

Wetland quality or condition speaks to how wetlands differ from their “natural” state, providing an assessment of the overall ecological integrity of the resource and the relative status of wetland processes, such as the ability of a wetland to absorb nutrients. In addition, the NWCA will identify the stressors most associated with degraded wetland condition because they provide insights into the causes of declining wetland quality.

“Wetlands are inextricably tied to water levels and changes in climatic conditions affecting water availability will greatly influence the nature and function of specific wetlands, including the type of plant and animal species within them.”

Secretary of the Interior Ken Salazar, announcing availability of the new wetland mapping standard.
August 18, 2009

Strategic Action 20: The NWP intends to work with partners and stakeholders to develop information and tools to support long term planning and priority setting for wetland restoration projects.

Wetlands have the potential to provide added benefits for climate change adaptation as well the potential to store and sequester carbon. The NWP intends to work with partners and stakeholders to share evolving

information and tools to encourage consideration of climate change in long term planning and priority setting for wetlands management strategies and sustainable restoration projects.

C. Coastal and Ocean Waters

VISION: Adverse effects of climate change along with collective stressors and unintended adverse consequences of responses to climate change have been successfully prevented or reduced in the ocean and coastal environment. Federal, tribal, state, and local agencies, organizations, and institutions are working cooperatively; and information necessary to integrate climate change considerations into ocean and coastal management is produced, readily available, and used.

Coastal and ocean environments are inextricably linked, both spatially and ecologically. This section borrows the concept of the “baseline” (a legal demarcation of ordinary low tide levels that also crosses river mouths, the opening of bays, and along the outer points of complex coastlines) to facilitate the discussion of strategies that may be more applicable to coastal environments (which we loosely define as being on the landward side of the baseline) or ocean environments (seaward of the baseline). The baseline may affect climate change strategies because of its jurisdictional implications relevant to governmental authority. However, although the terms “coastal” and “ocean” are used primarily to organize this discussion, we recognize that those domains grade into each other and that some strategies may be appropriate on both sides of the baseline.

As in other regions, coastal areas will face challenges to wetlands, watersheds, infrastructure, water quality, and drinking water. Some coastal problems, such as nonpoint source pollution and changing precipitation patterns, have the same causes and effects that are found in inland places.

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However, the ocean and coasts will experience unique impacts that the rest of the terrestrial United States will not. Sea level rise is already a multi-faceted problem that is worsening (Figure 9). Coastal wetlands and other estuarine habitats are being inundated or eroded, and many will not be able to sustain themselves as sea levels continue to rise. The potential for ocean acidification to damage the marine food chain, shellfish, and coral is another issue unique to the coastal and ocean environment. Coastal regions will also experience saltwater intrusion into ground water aquifers, the threats of rising seas to drinking water and wastewater infrastructure, and the effects of varying stream flow on estuarine salinity and ecology.

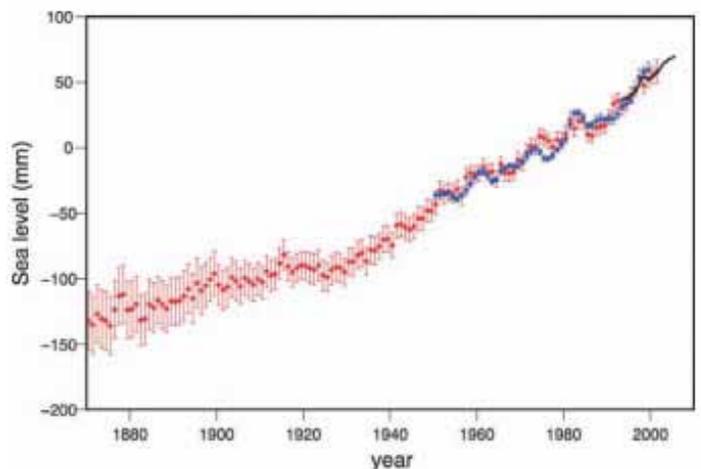
Scientific research over the last 10 years indicates that the adverse implications of ocean acidification (OA) for ocean and coastal marine ecosystems are potentially very serious because the ocean has a large capacity to absorb CO₂ from the atmosphere, and thus the resulting lowered pH levels in ocean waters can have serious cascading effects. In its 2010 report, *"Ocean Acidification: A National Strategy to Meet the Challenges of a Changing Ocean,"* the NRC (NRC, 2010f) concludes that ocean chemistry is changing at an unprecedented rate and magnitude due to human-made CO₂ emissions, and that there will be "ecological winners and losers." The report also states that "while the ultimate consequences are still unknown, there is a risk of ecosystem changes that threaten coral reefs, fisheries, protected species, and other natural resources of value to society".

