

## **NEWS RELEASE**

### **FOR IMMEDIATE RELEASE:**

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**Attached Photo:** Octopus and desmophyllum on wall in Norfolk Canyon. © Image courtesy of Deepwater Canyons 2013 Expedition, NOAA-OER/BOEM/USGS

### **Little-known Underwater Canyon off New York and New Jersey Nominated as National Marine Sanctuary**

- The Hudson Canyon is the East Coast's largest submarine canyon
- A plethora of marine life can be found here, including whales, sharks, turtles, and more
- Although many species rely on the canyon, this fragile area could face threats from incompatible human activity, specifically oil and gas exploration and extraction
- The Wildlife Conservation Society's New York Aquarium today nominated the Hudson Canyon as a National Marine Sanctuary
- Sanctuary status will not only protect wildlife from oil and gas exploration, but also help sustain commercial and recreational fisheries, as well as pelagic whale and bird cruises that depend on this area.
- Based on its discussions with members of the fishing community, WCS does not recommend any change in fishing regulations as a result of a designation.

**WCS Newsroom:** <http://newsroom.wcs.org/>

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**Brooklyn, N.Y. – Nov. 18, 2016** – WCS's (Wildlife Conservation Society) New York Aquarium is leading a broad coalition of organizations and stakeholders working to help the Hudson Canyon, a magnificent underwater canyon few people know exist. Located just 100 miles southeast of the Statue of Liberty, the Hudson Canyon is the East Coast's largest submarine canyon. Many species of marine life can be found here, including whales, sharks, turtles, deep sea corals and more.

WCS has just submitted a proposal to the National Oceanic and Atmospheric Administration to National Oceanic and Atmospheric Administration (NOAA) to designate the Hudson Canyon a National Marine Sanctuary through a transparent, inclusive stakeholder-driven public process. The proposal submission is the first of several steps in the nomination process. Without protections, the Hudson Canyon faces threats from oil, gas, and mineral exploration and extraction. The coalition is a diverse group of stakeholders that includes aquariums, NGOs, local businesses, elected officials and others in the effort to nominate the marine ecosystem for sanctuary status.

The Hudson Canyon was formed more than 10,000 years ago during the last ice age. Today, hundreds of species rely on the Canyon – making it what scientists call a biodiversity hotspot.

The canyon also helps to support a thriving local ocean economy. The many fish and invertebrates that live here are a critical food source for the marine mammal and seabird populations that are important to whale watching and pelagic birding cruises. WCS recommends that fisheries within the Hudson Canyon continue to be regulated through existing regional and federal entities, and does not recommend any change in fishing regulations as a result of a designation.

“The Hudson Canyon provides shelter and food for marine species including a number of endangered whales and sea turtles. It is a fragile ocean ecosystem just offshore of one of the most densely populated urbanized areas in North America, one that is currently open to the possibility of oil, gas, and mineral exploration and extraction,” said Jon Forrest Dohlin, Wildlife Conservation Society Vice President and Director of the New York Aquarium. “We respectfully ask NOAA to safeguard the Hudson Canyon from these activities by designating the canyon as a National Marine Sanctuary. Giving the Hudson Canyon sanctuary status will help marine life thrive for generations to come, while also ensuring a robust fishing area for both commercial and recreational fisheries. We thank Congressman Serrano and the other members for their leadership.”

More than 17,700 people have signed a petition to show their support for the Hudson Canyon. Others can sign here: <http://bit.ly/2eW3CiD>.

This project has been made possible with support of the National Marine Sanctuary Foundation. The New York Aquarium works to protect local waters through its NY Seascape Program. The program is designed to study and restore healthy populations of local marine species—many of them threatened—and protect New York and New Jersey marine waters and habitats, which are vital to wildlife and key to the area’s economic and cultural vitality.

The unique habitats of the Hudson Canyon will be featured in the aquarium’s Canyon’s Edge exhibit in the future Ocean Wonders: Sharks! building, which will educate visitors about submarine canyons and their inhabitants.

For more information or to speak with a WCS expert, contact Barbara Russo at 718-265-3428 or [brusso@wcs.org](mailto:brusso@wcs.org).

**Wildlife Conservation Society's New York Aquarium** is open every day of the year. Summer hours are 10 a.m. to 6 p.m. daily. Fall/winter/spring hours are 10 a.m. to 4:30 p.m., daily. Tickets are \$11.95 per person (ages 3 & up), and include Aquarium admission plus one admission to the new 4-D Theater; children age 2 and under are admitted free. Fridays after 4 p.m. in the summer and after 3 p.m. in the fall, Aquarium admission is by pay-what-you-wish donation. The aquarium is located on Surf Avenue at West 8th Street in Coney Island. The New York Aquarium is located on property owned by the City of New York, and its operation is made possible in part by public funds provided through the New York City Department of Cultural Affairs. For directions, information on public events and programs, and other aquarium information, call 718-265-FISH or visit our web site at <http://www.nyaquarium.com>. Now is the perfect time to visit and show support for the WCS New York Aquarium, a beloved part of Brooklyn and all of the City of New York. Due to Hurricane Sandy we are partially opened. Check our website for more information. [www.nyaquarium.com](http://www.nyaquarium.com).

**Wildlife Conservation Society (WCS) MISSION:** WCS saves wildlife and wild places worldwide through science, conservation action, education, and inspiring people to value nature. **VISION:** WCS envisions a world where wildlife thrives in healthy lands and seas, valued by societies that embrace and benefit from the diversity and integrity of life on earth. To achieve our mission, WCS, based at the Bronx Zoo, harnesses the power of its Global

Conservation Program in more than 60 nations and in all the world's oceans and its five wildlife parks in New York City, visited by 4 million people annually. WCS combines its expertise in the field, zoos, and aquarium to achieve its conservation mission. Visit: [www.wcs.org](http://www.wcs.org); <http://www.facebook.com/TheWCS>; <http://www.youtube.com/user/WCSMedia> Follow: @thewcs.

Special Note to the Media: If you would like to guide your readers or viewers to a Web link where they can make donations in support of helping save wildlife and wild places, please direct them to [wcs.org](http://www.wcs.org).

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*“It has always been my desire to see how close to New York City the life of the deep sea is to be found – to see within what narrow limits on the earth one could find such intensive civilization and such an absolutely unexplored field.” -William Beebe*



# Future of the Hudson Canyon

IMAGE: JULIE LARSEN MAHER © WCS

Just 100 miles off the coast of bustling New York City lies the largest submarine canyon along the U.S. Atlantic coast—the Hudson Canyon. Rivaling the depth and scale of the Grand Canyon, this special place supports a remarkable abundance and diversity of marine wildlife, including leviathan whales, endangered sea turtles, majestic sharks and tunas, colorful coldwater corals and many species that support local commercial and recreational fisheries. Ships regularly traverse the waters above the canyon to enter one of the busiest ports in the world, and lying on the bottom is a network of deep sea communication cables that connect us to the world. Yet, this natural wonder remains a mystery to many.

## Securing a Conservation Legacy for Hudson Canyon

The Wildlife Conservation Society (WCS) submitted a proposal to NOAA nominating the Hudson Canyon as a National Marine Sanctuary (NMS). NOAA accepted this nomination, determining that the Hudson Canyon meets their criteria as a site of national significance. NOAA must now consider whether to take the next step of designating the Canyon as an NMS, which would provide a wide range of benefits for New York and New Jersey residents and the diversity of wildlife living off our shores. WCS is building an already diverse coalition of conservationists, recreational users, fishing interests, maritime industries, academic institutions, businesses, and community-based organizations to support its nomination and encourage the designation of the Hudson Canyon.

The region's marine waters, also known as the New York Bight, support a world-class metropolitan region, a rich maritime history, and highly productive fisheries, meriting recognition as a national treasure. A National Marine Sanctuary in these waters could preclude oil, gas and mineral extraction in the Canyon, helping to maintain fish and wildlife populations and ensure a future for the fisheries and tourism industries that depend on healthy ocean ecosystems. It will also provide a special place for us to enjoy and use today while securing an ecological legacy for generations to come.

