 2003 (see [“Dams/impoundments”](#) subsection of Section 2.4.1.1. **“Flow regulation” for more information**).*
4. *State and federal agencies work together to secure grant or other funding for fish passage restoration. See [“Dams/impoundments”](#) subsection of Section 2.4.1.1. **“Flow regulation” for context.***
5. *Consider including culverts obstructing suitable anadromous fish spawning habitat as a source of water column impairment, and culvert removal as a restoration credit for the EEP and DOT. The EEP could then include such proactive restoration options in its overall mission to mitigate and restore lost ecosystem functions. See Section 2.4.1.2. [“Road fill and culverts”](#) for context.*

Ocean shoreline stabilization

1. *Completing a coast-wide beach management plan that carefully reviews cumulative impacts of activities and provides ecologically based guidelines, including sediment compatibility standards, to minimize cumulative impacts. The CRC’s beach nourishment rules should be evaluated and modified in a comprehensive manner as needed to minimize overall impacts from this activity. Conditions should include sediment compatibility, restricting time of nourishment, interval between nourishment events, and linear length of projects to enhance recovery of the benthic community. **The coastwide Beach and Inlet Management Plan has been drafted and pending review and finalization (see [“Status of beach nourishment from coastal storm damage reduction projects”](#) section for more information).***
2. *Encourage sand mining guidelines for beach nourishment that maximize biological recovery rates and do not degrade fish habitat functions. **Increased need due to storm damage projects using offshore borrow areas. See the [“Beach nourishment impacts at mining areas”](#) subsection in section 6.4.1.1. **Water-dependent development”** for context. May be addressed in BIMP.***
3. *Adequate monitoring of the effects of beach nourishment projects on the soft bottom community and associated surf fish populations. The monitoring should assess the direct and cumulative impact of beach nourishment activities on fish, their habitat, and biological recovery rates. See the [“Beach nourishment impacts at intertidal beach and adjacent subtidal bottom”](#) subsection in section 6.4.1.1. **“Water-dependent development”** for context.*

4. *All of the sand management recommendations of the Ocean Policy Report should be implemented. The first four items should be addressed in the BIMP. See the [“Shoreline stabilization”](#) subsection of section 6.4.1.1. **“Water-dependent development”** for context. CRC rule language should be modified to require a 500 m dredging buffer around all hard bottom areas, including those of low relief that are periodically buried with thin ephemeral sand layers. See the [“Shoreline stabilization”](#) subsection of section 6.4.1.1. **“Water-dependent development”** for context. The need was repeated in Section 7.4.1.2. [“Shoreline stabilization”](#).*
5. *Monitor the transport of sand from nourished beaches over time. Future research should attempt to determine if the probability or extent of burial are affected by sand volume, type, or grain size, by the time-of-year of project initiation, or by the distance between nourished beach and hard bottom. See Section 7.4.1.2. [“Shoreline stabilization”](#) for context. A DENR Beach Management Plan should be developed and implemented which includes specific guidelines to minimize impacts to hard bottom from nourishment projects (Street et al. 2005). See Section 6.4.1.1. [“Water-dependent development”](#) in the **“Soft bottom”** chapter for information on North Carolina’s Beach and Inlet Management Plan.*
6. *The natural processes that create these features (shoals, sand bars, sloughs, and tidal deltas that surf fish utilize) need to be maintained. See section 6.2.5.1. [“Foraging”](#) for context. Recommend allowing {new} inlets to remain open even if temporarily until a substantial flood tide delta forms. This will allow for long-term maintenance and stability of the barrier island. See the [“Oceanfront shoreline hardening”](#) subsection of section 6.4.3.1.*
7. *Require adequate monitoring prior to creation and during use of the Ocean Dredged Material Disposal Site (ODMDS) off Cape Fear River to determine its effect on nearshore hard bottom habitat (Street et al. 2005). Prior to disposal, any fine-grained sediments that are dredged are chemically and biologically tested to ensure the environmental integrity of an ODMDS. The USACE should continue environmental monitoring during use of the two Wilmington ODMDS to determine their effect on adjacent hard bottom habitat (Street et al. 2005). See Section 7.4.4. [“Water quality degradation”](#) for more information.*
8. *Additional public outreach to emphasize the importance of natural barrier island and estuarine processes. ECU has produced several publications on barrier island migration and shoreline stabilization of estuarine and ocean shorelines. See section 6.2.5.1. [“Foraging”](#) for context.*