Climate change impacts will in some respects be one more stressor that EPA's partners and programs will try to absorb or accommodate into their practices and portfolios. It will be important for EPA and the NWP to avert or resolve as many of the foreseeable climate adaptation problems as possible, while also preventing harm from responses to climate change that inadvertently increase vulnerability rather than reducing it.

However, in some parts of the country, such as parts of the Pacific Northwest, sea level rise is offset by coastal uplift. Such relative sea level decreases can offset absolute sea level rise and present benefits that enhance wetland preservation in coastal zones.

How others respond to the inevitable climate change impacts on coastal and ocean waters will have a large impact on EPA's ability to achieve or fulfill its mission. EPA intends to cooperate with other interested parties and work to enhance the adaptive capacity of our partners

Figure 9: Sea Level Rise



Annual, global mean sea level as determined by records of tide gauges (red and blue curves) and satellite altimetry (black curve) (NRC 2010c).

to effectively meet the coming 21st century environmental tests. We intend to work in close concert with local, state, tribal, and regional organizations and other federal partners through the wide range of existing programs and partnerships like the National Estuary Program (NEP), Large Aquatic Ecosystems (LAE), Great Waterbodies, and regional ocean groups. Working cooperatively with Canada and Mexico will also be critical if we are to be successful in near ocean environments.

Table 2: National Ocean Policy Implementation Plan Key Elements (NOC, 2011)

1. Ecosystem-based Management
2. Inform Decisions and Improve Understanding
3. Observations, Mapping, and Infrastructure
4. Coordinate and Support
5. Regional Ecosystem Protection and Restoration
6. Resiliency and Adaptation to Climate Change and Ocean Acidification
7. Water Quality and Sustainable Practices on Land
8. Changing Conditions in the Arctic
9. Coastal and Marine Spatial Planning

Similarly, the NOC has drafted an Implementation Plan for a new, comprehensive National Ocean Policy established by Executive Order 13547 on “Stewardship of the Ocean, Our Coasts, and the Great Lakes.” Following extensive stakeholder and expert input, the Plan is nearing completion in 2012. It describes a framework for federal agencies to work together to pursue common marine stewardship goals with cohesive actions, and to engage state, tribal, and local authorities; regional governance structures; nongovernmental organizations; the public; and the private sector. Table 2 lists the National Ocean Policy’s nine priorities, which include Resiliency and Adaptation to Climate Change and Ocean Acidification. Upon release, the Implementation Plan will identify specific Actions and milestones for each priority, in addition to

naming the federal agencies supporting those commitments. The Goals and Strategic Actions in this section reflect some of EPA’s intent to implement actions under Element 6, Resiliency and Adaptation to Climate Change and Ocean Acidification, as well as other parts of the plan.

GOAL 8: The NWP works collaboratively with partners so that the information and methodologies necessary to address climate change in ocean and coastal areas are collected or produced, analyzed or formatted, promoted, and easily available.

Protecting coastal and ocean environments from the adverse impacts of climate change will depend on policymakers and managers having the relevant information to make effective decisions. As the problems of climate change emerge and multiply, the need for knowledge will become even more pressing. Further, the NWP and our partners will need to know where to find the necessary information and tools. Agencies cannot afford to duplicate efforts and will need to work together to improve efficiency and leverage limited resources.

Strategic Action 21: To protect ocean and coastal areas, the NWP intends to collaborate within EPA and with other federal, tribal, and state agencies to ensure that synergy occurs whenever possible, lessons learned are transferred, federal efforts effectively help local communities and are not duplicative or working at cross-purposes.

Integrated Water Resources Management

As changing climates affect the decisions of water supply managers, coastal issues will be one more consideration. Managers are already balancing competing demands for in-stream ecological functions, water supply in reservoirs, water supply for downstream users, and power generation. Flows passing downstream have an effect on sediment delivery to coastal systems, the salinity structure of coastal estuaries, and how far upstream the salt front can push.