### Hudson Canyon at a Glance

- Begins ~100 miles southeast of the Statue of Liberty and stretches for another 350 miles offshore
- Is nearly 7.5 miles wide at its widest point
- Provides habitat for 100's of species, including deep sea corals, marine mammals, fishes, marine turtles, and seabirds, as well as for species important to fisheries, such as tilefish, squid, crabs, flounder, and tunas
- Canyon walls can reach 3,500 feet
- It's nutrient-rich upwelling currents sustain large populations of plankton that serve as the base of the food chain
- Its deepest point is 10,500 feet below sea level —more than 7 Empire State Buildings stacked end-to-end from the seafloor to the surface
- Canyon formed more than 10,000 years ago during the last ice age
- Hudson is the largest canyon off the U.S. Atlantic Coast and one of the largest submarine canyons in the world
- Seasonal visitors, such as seabirds and whales, migrate through the canyon, making it a popular destination for tour boats



### About National Marine Sanctuaries

There are currently 13 sanctuaries in the NMS network managed by the National Oceanic and Atmospheric Administration (NOAA), from the Olympic Coast to the Florida Keys. Currently, there is only one NMS in the Mid-Atlantic and none off the coast of New York or New Jersey.

Each sanctuary is dedicated to the conservation of unique and valuable marine ecosystems as well as economic, cultural and historical resources. And while all the sanctuaries emphasize resource protection and decision-making based on the best available scientific and socioeconomic data, they are managed with local input from stakeholders to address a variety individual issues and needs. Sanctuaries also provide unique opportunities for science monitoring and research efforts that can help improve our understanding of these special places. A sanctuary offers the best opportunity from threats associated with oil and gas exploration and extraction that can negatively impact species from giant whales, turtles and sharks that migrate through the canyon to the sensitive deep sea corals.

As a part of its nomination letter, WCS recommended that fisheries within the Hudson Canyon continue to be regulated through existing regional and federal entities, not through an NMS designation. When NOAA initiates a designation of a new National Marine Sanctuary, there are numerous additional opportunities for public comment to ensure all viewpoints receive fair consideration.



For more information, contact [nyseascape@wcs.org](mailto:nyseascape@wcs.org)



Updated 3/13/17

Rec fishing photo: Hudson Canyon supports economically important recreational and commercial fisheries. The Sanctuary Nomination calls for continued fishery management under existing authorities. Squid photo: The Hudson Canyon boasts an incredible diversity of marine wildlife including species like this longfin squid, *Loligo pealei*.



This is a truncated version of the Hudson Canyon Sanctuary Nomination document. For the full version, including appendices with references and letters of support, see: <http://www.mafinc.org/briefing/april-2017>.



# Hudson Canyon National Marine Sanctuary Nomination

November 2016

## **Section I:**

### **Basics:**

**Nomination Title:** Hudson Canyon National Marine Sanctuary Proposal

**Nominator Names(s) and Affiliations(s):** Jon Forrest Dohlin, Vice President and Director, Wildlife Conservation Society's New York Aquarium

**Nomination Point of Contact:** Noah Chesnin, Policy Program Manager, New York Seascape Program, Wildlife Conservation Society's New York Aquarium, Surf Ave at West 8th Street, Brooklyn, NY 11224, (718) 265-7937, nchesnin@wcs.org

## **Section II:**

### **Narrative Description:**

“It has always been my desire to see how close to New York City the life of the deep sea is to be found – to see within what narrow limits on the earth one could find such intensive civilization and such an absolutely unexplored field.” - William Beebe

The marine waters of New York and New Jersey sustain a world-class metropolitan region, a rich maritime history, highly productive fisheries, and a rich diversity of marine life, thus deserving recognition as a national treasure. Located just over 175 km (or over 100 mi) southeast of New York City, the Hudson Canyon (Canyon) is the largest submarine canyon along the United States' Atlantic coast and one of the largest in the world (Butman *et. al.* 2006). Rivaling the depth and scale of the Grand Canyon, the Hudson Canyon extends about 560 km (350 mi) seaward, reaches depths of 3-4 km (2-2.5 mi), and is up to 12 km (7.5 mi) wide. We seek to nominate the offshore area of Hudson Canyon as a new National Marine Sanctuary.

The grand scale and diverse structure of the Canyon make it an ecological hotspot for a vast array and abundance of marine wildlife from the familiar to the bizarre. The Canyon provides habitat for a range of endangered, protected, and sensitive species including the sperm whale, sea turtles, deep sea corals, and unique and diverse seep communities. The robust biodiversity of the Canyon directly supports our local economy as well, by providing productive waters and habitats for the fish and invertebrates that commercial and recreational fisheries depend on. Recreational divers explore some of the shallower areas in and around the Canyon, and the yearly migration of whales and seabirds through the Hudson Canyon attracts whale-watchers and birders from across the Northeast, which further supports jobs in the tourism industry. In addition to supporting diverse fisheries, ships regularly traverse the waters above the Canyon to enter one of the world's busiest ports, and lying on the Canyon's bottom is a network of deep sea communication cables that connect us to the world.

It is our intention that the designation of a new National Marine Sanctuary (NMS) would preclude such inconsistent uses as oil, gas, and mineral extraction in the Hudson Canyon, helping to maintain fish and wildlife populations, protect our coastline, and ensure a future for the economically important fisheries and tourism industries that depend on healthy ocean ecosystems. We therefore recommend that fishing should continue in this economically valuable area, especially in light of recent proactive measures taken to protect deep sea corals and forage species in the region. A Sanctuary can complement these and other management efforts, for example, by assisting with enforcement of the Council's amendments, raising awareness, supporting research, and excluding incompatible uses. In addition, a designation would also bring financial resources for monitoring and scientific research that will be an important source of information when helping to address impacts of warming and ocean acidification in the future.

A Hudson Canyon National Marine Sanctuary off the coast of New York and New Jersey will provide a special place for millions to enjoy and use today, while securing an ecological legacy for generations to come.

### Goals Description:

The purpose of nominating the Hudson Canyon as a National Marine Sanctuary is to:

- **Support conservation of marine wildlife and habitats:** A National Marine Sanctuary would help advance marine conservation for the sensitive species and habitats in Hudson Canyon, including by the permanent restriction oil, gas, and other mineral exploration and extraction from this ecological and economic hotspot.
- **Highlight and promote the sustainable economic uses of Hudson Canyon:** Hudson Canyon is a multi-use area, much beloved and used by diverse stakeholders. A National Marine Sanctuary would highlight these sustainable uses for the general public and help promote the continued economic contribution to the local, state, and regional economy.
- **Enhance science and monitoring:** A National Marine Sanctuary designation would increase federal investment and leverage state, local, and private investment in science research, monitoring, and exploration, which would help us better understand, manage, and protect this unique and vulnerable offshore ecosystem.
- **Expand ocean education and awareness:** A National Marine Sanctuary would increase opportunities for financial investment in locally based formal and informal ocean education and awareness efforts. This will provide a sense of place and reconnect New York and New Jersey residents back to the waters and their maritime roots.
- **Transparent and inclusive management process:** A National Marine Sanctuary would create a transparent process for science-based, stakeholder-driven management that promotes the ecological, economic, and cultural resources in the Hudson Canyon.
- **Build new partnerships:** A National Marine Sanctuary would bring together diverse individuals and institutions and provide a framework for local and regional partnerships that will help promote the other goals listed above.



A National Marine Sanctuary nomination for the Hudson Canyon will help to connect the 22 million people living along one of the busiest coastlines in the world to the ocean in their own backyard. This sanctuary designation would provide a window into the offshore and mysterious deep sea habitat in the Mid-Atlantic that few know exist or can visit first hand. Yet, the abundance of marine wildlife and one of the world's largest submarine in such close proximity to one of the largest and densest human population centers in the world is both a cause for celebration and an obligation for conservation.