Point sources

1. *More detailed monitoring is needed to assess the extent oceanfront septic systems are causing degradation to nearshore coastal waters. Some progress has been made with DEH-SS shoreline surveys. See Section 2.4.2.1. [“Point sources”](#) for context.*
2. *Increased inspections of sewage treatment facilities, collection infrastructure, land disposal sites, and onsite wastewater treatment facilities is needed to identify and prioritize sites needing upgrades. No specific progress (see Section 2.4.2.1. [“Point sources”](#) for context).*
3. *Loading of pollutants into coastal waters from mechanical failures, spills, and inadequate treatment must be reduced. This will require additional funding to upgrade plants and infrastructure. No specific progress (see Section 2.4.2.1. [“Point sources”](#) for context).*
4. *Enforcement of high fines should be consistently used by DWQ to encourage proactive maintenance of sewage infrastructure and plants. See Section 2.4.2.1. [“Point sources”](#) for context.*

5. *To improve water quality in North Carolina surface waters, the state should move toward requiring Best Available Technology for wastewater treatment, rather than Best Practicable Technology. See Section 2.4.2.1. “[Point sources](#)” for context.*
6. *WWTPs that currently have Best Available Technology (BAT) in place should be { } provided incentives to actually utilize this technology. See Section 2.4.2.1. “[Point sources](#)” for context.*
7. *The 2009 Ocean Policy Report (NC Sea Grant 2009) recommended that no new or expanded ocean outfalls for stormwater or wastewater be permitted, and existing stormwater ocean outfalls should be decommissioned in a phased out approach. See Section 2.4.2.1. “[Point sources](#)” for context. Similar need repeated to protect hard bottom. See Section 7.4.4. “[Water quality degradation](#)”.*

Sea level rise and climate change

1. *Restoration goals for anadromous stocks should be adjusted to reflect the shifting distribution of species with climate change. See Section 2.4.5. “[Sea level rise and climate change](#)” for context.*
2. *Site monitoring of SAV should include species composition and genetic diversity to track the potential impacts of climate change. See Section 4.4.5. “[Sea level rise and climate change](#)” for more information.*
3. *To sustain the carbon sink service provided by submerged grasses, the habitat must be preserved, with management efforts focused on maintaining environmental conditions (nutrient and sediment concentrations) needed for SAV growth (Bjork et al. 2008). See Section 4.4.5. “[Sea level rise and climate change](#)” for more information.*
4. *Inform buyers and owners of coastal property about sea level rise and resulting loss of wetlands and property (Street et al. 2005). No specific progress. However, recent publications, workshops, meetings, and television programs provide an ample source of information on the impacts of sea level rise (see Section 5.4.4. “[Sea level rise and climate change](#)”).*
5. *Acknowledge sea level rise in prioritizing coastal wetland protection and land acquisition efforts (Street et al. 2005). No specific action at the agency level. However, there are agency studies underway to help determine priorities (see Section 5.4.4. “[Sea level rise and climate change](#)”).*
6. *The importance and vulnerability of fringing coastal marsh merits decreasing the minimum area and/or length requirement for mitigation. Protecting or restoring fringing marsh is especially important where adjacent slopes allow landward migration with sea level rise. See Section 5.4.4. “[Sea level rise and climate change](#)” for context.*
7. *The enhancement or creation of marsh islands should accompany the net loss of marsh islands due to deterioration with sea level rise. See Section 5.4.4. “[Sea level rise and climate change](#)” for context.*
8. *Develop CRC and DENR policies regarding sea level rise adaptations and revise CRC land use planning guidelines. See Section 5.4.4. “[Sea level rise and climate change](#)” for context.*