The management of coastal waters can benefit from an IWRM perspective. Issues may arise, for example, due to diversion of fresh surface water to recharge coastal aquifers, reducing flows needed for healthy coastal estuaries. Similarly, the disposal of residual brines where desalination is implemented to provide fresh water will also need attention.

Ensuring that lessons learned are transferred among the many partner federal agencies will maximize the utility and accessibility of new information and methodologies needed by tribal, state, and local communities to effectively prepare for climate change impacts.

Some federal agencies have already formalized cooperative mechanisms through written agreements. For example, EPA and NOAA have signed a Memorandum of Agreement to work together on climate adaptation, resilience, and smart growth efforts. In the New England region, a “Statement of Common Purpose” exists among federal agencies working together on climate change adaptation and mitigation and coastal and marine spatial planning. Similar agreements to coordinate with other federal agencies in the coastal zone, such as many DOI agencies (e.g., USGS, National Park Service, USFWS, Bureau of Ocean Energy Management), the Federal Emergency Management Agency (FEMA), USACE, DOT, and USDA (among others), would also be helpful.

Strategic Action 22: The NWP intends to work within EPA and with the U.S. Global Change Research Program and other federal, tribal, and state agencies to collect, produce, analyze, and format knowledge and information needed to protect ocean and coastal areas and make it easily available.

The NWP intends to work within EPA; with the USGCRP; and with other federal, tribal, and state agencies to produce relevant knowledge and information that informs decision-making, and to make it available in user-friendly formats through compendiums, websites, and clearinghouses. Information needed that is specific to coastal and ocean planning includes:

- Projections of relative sea level change at finer scales, including Light Detection and Ranging (LIDAR) land elevations.
- Information on ocean acidification and warming.
- Monitoring of environmental effects and system thresholds specific to the coastal and marine environments.
- Improvements in the ability to quantify real reductions of CO₂ due to salt marsh and coastal restoration.

EPA intends to continue to share similar information through portals such as ocean.data.gov and federal climate clearinghouses, such as the one under development by the USGCRP.

Please also see Strategic Action 44: Monitor climate change impacts to surface waters and ground water.

GOAL 9: Support and build networks of local, tribal, state, regional and federal collaboration partners that are knowledgeable about climate change effects and take effective adaptation measures for coastal and ocean environments through EPA's geographically targeted programs.

EPA's Large Aquatic Ecosystem Programs

- Chesapeake Bay Program
- Columbia River Basin
- Great Lakes
- Gulf of Mexico Program
- Lake Champlain Basin Program
- Long Island Sound Study
- Pacific Islands Office
- Puget Sound—Georgia Basin
- San Francisco Bay Delta Estuary
- South Florida Geographic Initiative

A primary role of the federal government will be to work within our existing networks to build adaptive capacity at the regional, state, tribal, and local levels.

Strategic Action 23: The NWP intends to work with the NWP's larger geographic programs to incorporate climate change considerations focusing on both the natural and built environments.

Geographically based programs in which EPA participates include 10 large aquatic ecosystems, Regional Ocean Partnerships, and regional planning bodies established under the National Ocean Council. The NWP intends to work to provide these key geographic programs with tools necessary to consider climate change effects in their plans and programs. EPA regional and geographic program offices and the Council of LAEs all intend to play key roles

addressing climate change impacts to both the natural and built environments when making policies or decisions, and intend to work to ensure that best practices and lessons learned from local projects are widely shared.

The NWP intends to continue working with Regional Ocean Partnerships that undertake planning for resiliency. According to the Coastal States Organization's website, "[t]here is an ever-growing recognition that multi-state, regional approaches are one of the most effective and efficient ways to address many of our ocean and coastal management challenges. To meet these challenges, governors around the country have voluntarily established Regional Ocean Partnerships and are working in collaboration with federal agencies, tribes, local governments, and nongovernmental and private sector stakeholders to identify shared priorities and coordinate ocean and coastal management on a regional basis. While each partnership is unique in terms of its region's issues and concerns, they all share a desire for more effective management of ocean and coastal resources. This includes balancing ecological and economic needs,