The proposed Sanctuary sits approximately 140 km (86 mi) southeast of New York City and nearly 160 km (100 mi) from the United States' Exclusive Economic Zone (EEZ) boundary, in waters ranging from 55 to 2560 m (80 - 8,400 ft) deep (Figure 1). It encompasses an area roughly 7,500 km<sup>2</sup> (2,900 sq. mi.) (40° 00' N, 72° 40.5' W to 39° 00' N, 71° 40' W). To put these numbers in context, the proposed Sanctuary's distance from shore is less than that from NYC to Philadelphia, and it's about one third the size of New York's Adirondack Park in area.

### **Section III: Criteria Information**

**Criteria 1: The area's natural resources and ecological qualities are of special significance and contribute to: biological productivity or diversity; maintenance or enhancement of ecosystem structure and function; maintenance of ecologically or commercially important species or species assemblages; maintenance or enhancement of critical habitat, representative biogeographic assemblages, or both; or maintenance or enhancement of connectivity to other ecologically significant resources.**

Located about 175 km (~100 mi) offshore from New York City and connecting to the Hudson Shelf Valley, the Hudson Canyon is the extension of the Hudson River bed that was drowned by the retreat of the glaciers during the Pleistocene Ice Age. As the largest of the 14 major submarine canyons incising the continental shelf along the United States' Atlantic Coast and one of the largest canyons in the world (Butman *et al.* 2006), the Hudson Canyon is a significant geophysical feature. Its presence is critical to the support of resident and migratory marine wildlife in the New York Bight, as well as the Mid-Atlantic region. Rivaling the depth and scale of the Grand Canyon, the walls of the Hudson Canyon reach heights of more than 1,100 meters (0.7 mi) and over 12 kilometers (7.5 mi) wide. Despite its size and proximity to one of the world's largest metropolitan centers in New York City, few know of this "stately, invisible gorge" that was first explored by William Beebe during his 1925 expedition on the *Arcturus* (Beebe 1925; McLeod 2015).

William Beebe's early deep-sea explorations of the Hudson Canyon and Sargasso Sea in his now-famous Bathysphere, the first manned submersible (Beebe 1926), generated a scientific and multidisciplinary fascination with the Mid-Atlantic canyons over the next 90 years.

Since 2000, a handful of federally funded expeditions to the Hudson Canyon have mapped the seafloor, collected amazing images and video, tracked the flow and impact of land-born pollutants, identified methane seeps, and collected sediment samples and new species from deep within and around the canyon (NOAA 2010a).

Scientists were not the only ocean-goers drawn to the Canyon. By the 1950s, recreational fishermen were heading far offshore in pursuit of giant and abundant tunas, billfishes, and sharks (Boyle 1964). The canyon remains a mecca for big-game anglers today. The waters above and deep in the Canyon remain the target of both recreational and commercial fisheries seeking giant game fish, tilefish, squid, and scallops. A National Marine Sanctuary could provide a "window" to this special place for the rest of the public, who cannot experience the Canyon first-hand because of its location far offshore. For example, the Wildlife Conservation Society's (WCS) New York Aquarium could provide a land-based portal for millions of visitors each year to learn about and explore the ecological and economic importance of the Canyon.

Indeed, the Hudson Canyon's grand scale and physical complexity—steep slopes, firm outcrops, diverse sediments, flux of nutrients, and areas of upwelling—leads to the high biological productivity that supports the abundance and diversity of species associated with this ecological hotspot. Hundreds of species of marine wildlife call the Canyon home (at least for part of the year), including marine mammals, sea turtles, sharks and other fishes, seabirds, and invertebrates including deep sea corals. Unfortunately, there has been no overarching assessment of species diversity or abundance directly associated with the Canyon. The biodiversity discussed below was compiled from a variety of sources (NMFS 2016a; V. Guida, pers. comm.; Lagueux *et al.* 2010; NEFSC and SEFSC 2010-2012; D. Gochfeld, pers. comm.) reflecting species that have been caught or observed in and above the Canyon over the past 20 years, but the list is undoubtedly incomplete. In the Canyon and surrounding waters, bounded by National Oceanic and Atmospheric Administration's (NOAA) Statistical Area 616, at least 200 species of fishes, 115 species of invertebrates, 17 marine mammals, 3 or 4 sea turtles, and about 20 seabirds have been reported. To date, there has been relatively little exploration of coral presence in Hudson Canyon. However, a habitat suitability model based on documented coral sightings predicts large areas of highly suitable habitat for soft corals, which illustrates the need for greatly increased investment in benthic exploration.

**Protected Species:** The New York Bight supports one of the highest diversities of marine mammals (27 species reported, of which 17 are known to occur in the Hudson Canyon) and sea turtles (4 species are regular visitors) in US waters (USFWS 1997). All of these species are protected under the US Endangered Species Act (ESA) and/or the Marine Mammal Protection Act (MMPA). Sperm whales (Endangered), bottlenose dolphins, and loggerhead (Threatened) and leatherback (Endangered) sea turtles have been sighted more often in around the Canyon than in other areas of the Mid-Atlantic during summer months. The Canyon is also home to several federally listed Candidate Species (under review for listing on ESA) and Species of

Concern, i.e., species for which there is significant concern about their conservation status and threats but insufficient information to support listing under ESA. Species that depend on the Canyon for at least part of their life cycle (for example, as essential fish habitat, EFH) include Atlantic bluefin tuna, targeted both by recreational and commercial fishermen over the Canyon, as well as dusky shark, basking shark, oceanic whitetip shark, thorny skate, Atlantic wolffish, and cusk. Many of these species have been petitioned for ESA listing as well.

**Fish and Invertebrates:** The Hudson Canyon provides invaluable habitat for hundreds of species of bony and cartilaginous fishes and invertebrates. A few dozen of these are the targets of commercial and recreational fisheries, offshore and/or inshore, and are therefore subject to management under the National Marine Fisheries Service's (NMFS) Highly Migratory Species Division (HMS), the Mid-Atlantic Fishery Management Council (MAFMC), the Atlantic States Marine Fisheries Commission (ASMFC), or in New York and New Jersey state fisheries programs. Under the Magnuson Stevens Act, essential fish habitat (EFH) is defined by NMFS as "the habitat necessary for managed fish to complete their life cycle, thus contributing to a fishery that can be harvested sustainably." EFH has been designated for various life stages of 50 different species of federally managed fish and shellfish that occur in and/or around the proposed Sanctuary. These species include 24 Highly Migratory Species, including highly prized recreational species such as yellowfin tuna, blue and white marlin, and shortfin mako, and commercial species such as swordfish, albacore, and bluefin tuna (Figure 1). The Canyon also contains EFH for 25 coastal species that rely on the Hudson Canyon area during one or more life stages, including fluke (summer flounder), black sea bass, and bluefish. In addition to serving as EFH for sea scallops, large swaths of seafloor just to the southeast of the Canyon are part of a rotational fishing access area to facilitate population recovery (NMFS 2016a). Both juvenile and adult longfin squid, one of the most valuable commercial species on the East Coast, also depend on the Canyon as EFH.