Suspended sediment and turbidity

1. *There remains a need to enhance monitoring of turbidity in estuarine waters and in the adjacent nearshore ocean. See Section 3.4.2.2. “[Sedimentation and turbidity](#)” for context.*
2. *Restoration activities should be planned to restore natural hydrology, dredge excess sediment, reduce the sources of excess sediment, and plant oysters on historic oyster bed foundations. See Section*

3.4.2.2. [“Sedimentation and turbidity”](#) for context.

Toxic chemicals (including endocrine disruptors)

1. *Although safeguards are in place, the N.C. Pesticide Board’s policies on drift should be assessed and modified if necessary to ensure adequate protection of aquatic life and water quality. **No specific progress** (see [“Pesticides”](#) subsection of Section 2.4.3.3. **“Toxic chemicals”** for more context).*
2. *Education and enforcement to ensure proper application of pesticides according to label instruction, is needed. See [“Pesticides”](#) subsection of Section 2.4.3.3. **“Toxic chemicals”** for context.*
3. *An EDC monitoring program should be established through cooperative efforts of DMF, DWQ, Shellfish Sanitation, USGS, and the North Carolina Department of Agriculture and Consumer Services (NCDA&CS) to determine the presence and concentrations of selected chemicals in North Carolina’s coastal waters, beginning in the Neuse River estuary. See Section 3.4.2.4. [“Toxic chemicals”](#) for context. The NC Division of Water Quality could expand its sampling program to include collection of water samples for analyses, with USGS laboratories conducting the analyses. Critical chemicals should be selected for analyses, rather than analyzing for everything. Chemicals like fipronil (frontline), bisphenol A (certain plastics), alpha and beta estrodiol (hormones), antibiotic degradation products, alachlor and other high-use pesticides, juvenile hormone analogs (mosquito control), etc. should be prime candidates. A monitoring task force comprised of USGS, DWQ, DMF, NCDA, Shellfish Sanitation, as well as representative researchers, could identify a list of most likely problematic chemicals. See [“Endocrine disruptors”](#) subsection of Section 2.4.3.3. **“Toxic chemicals”***
4. *Recommendations to address endocrine disruptors include:*
 - a. *education and outreach regarding proper disposal of pharmaceuticals, pesticides and antibiotics, including what existing waste management and recycling programs are available,*
 - b. *expand the NC Pesticide Disposal Assistance Program to include unused and outdated pharmaceuticals, and a plan for removal of chemicals from wastewater and runoff.*
 - c. *Assistance and support is needed from the Attorney General’s office to implement a drug take-back program in North Carolina. See [“Endocrine disruptors”](#) subsection of Section 2.4.3.3. **“Toxic chemicals”** for context.*
5. *Due to the high potential impacts associated with deepwater drilling, there should be a continued ban of oil and gas drilling in off North Carolina waters. See [“Fossil fuels”](#) subsection of Section 2.4.3.3. **“Toxic chemicals”** for context. Same need mentioned in Section 5.4.2.2. [“Fossil fuels”](#).*
6. *Recycled plastics, concrete, and natural rock are non-wood alternatives that do not require any chemical preservatives and should be recommended for use in future water-dependent development projects. See Section 3.4.2.4. [“Toxic chemicals”](#) for context.*
7. *More information on the in situ effects of various contaminant levels, in combination with other contaminants and existing environmental stressors, on survival, growth, and reproduction of many important fish species in North Carolina. See section 6.4.4.3. [“Toxic chemicals”](#) for context.*
8. *To better determine if contaminated sediment is a significant threat to coastal fish habitat, the distribution and concentration of heavy metals and other toxic contaminants in freshwater and estuarine sediments need to be adequately assessed and areas of greatest concern need to be identified. Continued minimization of point and nonpoint sources of toxic contaminants is vital for protecting not only soft bottom but also the other fisheries habitat. See section 6.4.4.3. [“Toxic chemicals”](#) for context.*