Regional Ocean and Great Lakes Partnerships

- Great Lakes Regional Collaboration
- Governors' South Atlantic Alliance
- Gulf of Mexico Alliance (GOMA)
- Mid-Atlantic Regional Council on the Ocean (MARCO)
- Northeast Regional Ocean Council (NROC)
- West Coast Governors' Agreement on Ocean Health

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and addressing climate change, through such approaches as ecosystem based management, and coastal and marine spatial planning.” [CSO, 2011]

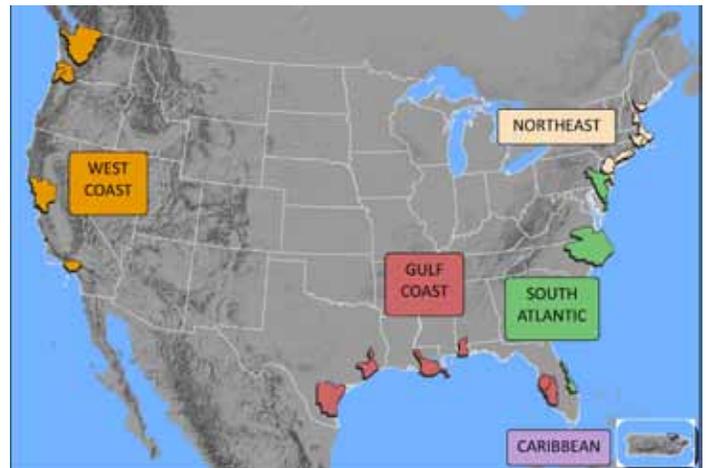
The NWP intends to also collaborate with the NOC’s Regional Planning Bodies established under the National Ocean Policy’s framework for effective Coastal and Marine Spatial Planning (CMSP) (see Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*). The regional planning bodies implement the framework for CMSP, leading to the eventual development of regional, coastal, and marine spatial plans that will guide and inform Agency decision-making under existing statutory authority. The NWP intends to inform the CMSP process and the development of plans to implement two priority objectives: 1) Coastal and Marine Spatial Planning (which is driven in some areas by the demand for offshore renewable energy development), and 2) Resiliency and Adaptation to Climate Change and Ocean Acidification.

Strategic Action 24: Address climate change adaptation and build stakeholder capacity when implementing NEP Comprehensive Conservation and Management Plans and through the Climate Ready Estuaries Program. Each Program intends to build its stakeholders’ adaptive capacity through funding, technical assistance, and coordination.

The 28 NEPs around the country improve the quality of estuaries of national significance through community-based programs. NEPs are strategically positioned to build the adaptive capacity of stakeholders because they work directly with and within communities. In fact, many of the NEPs have specific goals in their Comprehensive Conservation and Management Plans (CCMPs) addressing climate change adaptation (Figure 10).

The Climate Ready Estuaries (CRE) program, which is jointly administered by EPA’s Office of Water and Office of Air and Radiation, provides funding or direct technical assistance to help NEPs complete climate change vulnerability assessments and to build their adaptive capacity to respond to climate change. CRE intends to continue to expand its information and guidance offerings and to develop and share the lessons learned from its sponsored projects. Incorporating CRE tools and methods into the NEP base programs by mainstreaming climate change adaptation into planning documents (e.g., CCMP or annual work plans) is expected to ensure that climate change is considered by all NEPs, and helps to prepare communities to respond to climate change impacts. Many other organizations also manage coastal and ocean resources in or near NEP watersheds, so CRE intends to work collaboratively with other EPA programs (e.g., CRWU), federal agencies (e.g., NOAA’s National Estuarine Research Reserves and Sea Grant,

Figure 10: NEP Study Areas



<http://water.epa.gov/type/oceb/nep/index.cf>

USDA's conservation planning activities), land trusts, and other nonprofit coastal organizations to build mutually supportive networks.

Strategic Action 25: The NWP intends to conduct outreach and education, and provide technical assistance to state and local watershed organizations and communities to build adaptive capacity in coastal areas outside the NEP and LAE programs.