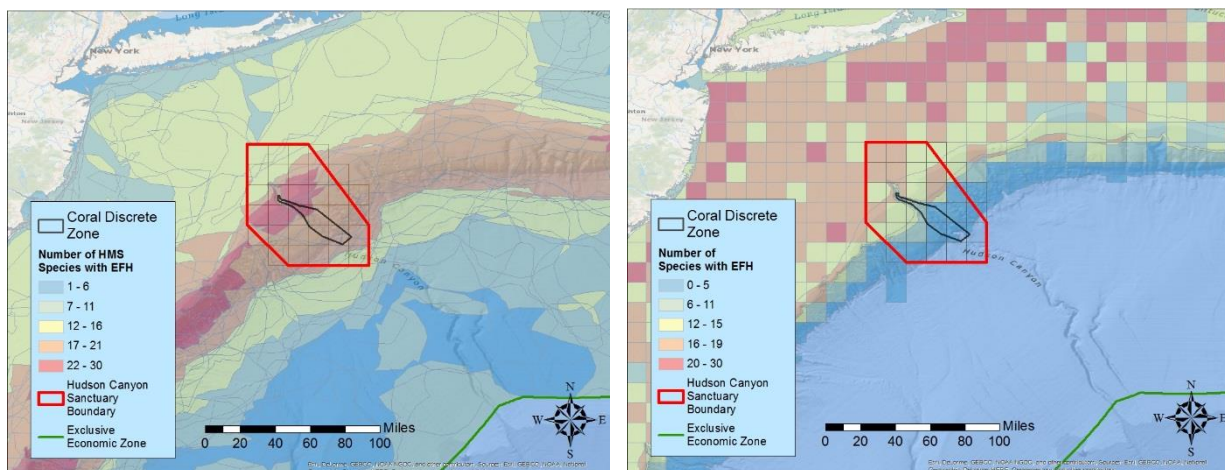


Figure 1. Number of species that have designated essential fish habitat in the proposed sanctuary boundaries including highly migratory species (left) and 39 species under federal management in the Mid-Atlantic and Northeast (right) (MARCO 2016).

**Deep Sea Corals:** One thing that makes the Hudson Canyon unique among marine habitats in the New York Bight is the presence of deep sea, cold-water coral communities. NOAA characterizes deep sea corals as occurring at >50 m depths on continental shelves, slopes, canyons and seamounts, but deep sea corals can be found anywhere from surface waters to 3,000 m depth (~1,000 ft; Menza *et al.* 2012). Rocky outcrops and boulders at the head of the Canyon and along its steep walls provide the hard substrate needed for attachment by hard and soft corals, sea pens, anemones, and sponges.

These slow growing, long-lived coral species are thought to produce colonies that may be over 1,000 years old (P. Auster, pers. comm.). Their complicated branching growth form provides structure, valuable habitat, and refuge for many other canyon species. But these life history traits also make deep sea corals particularly vulnerable to damage from fishing gear, oil fouling, plastic garbage, and other anthropogenic impacts. Once damaged, it may take them centuries to recover.

Although there are documented sightings of deep sea corals within the Hudson Canyon itself (e.g., Packer *et al.*, 2007; Hecker and Blechschmidt 1980), our current understanding of coral abundance and distribution in the Northwest Atlantic, and particularly in the Hudson Canyon, remains incomplete. This highlights the need for additional biological research in Hudson and nearby canyons, with conservation measures taken in the interim to protect these highly sensitive communities from destruction. In 2015, the MAFMC adopted the Deep Sea Coral Amendment to the Mackerel, Squid, and Butterfish Fishery Management Plan. To help protect sensitive deep sea corals, this action restricts the use of bottom-tending fishing gear in discrete zones in 15 Mid-Atlantic canyons over a total of 61,000 km<sup>2</sup> (38,000 mi<sup>2</sup>). A National Marine Sanctuary in the Hudson Canyon will build on the foundation provided by the Deep Sea Coral Amendment and give scientists greater opportunity to study the deep sea corals and other life of the Hudson Canyon in more depth.

**Seabirds:** Seabirds spend most of their lives at sea, some only coming to land to breed. Coastal or nearshore seabirds are most common within 5 km (3 mi) of land, and these include sea ducks, grebes and gulls. Pelagic seabirds occur much further offshore and include, among others, petrels, fulmars, gannets, and jaegers. The Atlantic Flyway, a major route for migrating seabirds, shorebirds and other birds, overlaps the New York Bight.

Of particular relevance to the Hudson Canyon are the offshore seabirds that rely on the nutrient-rich marine waters (resulting from upwelling in late winter and spring) and habitats that support their prey. At least 29 species of pelagic seabirds summer or overwinter in the New York Bight (O'Connell *et al.* 2009). Species composition, concentrations, and densities shift seasonally depending on the distribution of food resources and migration routes. For example, shearwaters and storm-petrels are the most abundant pelagic birds in summer, including over the Canyon, while gannets, phalaropes, and jaegers migrate through in spring and fall. In spring of 1980 – 1988, seabird densities surrounding the Hudson Canyon were > 50 birds/km<sup>2</sup>, making it a critical habitat for migrating seabirds (Hoopes *et.al.*, 1994). Seabird densities are almost as high during



winter, suggesting that the Hudson Canyon and surrounding waters are important seabird habitat for much of the year.

Major threats to pelagic seabirds include oil spills, poor water quality, overfishing of seabirds' prey, entanglement in fishing gear, and possible negative interactions with wind turbines (USFWS 1997; O'Connell *et al.* 2009). Predictive models of seabird distributions in the New York Bight have been developed to guide ocean planning, offshore wind energy development, and conservation (Menza *et al.* 2012). Generated hotspot maps suggest that the head of the Canyon and shelf break to the north of the Canyon are areas of high seabird abundance, whereas the Hudson Shelf Break is an area of greatest species richness. The Hudson Canyon and surrounding waters of the New York Bight provide essential habitat for seabirds and their prey, and must be protected to prevent future harm to pelagic seabird populations.

**Criteria 2: The area contains submerged maritime heritage resources of special historical, cultural, or archaeological significance, that: individually or collectively are consistent with the criteria of eligibility for listing on the National Register of Historic Places; have met or which would meet the criteria for designation as a National Historic Landmark; or have special or sacred meaning to the indigenous people of the region or nation.**

The Hudson Canyon remains a mysterious deep ocean wilderness. Distance from land and the depth of the Canyon have resulted in limited human presence thereby protecting, in large part, its ecological integrity. Despite this, the waters surrounding the Canyon hold historical, economic, and cultural importance to those living along its shores. Shipwrecks provide important and dramatic views into the maritime heritage of this area.

**Submerged Archaeological Sites (Submerged Native American Heritage Sites):** Today, there are nine federally and state recognized tribes in New York State (e.g., Cayuga Nation, Oneida Nation of New York, Onondaga Nation, Saint Regis Mohawk Tribe, Seneca Nation, Shinnecock Nation, Tonawanda Band of Seneca, Tuscarora Nation of New York, and the Unkechaug Nation) (NCSL 2016) and three tribes acknowledged by New Jersey, which serve on the New Jersey Commission of American Indian Affairs (the Nanticoke Lenni-Lenape, Powhatan Renape, and the Ramapough Lenape Tribes) (State of New Jersey Department of State 2016). Despite a long tribal history in the region, there appear to be no known submerged tribal archeological sites in or directly adjacent to the proposed sanctuary boundaries, probably due to the distance of the Hudson Canyon from the coast in the New York Bight today (~160 km/100 mi).

**Shipwrecks (Submerged Maritime Heritage):** The majority of the information we have on local shipwrecks comes from the very active dive community in New York and New Jersey. However, due to the confidential nature of certain dive sites, actual names and locations of shipwrecks vary from one dive organization to the next. The types of wrecks found within the

proposed boundaries of the Hudson Canyon National Marine Sanctuary vary from freighters to U.S. military radar platforms, some dating back to the mid-19th Century.

For example, located about 100 km (~60 mi) off the coasts of NY and NJ (just within the proposed boundaries of the Sanctuary) in water about 55 m (180 ft) deep, the *Texas Tower #4*, a U.S. Air Force radar platform aptly named for its resemblance to an oil rig, was one of three East Coast radar platforms and dates back to 1955. Built on unstable soft mud and sand, the Tower sunk in 1962 with all 28 crew aboard (Baker-Wager 1996). Aside from its historical significance as one of three original Air Force radar platforms as part of the Distant Early Warning (DEW) Line, this wreck serves as a familiar landmark for fishermen heading to the Canyon. The *Texas Tower #4* also provides structure and habitat for a diverse array of fishes, and has become a popular fishing wreck for recreational fishermen. Other shipwrecks found within the proposed Sanctuary boundaries include the *Manantice* (built 1880), the *St. Rita* (built 1925), the *Sagua* (built 1901) and the *Sharon* (built 1863; New Jersey Maritime Museum 2016).