9. *Efforts should be taken by state agencies to assist with creating Ecosystem Sensitivity Index (ESI) maps of NC. NCDMF is currently cooperating with NOAA to create maps showing the presence of fauna collected by NCDMF sampling surveys (see section 6.4.4.1. "[Toxic chemicals](#)" for context).*

Water Quality Degradation - Sources

1. *Pollution source/pollutant contribution modeling could be used to support DWQ assessment of impairment sources. The attribution of pollution sources is a vital component in developing Local Watershed Plans and TMDLs - the current management tools for addressing cumulative impacts. Such modeling could also be used to evaluate impairment where water quality data is lacking. See Section 2.4.2. "[Water quality degradation – sources](#)" for context.*
2. *Focus management efforts on protecting (and enhancing) existing SAV habitat and preventing any additional direct or indirect losses (Street et al. 2005). Direct losses of habitat areas meeting the definition of SAV are strongly discouraged by permitting authorities. If losses are unavoidable, publicly funded projects are required to mitigate for the losses whereas privately funded project may be asked to include a mitigation plan. Indirect losses due to changes in water quality are more difficult to project. See Section 4.4.2.1. "[Nutrients and sediment](#)" for more information.*
3. *The need and feasibility for a water quality standard for light attenuation {or other means to protect water quality for SAV} should be further investigated to provide a pro-active target or standard for protection and restoration of SAV (Street et al. 2005). The need for a water quality standard is demonstrated in Section 4.4.2. "[Water quality degradation](#)". See Section 4.4.2.1. "[Nutrients and sediment](#)" for more information.*
4. *Track the rates and trends in land conservation and development to predict future landscape characteristics and water quality impacts, and determine conservation actions needed. See Section 2.3.5. "[Designations](#)" for context.*

Water withdrawals

1. *Public education is needed to encourage greater voluntary re-use and recycling of water within communities. The drought of 2007-08 led to restriction in water use and incentives for wise use of water (see "[Water withdrawals](#)" subsection of Section 2.4.1.1. "Flow regulation" for more information).*
2. *Assessments of groundwater water supplies in coastal counties should be made to determine what the environmental consequences will be if the increase in water withdrawals continues. An assessment has been conducted (see "[Water withdrawals](#)" subsection of Section 2.4.1.1. "Flow regulation" for more information).*
3. *Until standards are implemented and effective exclusive technology is available, withdrawals should be reduced as much as possible during and following spawning season in areas known to be used by eggs, larvae, and early juveniles. This would include DMF designated PNAs and anadromous fish spawning and nursery areas that are currently being mapped by DMF staff. No specific progress (See "[Water withdrawals](#)" subsection of Section 2.4.1.1. "Flow regulation" for context).*
4. *New large volume surface water intakes should not be permitted behind dams in areas that would prevent stream passage restoration, where the dam has been identified as a priority for removal. See "[Water withdrawals](#)" subsection of Section 2.4.1.1. "Flow regulation" for context.*
5. *To properly review mining applications, more information is needed on the expected effect of the freshwater discharge on the salinity of receiving waters. See "[Water withdrawals](#)" subsection of Section 2.4.1.1. "Flow regulation" for context.*

LITERATURE CITED

Deaton, A.S., W.S. Chappell, K. Hart, J. O'Neal, B. Boutin. 2010. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries, NC. 639 pp.

Street, M.W., A.S. Deaton, W.S. Chappell, and P.D. Mooreside. 2005. North Carolina Coastal Habitat Protection Plan. North Carolina Department of Environment and Natural Resources. Division of Marine Fisheries, NC. 656 pp.