All coastal areas, including regions outside NEP and LAE watersheds, should build their adaptive capacity to reduce adverse effects of climate change. The NWP can support the work of states and local watershed organizations by providing technical assistance or educational support that leverages the work of EPA's CRE and other geographic programs and partnerships. Communication will also help minimize the selection of responses to climate change that may work at cross-purposes, or have unintended adverse consequences.

GOAL 10: The NWP addresses climate driven environmental changes in coastal areas and provides that mitigation and adaptation responses to climate change are conducted in an environmentally responsible manner.

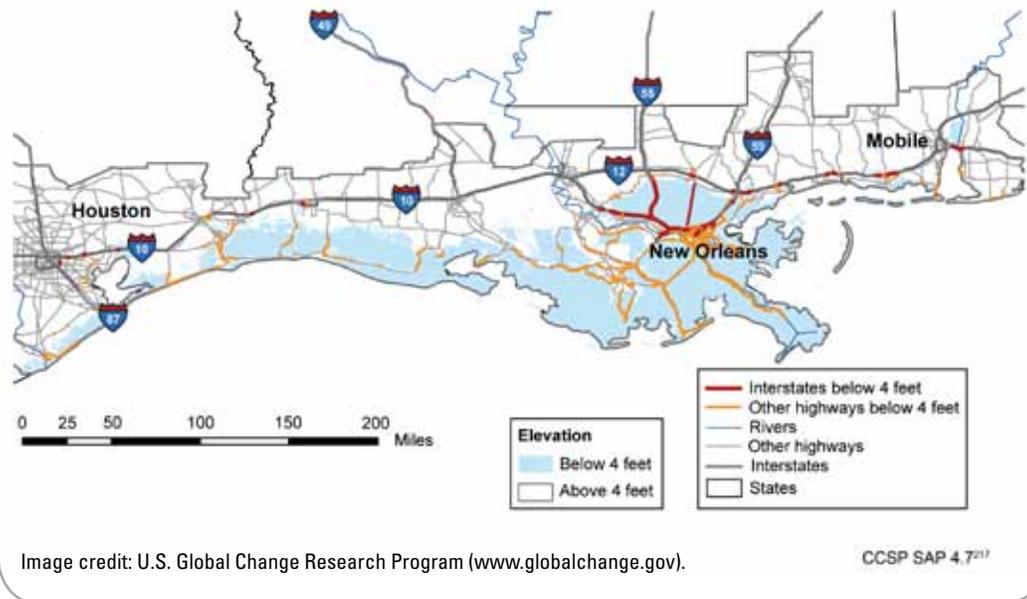
Impacts of climate change have greater consequences in coastal areas because so much of the country's population and economic infrastructure are located in those areas. Coastal areas will see greater demand for storm protection and erosion control. Strategies are needed to protect and enhance the natural environment while working toward a sustainable built environment that is prepared for climate impacts.

Coastal waters have the same potential problems with invasive species and water quality that all waters and watersheds have, in addition to marine-specific challenges such as ballast water discharges from commercial shipping. Changing precipitation patterns will affect runoff, nonpoint source pollution, and combined sewer systems, and warmer waters may foster increases in algal blooms and hypoxic conditions, decreasing the quality of waters for recreational uses such as swimming and other water sports that are extremely important in coastal areas. Warmer water will also likely worsen the already increasing occurrences of harmful algal blooms and other aspects of water quality, including the expansion in the range of many invasive species already present in U.S. waters, such as zebra mussels. Increasing temperatures in water bodies such as Lake Superior may allow organisms that have established in the other four Great Lakes to more easily establish in Superior's waters. Water bodies that were previously not receptive to invasion by many transoceanic invaders may become more habitable to those organisms.

Coastal wetlands, like all wetlands, are dependent on suitable hydrologic conditions. Climate change will severely challenge the resilience of coastal wetlands. Altered salinity from sea level rise and changing hydrometeorology will threaten coastal ecology. Geologic history and geomorphic research suggest that coastal wetlands will have a very hard time surviving at accelerated rates of sea level rise. Where salt marshes have limited sediment supplies, they will probably not be able to accrete enough material to stay above rising water level. As the intertidal zone shifts upward and landward, the area that can sustain salt marshes will shrink—in places where topography, coastal development, or insular layout prevents ecosystem shifts, marshes may disappear entirely. Some salt marshes may be able to become established

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Figure 11: Infrastructure Risk from Sea level Rise



upstream as the salinity changes; however, they are likely to replace freshwater tidal marshes, not to establish new wetland habitats. Both freshwater and salt marshes also are subject to changing temperature and precipitation that may affect the ability of existing species to continue to thrive.