**Criteria 3: The area supports present and potential economic uses, such as: tourism; commercial and recreational fishing; subsistence and traditional uses; diving; and other recreational uses that depend on conservation and management of the area's resources.**

New York and New Jersey are maritime states that have long been economically dependent on the healthy ocean ecosystem at their doorstep. A formal designation process would provide an opportunity for a thorough and publicly vetted economic analysis of ocean-based economies here in the New York Bight and Canyon. The beginning of such an analysis follows.

According to NOAA, in 2013 there were 130,626 jobs in New Jersey tied directly to the ocean economy. In New Jersey, more than 69% of these jobs were in the tourism and recreation sector, 26.7% in the marine transportation sector, 1.2% in the living resources sector, 0.9% in the shipping and boat building sector, and 1.6% in the marine construction sector (NOAA 2016a). This same year, 348,324 jobs were tied to the ocean economy in New York State. As with New Jersey, the tourism and recreation sector comprised the largest portion of jobs (91.5% of NY ocean jobs), followed by marine transportation (6.7%), marine construction (0.7%) and living resources (0.8%) (NOAA 2016b). While these statistics apply statewide, they reflect some of the key economic uses of Hudson Canyon, which depend on conservation and management of the area's resources.

**Offshore Mineral Extraction:** The offshore mineral extraction industry in New York and New Jersey, which includes oil and gas exploration and production and sand and gravel mining, is relatively small. In 2013, approximately 600 people and 800 people were employed in this sector in New Jersey and New York, respectively (NOAA 2013a). Although the New York Bight is currently off limits to oil and gas extraction, exploration has taken place and interest in potential nonrenewable energy extraction continues today (see Consideration 3).

**Deep Sea Cables:** New York is a critical trans-Atlantic telecommunications hub, connecting the East Coast to the rest of the world. According to the Mid-Atlantic Regional Council on the Ocean (MARCO) Data Portal, there are 26 submarine telecommunication cables and cable segments that make landfall in New York and New Jersey (MARCO 2016a, 2016b). At least nine of these cables either abut or cross the Hudson Canyon. Cables are typically buried 1–2 m (3–6 ft) below the seafloor (and are responsible for transmitting 97–99 percent of international communication from the U.S. (MARCO 2016c; Mid-Atlantic RPB 2016).

**Shipping:** The Port of New York and New Jersey, situated at the apex of the New York Bight and mouth of the Hudson River, is the largest port on the East Coast and the third largest in the nation, handling 3,342,286 cargo containers valued at more than \$200 billion in 2014 (a 5.4% increase in total container traffic from 2013, and a 30% market share of all East Coast shipping; Port Authority of NY & NJ, 2016; NYMAR 2016). In 2015, the Port of New York and New Jersey imported and exported a total of more than 73.5 million metric tons of cargo, valued at over \$203 billion (Port Authority of NY & NJ 2016). The Port was responsible for 51.9% of all North Atlantic port cargo (up 2.4% from 2014; NYMAR 2016). In 2014, the Port was responsible for 190,100 direct jobs and 336,600 full-time job equivalents across the region, including 47,120 total jobs in New York and 284,000 total jobs in New Jersey. The Port generated over \$21.2 billion in personal income and nearly \$53.5 billion in business income, as well as nearly \$4.7 billion in federal and \$2.3 billion in state and local tax revenue (NYSA 2014).

The current separation scheme/zone, which directs vessels in and out of this very busy Harbor, does not extend as far offshore as the Canyon, so there is no formal routing of vessels in the waters over and around the Canyon. Similarly, the North Atlantic right whale regulations that currently exist within the New York Bight do not extend to the Canyon.

**Commercial Fisheries:** The Hudson Canyon and surrounding waters are home to some of the most commercially valuable species on the U.S. Atlantic Coast, including sea scallops and American lobster, valued at nearly \$1 billion (ex-vessel) in 2014. For sea scallops, the seafloor immediately south and west of the Canyon is so vital to the population that it has been designated the Hudson Canyon Scallop Access Area, one of three areas closed to the sea scallop fishery on a rotating basis to allow for recovery of this commercially important species. In 2014, the Hudson Canyon area produced nearly \$31.5 million worth of scallops. The Canyon has also become an important site for lobster fishermen from southern New England. As this lobster population moves offshore and north as a result of adverse environmental conditions including warming, areas like the Hudson Canyon could become even more important to the survival of this regional lobster fishery (NMFS 2016b, NMFS 2016c).

Longfin squid (aka *Loligo*) landings from the Atlantic Coast totaled over 26 million pounds in 2014, netting fishermen over \$25 million. Fifteen percent of those landings came from the Hudson Canyon area, generating nearly \$4 million. Other major Atlantic Coast fisheries present in the Canyon include summer flounder or fluke (20% total Atlantic landings, \$6.3 million), scup or porgy (19%, \$1.8 million), black sea bass (22%, \$1.8 million), and golden tilefish (22%, \$1.7

million). In all, commercial fisheries associated with the Hudson Canyon generated over \$48 million in 2014.

**Recreational Fisheries:** Recreational fishing is an important public use of our local ocean: 2.6 million anglers fished annually in the Mid-Atlantic from 2003-2013. In 2013, total fishing trip and equipment spending topped \$3.5 billion (NMFS 2016d). Within the New York Bight, the Hudson Canyon is *the* destination for big game anglers seeking the largest and fastest fishes. Given the distance from the coast (for most boats it takes 3-6 hours to reach these fishing grounds), Canyon trips are often overnights. Numerous tuna species, including Atlantic bluefin, yellowfin, and bigeye tunas, are commonly targeted in the Canyon in summer months, and mahi mahi are found around structure (e.g., lobster pots). The presence of these species inevitably attracts other large and highly sought predators such as shortfin mako and blue sharks, swordfish, and blue marlin.

From 2000-2009, federally permitted charter and party boats reported 2,125 trips to the proposed Sanctuary area (MARCO 2016a). A similar survey from 2001-2010 found that over 190,000 lbs of fish were landed from the proposed Sanctuary area (NYSDOS 2013). Neither of these estimates includes private boaters, which could represent a significant number of trips.

**Criteria 4: The publically-derived benefits of the area, such as aesthetic value, public recreation, and access to places depend on conservation and management of the area's resources.**

The New York Bight is home not only to the Hudson Canyon, but also to 22 million people living along 420 km (260 mi) of coastline, one of the largest and busiest ports in the world, and a cultural mecca in New York City. The Canyon remains a biological treasure that needs to be protected so that future generations may learn of the wonders of this special place and enjoy the resources it provides.

Despite having scale and majesty that rivals—and faunal biodiversity that likely exceeds—the Grand Canyon, most people are astounded to learn about the Hudson Canyon. The establishment of a Sanctuary off the coast of New York and New Jersey would help build a critically needed sense of place, connecting residents of the tri-state area to the ocean and its treasures in their own backyard. As NOAA's Sanctuary Program notes, "Sanctuaries provide a sense of place that stimulates interest, curiosity and investment about the world and its diverse inhabitants and habitats" (NOAA 2016). The proposed area is far from shore, and therefore relatively few people will have direct access to the Sanctuary. Through government and academic research and monitoring, as well as citizen science, the Sanctuary will provide a centralized platform to not only consolidate existing and new information about the Canyon, but also to help visualize to the public the astounding ecological riches of national significance buried deep beneath the waves off our shore. In addition, people will be able to learn about and connect to the Sanctuary



through a diverse range of formal and informal educational programming, including canyon-focused exhibits at the WCS's New York Aquarium (see Consideration 6).