Sea grasses are another very important aquatic resource that is vulnerable to climate change. Sea grass beds serve as critical habitat for juvenile life stages of many marine species. Most sea grass species live in a narrow strip of shallow coastal water and are extremely sensitive to changes in water clarity that control how much sunlight they receive. Warmer water, increased water depth, and turbidity from soil erosion caused by extreme precipitation and other storm events can all reduce water clarity and adversely impact the survival of sea grasses.

Strategic Action 26: The NWP intends to work collaboratively to support coastal wastewater, stormwater and drinking water infrastructure owners and operators in reducing climate risks and will encourage adaptation in coastal areas.

Impacts of climate change will threaten all types of coastal infrastructure, but the water sector is particularly at risk. Sea level rise and coastal subsidence, storms and storm surge, flooding and coastal erosion, saltwater intrusion into coastal aquifers, and increasing water temperatures all threaten wastewater and drinking water treatment facilities, conveyance systems, and utility operations (See Figure 11).

Stormsmartcoasts.org

...was established by the Gulf of Mexico Governor's Alliance with startup funding from NOAA and a 3-year EPA grant to expand it. Smartcoasts provides a platform for the open exchange of information among states, communities, counties, and others. A Community of Practice for Climate Change includes 100 members across the Gulf region from Sea Grant programs, NOAA, EPA, FEMA, the five Gulf of Mexico states, counties, parishes, communities, and universities.

National Water Program 2012 Strategy

EPA's CRWU and CRE programs intend to continue working together to provide coastal managers and infrastructure operators with planning support and technical assistance to help reduce climate risks and encourage adaptation. The NWP also intends to consider new approaches for ensuring that financial assistance to the water sector is used in ways that increase resiliency, reduce vulnerability, and avoid adverse unintended consequences.

Strategic Action 27: The NWP intends to work collaboratively to support climate readiness of coastal communities, including hazard mitigation, pre-disaster planning, preparedness, and recovery efforts.

Climate change impacts such as sea level rise and increased storm intensity will exacerbate existing coastal hazards. Flooding, wind, waves, and storm surge that damage coastal communities can directly affect water quality, as well as damage water infrastructure.

To avoid such problems and minimize the need for emergency response, the NWP intends to work within EPA and with other federal, tribal, and state agencies to provide technical assistance to coastal communities for hazard mitigation and pre-disaster planning. After a disaster, recovery and rebuilding efforts should avoid choices that reproduce previous vulnerabilities. EPA's CRWU, CRE, and Sustainable Communities programs intend to collaborate to provide local communities with planning tools to improve resiliency to natural hazards as well as to bring other economic, environmental, and quality of life benefits. FEMA is a critical federal partner; in 2010, EPA and FEMA signed a Memorandum of Agreement that will make it easier for the two agencies to collaborate to help communities recover from disasters and better plan for future resilience, including for climate change adaptation (EPA, 2011i). The NWP also intends to coordinate with NOAA's Storm Smart Coasts program to maximize efficiencies in delivering tools and other information to local communities. These programs will assist with vulnerability analyses and help to develop and implement hazard mitigation strategies.

Local projects supported by EPA grants may be affected by climate change impacts. EPA intends to provide advice on how funding recipients can include an assessment of adaptation and mitigation measures in their planning for federally funded projects.

Strategic Action 28: The NWP intends to support preparation and response planning for a diverse array of impacts to coastal aquatic environments.

The sea, the great unifier, is man's only hope.
Now, as never before, the old phrase has a literal
meaning: We are all in the same boat.

— Jacques Cousteau

Coastal upland, wetland, and aquatic ecosystems and resources have evolved over centuries and millennia. They are stressed by human uses and activities and invasive species, and now face further stress from a full range of climate change impacts, including threats such as sea level rise that are unique to coastal areas.