The Hudson Canyon Sanctuary would create opportunities to expand the extensive network of wildlife sanctuaries and nature preserves already in existence along the East Coast and on the mainland of New York and New Jersey. From small private preserves to large expanses of federally protected coastline like the Fire Island National Seashore and the Gateway National Recreation Area, the designation of the Hudson Canyon as a National Marine Sanctuary offers a new perspective on the



Blue shark. © Keith A. Ellenbogen

beauty and biodiversity offshore that connects our productive coastal waters to the equally rich waters of the continental shelf and the deep sea canyons.

**Recreational Fishing:** Recreational fishing is a pastime that dates back hundreds of years, especially in the Mid-Atlantic. According to the NYS Department of Environmental Conservation, in 2011 recreational saltwater anglers generated \$369 million in sales, contributed \$212 million to the gross state product and added 3,000 jobs to the state workforce, all stemming from approximately four million trips on an annual basis (NYS DEC 2016), some of which target areas around and directly above the Hudson Canyon.

**Pelagic Birding and Wildlife Viewing:** In addition to the productive fisheries, Hudson Canyon is a popular destination for pelagic birding cruises that depart from ports across the Mid-Atlantic, with many trips beginning in the ports of Cape May, NJ, and Freeport and Sheepshead Bay, NY. Like fishermen, dedicated birders brave pitching seas and sardine-like sleeping quarters during overnight trips for the chance to see first-hand the biodiversity far offshore that the Hudson Canyon helps to sustain. Popular targets and sightings include various species of shearwaters and storm-petrels (e.g., Wilson's Storm-petrel, Cory's Shearwater, the Great Shearwater, the White-faced Storm-Petrel, and Audubon's Shearwaters), sea turtles, Common and Risso's dolphins, fin and long-finned pilot whales, ocean sunfish, manta rays, flying fish, sharks, and many more species. Ensuring a healthy Canyon ecosystem is critical to maintaining these valuable non-consumptive uses.

#### **Section IV: Consideration Information**

##### **Consideration 1: The area provides or enhances opportunities for research in marine science, including marine archaeology.**

Despite its proximity to one of the world's largest population centers, little was known about the Hudson Canyon prior to William Beebe's 1925 *Arcturus* expedition, when he spent four days with "not a moment's idleness from lack of specimens" as he explored and described the life in Hudson "gorge" (Beebe and Rose 1926; McLeod 2015). Later studies in the 1970s – 80s, including deep sea research dives with the *Alvin* submersible, began to yield unique information about the Canyon's bottom geology, morphology, sedimentation, currents (Cacchione *et al.* 1978; Hotchkiss and Wunsch 1982), and biology. These studies revealed thick accumulation of mud covering the Canyon floor in the shallow sections (Keller *et al.* 1973) and erosion of Canyon walls by strong episodic bottom currents and burrowing by benthic organisms at depths of 2,900 to 3,500 m (Cacchione *et al.* 1978).

Since the late 1990s, a series of expeditions, conducted by NOAA in partnership with Woods Hole Oceanographic Institute, U.S. Geological Service, BOEM, Rutgers, Stony Brook and other academic institutions (e.g., see <http://oceanexplorer.noaa.gov/>), have advanced our understanding of the bathymetry and ecology of Hudson Canyon. This work included hydrographic surveys (e.g., see NOAA online report H-9574); multibeam sonar mapping of seafloor topography (Butman *et al.* 2006); and benthic habitat, visual imaging, sedimentological, and trawl sampling of megafauna (Pierdomenico *et al.* 2015). Nutrient availability (including chemosynthetic sources), internal waves, tides, and turbidity currents (Hotchkiss and Wunsch 1982), benthic sediment characteristics, topographic complexity, and habitat-forming taxa (Able *et al.* 1982; Twitchell *et al.* 1985; Buhl-Mortensen *et al.* 2010) create the dynamic conditions and diverse microhabitats that support the Canyon's noted faunal abundance and diversity and make it an ecological hotspot (Rona *et al.* 2015; Pierdomenico *et al.* 2015).

Although Hudson Canyon is considered to be highly productive area critical in support of regional fisheries (Pierdomenico *et al.* 2015; NEFMC 2016), additional research is needed to improve our understanding of the full diversity (although see Moore *et al.* 2003 for deepwater fishes), distribution, and abundance of Hudson Canyon-associated fauna, and their sensitivity to anthropogenic impacts (e.g., derelict fishing gear: Gerle and DiGiovanni 1998 ; NOAA 2014; ocean noise: Nowacek *et al.* 2015; warming patterns; Nye *et al.* 2009: etc.). At least 122 taxa of fish and invertebrates were identified from benthic trawl samples (Guida *et al.* 2011), and over 300 species have been reported taken (both target and bycatch) in local fisheries (in Statistical Area 616). There are relatively few historical records of deep sea corals (largely sea pens and cup corals) from the Canyon itself due to the lack of exploration (Packard and Dorfman 2012; NEFMC 2016). Increased mapping and survey efforts, studies of canyon-dependent biodiversity, life history traits and habitat needs, and an assessment of human impacts (e.g., acidification) on these sensitive ecological communities are key research priorities (Packer *et al.* 2007).

A growing area of research in Hudson Canyon is addressing the extent, distribution, and importance of methane gas deposits and cold seeps. Recent research expeditions conducted largely seaward of the shelf break off NOAA's ship Okeanos Explorer, revealed a much higher occurrence of methane leakage from the seafloor in Hudson Canyon than previously believed. At least 50 methane plumes were documented in the Canyon found at depths between 100 and 600 meters below sea level (Skarke *et al.* 2014).

Cold seeps on the sea floor support unique chemosynthetic communities rich in microbial organisms that are metabolically dependent on methane for energy and growth and, in turn, support an array of macrofauna including mussels, tubeworms, clams, and crabs. Research is needed to better understand the high rates of methane venting and oxidation in the region and the global impact of this methane release, given that methane is a potent greenhouse gas (Stanley 2015). These communities are markers for oil and gas, and may be a source for new commercially valuable bacteria.

The most significant impact to deep sea ecosystems may ultimately come from climate change (Ramirez-Llodra *et al.* 2011). Hudson Canyon could serve as a valuable sentinel site for a long-term study of the links between methane, acidification, deoxygenation, and warming, as well as the potential role of submarine canyons as refugia for wildlife against a shifting climate.

Compared to Monterey Canyon and the Monterey Bay National Marine Sanctuary, Hudson Canyon lacks data needed to address interdisciplinary questions (Rona *et al.* 2015) and management issues, such as establishment of Habitat Areas of Particular Concern for key species (HAPCs; Pierdomenico *et al.* 2015; NEFMC 2016). A recent report identified top research priorities for future ocean exploration, including research in the U.S. EEZ, the water column, coral ecosystems, methane seeps, marine life, and ocean acidification (Aquarium of the Pacific and NOAA 2013). Hudson Canyon can provide a critical long-term monitoring site to help fill these critical information gaps, while a National Marine Sanctuary can provide a platform to collate and disseminate existing data (much of which has not yet been published) and facilitate ecosystem-based management for this special place.

In 2014 and 2016, MARCO convened experts to review our state of knowledge about submarine canyons in the Mid-Atlantic and set forth a "course of action" for their conservation. Stated objectives include working collaboratively to gather and apply best available science on canyon ecology, processes, and human impacts, identify and close data gaps, and recommend mechanisms to protect canyon habitats, while recognizing their economic importance. To promote both scientific knowledge and public awareness, WCS plans to host a one-day expert science workshop in early 2017 to further explore the research needs and opportunities for Hudson Canyon, and help guide Sanctuary research priorities.

**Consideration 2: The area provides or enhances opportunities for education, including the understanding and appreciation of the marine and Great Lakes environments.**

A National Marine Sanctuary designation of the Hudson Canyon will provide many rich educational opportunities for diverse audiences to enhance their understanding and appreciation of the region's ecology, resources, and history. With a myriad of academic and cultural institutions already showing interest in showcasing marine science and conservation, designating the Hudson Canyon as a Sanctuary would bolster these efforts and help build a local marine ethic.

Curriculum developed by the Sanctuary Program and partner institutions related to the Hudson Canyon ecology, resources, and history could be shared with nearby schools, academic institutions and aquariums to further increase opportunities to build the understanding and appreciation of this region. Potential topics include learning about the environmental health and ecology of the Hudson Canyon, providing an introduction to the Sanctuary process, and introducing students to careers in marine biology and conservation. The Sanctuary would provide a unique opportunity to connect people from one of the most urbanized places in the world with the deep sea.

New York and New Jersey support a large and diverse range of arts and culture organizations. According to New York City's Department of Cultural Affairs, the City is home to more than 700 art galleries, 380 nonprofit theater companies, 330 dance companies 131 museums, 96 orchestras, 40 Broadway theaters, 15 major concert halls, five zoos, five botanical gardens, and one aquarium (NYC Dept. of Cultural Affairs, 2016). Some of institutions may provide unprecedented opportunities for innovative collaborations that can help broaden the reach of the Sanctuary Program's messages. WCS has already started reaching out to new audiences through the New York Aquarium's inaugural artist-in-residence program, which we envision to grow to include public-facing workshops, presentations, blog posts, and exhibitions.

Given its distance from shore, most local residents are unaware and /or unable to experience first-hand the astounding biodiversity of the Canyon and surrounding waters in the New York Bight. To bring this unseen world to the public, WCS is working with a renowned underwater photographer to develop a photographic catalog of marine wildlife, which can be made available to support Sanctuary education and outreach initiatives to help visualize the splendors beneath the waves in the Canyon and our coastal waters.



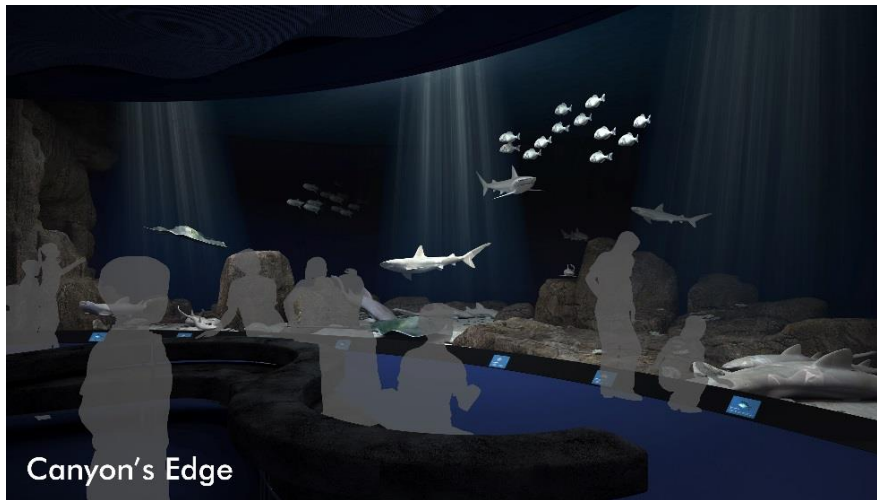


Figure 2. Artist rendering of New York Aquarium's "Canyon Edge" exhibit (opening 2018).

The New York Aquarium has the potential to reach a million visitors annually within its walls and many millions more through its education, outreach, and digital programs. This provides both an opportunity and a responsibility to educate the public about the ecological treasures at risk in our ocean backyard and to provide them with

diverse opportunities to

become active stewards of these marine resources. The post-Sandy reconstructed New York Aquarium, which will reopen in 2018, will allow visitors to come face-to-face with 115 species that thrive in the local seascape. A centerpiece exhibit of a new 57,000 sq. ft building will showcase the Hudson Canyon and provide classroom space and many opportunities for students, teachers, and visitors to learn more about the region's ecology and resources (Figure 2). Hudson Canyon-specific curriculum is currently being developed by New York Aquarium education staff and will be shared with aquarium docents who will, in turn, create lessons, games, and activities for visitors of all ages.

New Jersey and New York are rich with academic and research institutions, a number of which have engaged over the years in research in and around Hudson Canyon research (e.g., Stony Brook University and Rutgers University). Academic research cruises provide excellent opportunities for scientists and students to gain field experience and learn first-hand about the Hudson Canyon environment as a whole. The designation of a sanctuary would further draw academic research cruises to this region, increasing valuable data collection and contributing to the understanding of the Canyon's environment. Partnerships with universities and other learning institutions could produce both classroom and hands-on experience, field opportunities, and access to various labs and field supplies related to higher learning about the Hudson Canyon. In addition to academic partners, the Sanctuary would benefit from tools, materials and guidance developed within other National Marine Sanctuaries to support other education and engagement opportunities.

**Consideration 3: Adverse impacts from current or future uses and activities threaten the area's significance, values, qualities, and resources.**

Hudson Canyon sits offshore from one of the most densely populated and urbanized coastlines in the world and the largest shipping port along the U.S. Atlantic Coast. That this ecological

hotspot – which some refer to as a wilderness – is so near a globally significant urban center, is a compelling reason to protect it, but it also poses risks to its integrity. Although the Canyon’s remote location offshore means that it is still relatively intact—and thereby even more worthy of protection—ongoing human activities and ever-changing technological advances emerging to meet the growing demand for resources, could threaten this exceptional ecosystem. The following briefly addresses a number of potential threats to the long-term well-being of the Hudson Canyon and its wildlife and habitats, as they relate to disposal, exploitation, and climate change (Ramirez-Llodra *et al.* 2011).

### Energy Development: Oil and Gas:

The Bureau of Energy Management (BOEM) oversees the exploration and development of oil and gas (O&G), renewable energy, and mineral extraction on the Atlantic Outer Continental Shelf. Today, O&G exploration and development probably represents the greatest threat to life and habitats in the Hudson Canyon. The potential impacts are many. Seismic surveys and drilling can cause hearing loss in whales, dolphins, and other species, and the acoustic disturbance can chase animals from habitat they depend on. Installation of large-scale infrastructure disturbs habitat and drilling activities generate wastes. Oil spills, like that of the Deepwater Horizon disaster in 2010 (the largest accidental oil spill in the ocean), expose wildlife (including corals and seabirds) to oil, chemical dispersants, and/or extremely depleted oxygen. Many of the same impacts that are associated with exploration would also apply to renewable energy development and mineral extraction.

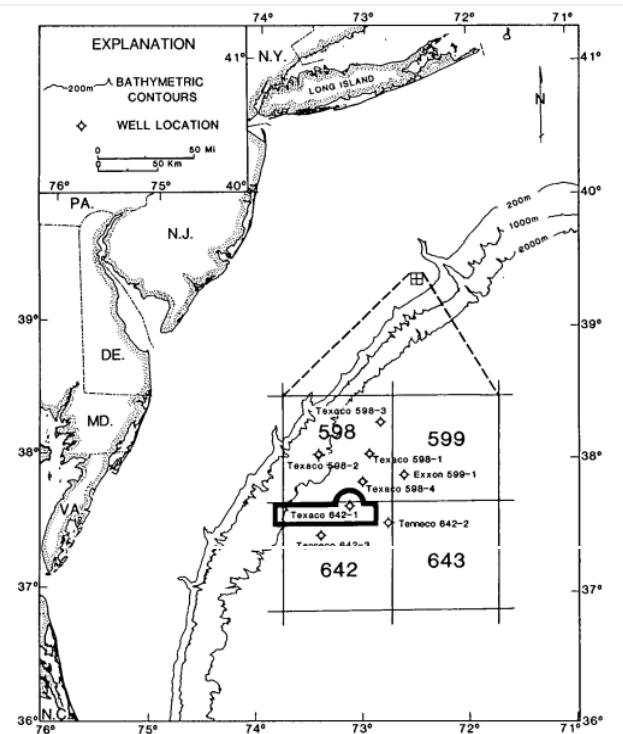


Figure 3 Historic lease drill sites from the 1970's and 1980's in the vicinity of Hudson Canyon. (Amato and Bielak 1990)

While there are currently no operational wells, nor plans to explore or drill at the moment, there is a long history of exploration in the region from the federal government and petroleum industry. Between 1978 and 1984, 32 exploratory wells were drilled offshore New Jersey and Maryland, in the Baltimore Canyon Trough including eight wells to the southeast of Hudson Canyon. Although reserves of gas were found at a number of these sites (less than 145 km (90 mi) from Atlantic City and within about 65 km (40 mi) of the Hudson Canyon), all were abandoned (Figure 3; Bielak 1986; Kobelski 1987; Amato and Bielak 1990).