NWP base programs and initiatives will need to be cognizant of threats to coastal water quality. While extensive expertise in restoration planning resides within EPA and at other agencies and organizations, there is a need for decision support tools to help answer challenging questions about whether restoration is viable or whether alternative strategies should be pursued in certain places. Protecting water quality and aquatic habitats such as sea grass beds may

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require innovative actions like ensuring that the volume and quality of freshwater inflows into estuaries are maintained. In the context of coastal change and sea level rise, decisions about coastal marshes may need to consider long-term viability and replenishment costs. The NWP intends to use existing partnerships and networks, such as the Interagency Coastal Wetlands Workgroup, Coastal America, the National Dredging Team, and other interagency planning groups, to promote the consideration of sea level change and other climate change impacts in coastal habitat restoration planning. The National and Regional Dredging Teams intend to promote the beneficial use of suitable dredged material for maintaining and restoring coastal marshes and other habitats.

In addition, “Blue Carbon” is an emerging concept that refers to the ability of aquatic ecosystems to sequester CO₂. Should emissions trading practices take hold that include Blue Carbon, the use of external funding from private sector CO₂ emissions offsets might become a useful strategy for funding restoration or creation of sustainable coastal habitats. Care should be taken, however, to ensure that other ecosystem services do not suffer if some aquatic environments are managed strictly for their ability to sequester CO₂.

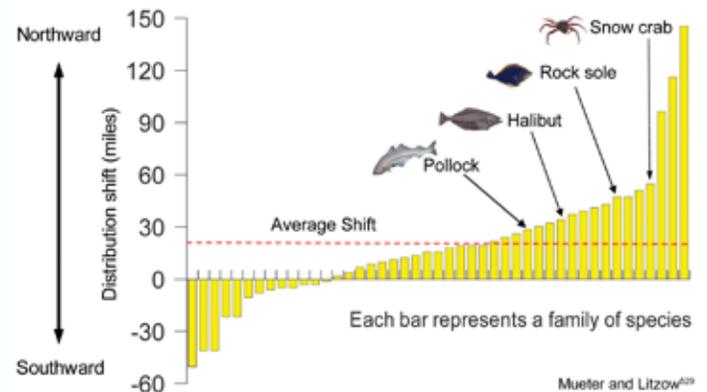
GOAL 11: Protect ocean environments by incorporating shifting environmental conditions and other emerging threats into EPA programs.

Protecting the ocean environment from adverse impacts of climate change is critical to human well-being because the ocean provides food, regulates our weather, and offers numerous opportunities for renewable energy, among many other benefits. Society will also be tempted to look to the oceans for seemingly simple solutions. It is important that strategies to reduce carbon dioxide levels in the atmosphere do not impose long-term costs on ocean waters, and that the many uses of marine spaces are responsibly balanced. (Figure 12)

Strategic Action 29: The NWP intends to consider climate change impacts and associated impacts (e.g., ocean acidification, nitrogen and phosphorus pollution) on marine water quality in its ocean management authorities, policies, and programs.

Climate change impacts to the ocean environment, including temperature increases, increased pollutant runoff, and hazardous algal blooms, as well as increases in ocean/coastal acidity, hazardous algal blooms, and spread of invasive species, add pressure to already stressed systems.

Figure 12: Observed Northward Shift of Marine Species in the Bering Sea Between the Years 1982 and 2006



As air and water temperatures rise, marine species are moving northward, affecting fisheries, ecosystems, and coastal communities that depend on the food source. On average, by 2006, the center of the range for the examined species moved 19 miles north of their 1982 locations.

The National Coastal Conditions Report that describes the ecological and environmental conditions in U.S. coastal waters will incorporate climate change impacts into its evaluation. EPA issued a Memorandum (EPA, 2010e) that recognized the seriousness of aquatic life impacts associated with ocean acidification and described how states can move forward, where ocean acidification information exists, to address it during the CWA 303(d) listing cycle using the current 303(d) Integrated Reporting (IR) framework. Additional guidance may be necessary as improved monitoring and assessment information becomes available. If other climate change impacts on ocean environments substantially affect water quality, such as dissolved oxygen and temperature, then the NWP intends to respond to them as well (USGCRP, 2008).

Strategic Action 30: The NWP intends to use available authorities and work with existing regional ocean governance structures, federal and state agencies, and other networks so that offshore renewable energy production does not adversely affect the marine environment.

Federal and state agencies are exploring offshore renewable energy production as a means to reduce the production of GHGs and increase energy independence. The NWP believes it is vital that the installation of renewable energy infrastructure (e.g., offshore wind turbines or wave energy systems, transmission cables, and shore-based facilities) be conducted in an environmentally responsible manner that does not result in unintended adverse consequences.

Relevant statutory authorities administered by the NWP include the National Environmental Policy Act (NEPA), the Marine Protection Research and Sanctuaries Act (MPRSA), and the CWA.

It will be particularly important to partner with and engage Regional Ocean Partnerships and EPA's geographic programs (e.g., Chesapeake Bay, Long Island Sound, Gulf of Mexico, NEPs), as well as other federal agencies, states, and tribes, and to participate in CMSP. CMSP is a comprehensive, adaptive, integrated, ecosystem-based, and transparent spatial planning process, based on sound science and intended to foster collaboration about how the ocean, coasts, and Great Lakes should be sustainably used and protected now and for future generations. Various sections of the CWA may apply to offshore energy facilities.

Strategic Action 31: The NWP intends to support the evaluation of sub-seabed sequestration of CO₂ and any proposals for ocean fertilization.

EPA intends to work with other agencies and the international community to provide technical assistance on sub-seabed carbon sequestration and coordinate with federal partners in addressing proposals for carbon sequestration in the sub-seabed or other proposals, such as potential fertilization of the ocean, including any applicable permitting that may be required under the MPRSA or the UIC program.

Carbon dioxide sequestration in sub-seabed geological formations, for example, involves separation of carbon dioxide from industrial and energy-related sources, transport to and injection into an offshore geological formation, and long-term isolation from the atmosphere. The NWP believes it is vital that the new technologies are responsibly deployed to protect the marine environment and avoid risks to coastal populations and habitats.

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Strategic Action 32: The NWP intends to participate in the interagency development and implementation of federal strategies through the National Ocean Council Strategic Action Plans and the ICCATF.

Many federal agencies manage or use coastal and ocean resources to support commerce, maintain national security, and ensure environmental sustainability. The NWP intends to participate in development and implementation of federal strategies so that coastal and ocean environments are protected and are prepared for climate change adaptation and mitigation, especially through the NOC. The National Ocean Policy identifies nine priority objectives, including to “strengthen resiliency of coastal communities and marine and Great Lakes environments and their abilities to adapt to climate change impacts and ocean acidification” and “increase knowledge to continually inform and improve management and policy decisions and the capacity to respond to change and challenges.” The NOC is developing a strategic action plan for this objective that will also serve as the National Action Plan (NAP) for Oceans and Coasts under the ICCATF. The NWP intends to continue to participate in writing and implementing this strategic action plan.

D. Water Quality

VISION: Our Nation’s surface water, drinking water, and ground water quality are protected, and the risks of climate change to human health and the environment are diminished, through a variety of adaptation and mitigation strategies.

This section focuses on the NWP’s strategy for responding to climate change impacts on water quality, using both regulatory and nonregulatory controls. Regulatory controls include WQS, TMDLs, and the NPDES, as well as drinking water regulations such as the UIC program. Nonregulatory controls include promotion of GI and LID strategies and other collaborative approaches. (Larger landscape strategies are covered in the Watersheds and Wetlands section). This section also discusses strategies for maintaining water quality while encouraging the adoption of alternative sources of energy and fuel technologies that reduce greenhouse gas emissions.

GOAL 12: The NWP protects waters of the United States and promotes management of sustainable surface water resources under changing climate conditions.

As detailed in the *2008 Strategy*, climate change is expected to impact surface waters in several ways, affecting both human health and ecological endpoints. For example, it is projected that warmer air temperatures in many locations will heat surface water temperatures to levels that will decrease the water’s ability to hold dissolved oxygen, leading to growth of harmful algal blooms and hypoxia. Warmer air temperatures may also lead to more evaporation, which could cause lower flows and higher salinity, as well as higher concentrations of other substances. Lower flows and greater salinity would likely cause an increase in impaired waters, even if actual pollutant loadings from dischargers do not increase. In many parts of the country, precipitation events are expected to become more extreme, increasing runoff with associated increases in pollutant loads, increasing variability of streamflow and associated sedimentation, and expanding flood risk.