The Atlantic was under consideration for exploration in the Outer Continental Shelf (OCS) Oil and Gas Leasing Program for 2017-2022. In March 2016, however, the Obama Administration announced that it was withdrawing the Atlantic from consideration for the five-year plan (Kershaw 2016). This is an important conservation and economic victory for the region south of Hudson Canyon, as well as for species that migrate to the Canyon through the Mid- and South Atlantic region. However, continued interest exists in exploring potential reserves in the region as evidenced by a 2014 Record of Decision released by BOEM (BOEM 2014), and there is no guarantee that the moratorium in the Mid-Atlantic will be maintained by future administrations, especially in light of recent discoveries of methane deposits.

Noise generated during seismic surveys and other activities associated with O&G exploration and research can lead to adverse physical, psychological, and behavioral impacts on sensitive marine fauna (Gedamke *et al.* 2016), even if that activity occurred at a great distance from Hudson Canyon (Nowacek *et al.* 2015). O&G development in the New York Bight would not only affect the unique and vulnerable wildlife and habitats of the Hudson Canyon, it would also pose a threat to the fishing, tourism, and shipping industry in the region. A National Marine Sanctuary Designation for Hudson Canyon could provide permanent protection for the ecological, cultural, and economic resources of the area from the threat of offshore O&G development and mineral extraction. Further, proposed energy leases outside the Sanctuary boundary would also need to consider the impacts to Sanctuary resources.

Methane deposits represent a large, yet untapped source of extractable energy from the deep sea. As suspected from high concentration of dissolved methane in the water column and bubbling from the sediment 500 m below the surface (Rona *et al.* 2015), recent multibeam sonar surveys corroborate that the canyons and shelf break along the U.S. Atlantic, including Hudson Canyon, are rich in methane deposits (Skarke *et al.* 2014). Within the depths of the Canyon, the methane is trapped in the sediment as icy methyl hydrates. It was recently determined that this methane originates from microbial decomposition of organic matter and, in turn, is consumed by other organisms in unique chemosynthetic “cold seep” communities deep in the Canyon (Rona *et al.* 2015; Prouty *et al.* 2016).

This recent discovery of methane from hundreds of seafloor sites (Skarke 2014) could lead to increased pressure for oil and gas development within the submarine canyons (including Hudson) and along the shelf break in the Mid-Atlantic, particularly if the gas occurs in large reservoirs. Methane is a potent greenhouse gas. Given the depth of the known cold seeps, the methane released from seeps probably do not reach the atmosphere, but is instead oxidized to carbon dioxide in the water column. The release of large stores of deepsea methane can lead to ocean acidification.

Although deep sea methane reserves may offer a potential source of natural gas, questions remain whether extraction can be done safely (Ramirez-Llodra *et al.* 2011). In addition to local habitat disturbance, pollution, and loss of a critical source of energy to seep-dependent ecological communities, extraction of methane gas could destabilize overlaying sediments and lead to large-scale geohazards including underwater landslides that could snap communication

cables near Hudson Canyon and trigger tsunamis with grave consequences to coastal communities.

**Wind Energy:** Renewable wind energy development is coming to the New York Bight. In June 2016, for example, BOEM announced the proposed lease of 81,130 acres about 18 km (11 mi) south of Long Island for commercial wind energy development. In September 2016, New York released its offshore wind master plan (NYSERDA 2016). Current technology limits wind development to areas of less than 60 m depth (~200 ft; BOEM, 2016a), and to locations where resulting energy can be readily and economically transported to land, so there is little potential in the short-term for wind turbines over the Hudson Canyon. Nonetheless, noise generated from exploration, construction, and operation of wind farms in nearshore waters could still impact noise-sensitive wildlife in the canyons, including sperm whales.

**Pollution:** Pollution posed one of the earliest threats to the Hudson Canyon, particularly from the centuries-long flow of land-based sewage sludge and toxins. Until 1992, the Hudson River and the 12-Mile Site (opened in 1924) served as New York City's and northern New Jersey's sewer, when, in the 1970s, medical debris, pathogens, and contaminated seafood led to public pressure to end ocean dumping (Swanson *et al.* 2004). In 1986, sludge dumping shifted to the aptly named 106-Mile Dumpsite, just south of where the Hudson Canyon meets the continental slope at 2200 m (1.4 mi) below the surface.

Despite our “out of sight, out of mind” mentality, canyon exploration (in Hudson and others) has provided disturbing images of corals draped in plastics and other marine debris. Sea turtles, seabirds, marine mammals, and fish are known to consume plastics, including microscopic fragments from debris degradation (Thompson *et al.* 2004) and suffer from entanglement in derelict fishing gear especially in areas of high population densities and fishing intensity (NOAA 2014). This litter originates both from land and from vessels, which exceeded 636,000 mt/yr prior to 1988 when Annex V to MARPOL (International Convention for the Prevention of Pollution from Ships, formally adopted in 1973) went into force banning the practice of dumping from ships. Dedicated studies of the sources, types, and amounts of litter in the Hudson Canyon, as well as the impacts of microplastics on Canyon, deep sea, and pelagic fauna are needed and could have global implications (Ramirez-Llodra *et al.* 2011).

Although these past pollution abuses have been greatly curtailed with the passage of the Clean Water Act (1972), the London Convention (1972), the Ocean Dumping Ban Act (1988), and the closure of the 106-Mile Dump site in 1996, questions remain about the long-term implications of sewage, toxic chemical, and plastics from waste disposal in the deep sea ecosystems and on canyon fauna (Bothner *et al.* 1994). Designation of a National Marine Sanctuary in the Hudson Canyon will facilitate continuation of unique and critical research into the long-term impacts of deep sea sewage and other dumping, raise awareness, and support policies to address impacts of varied sources of pollution on sensitive deep sea communities.

**Shipping:** Shipping is an important economic driver for the region surrounding the proposed Hudson Sanctuary and the existing data shows that ships of all types (cargo, passenger, tankers,



and even tugs) bisect the Hudson Canyon (MARCO 2016a). This potentially exposes wildlife and habitats in the area to ship strikes, oil spills, noise pollution, and marine debris originating from ship-based sources. However, data are limited concerning the level, timing, and nature of ship traffic offshore. A Sanctuary designation would facilitate scientific assessment and industry monitoring that could help quantify the scale of these impacts and provide future guidance for changes in management.

**National Security:** Based on information provided through the national security data layers in the MARCO portal, there are multiple security operations that overlap with the proposed Sanctuary boundaries, including the Military Range Complex and Operating Area Boundaries (OPAREA). These and other security activities will be evaluated for compatibility with Sanctuary objectives during the designation process and development of the management plan.

According to the MARCO Data Portal, located at head of the Hudson Canyon are two sites with unexploded ordnances (UOs). In 2010, a fishing vessel near the Hudson Canyon dredged up an old munitions canister containing mustard gas. Although these abandoned explosives slowly degrade, they still have the potential for detonation if disturbed, causing physical and chemical damage to benthic communities, which can be especially serious if mustard gas is involved (Aker *et al.* 2012). In addition, detonation and the resulting shock wave can cause auditory disruption to marine mammals that rely on vocal communications and other sensitive wildlife (von Benda-Beckmann *et al.* 2015). The Sanctuary can play a role in raising awareness about these explosives, both for the safety of fishermen and to protect local wildlife.

**Fisheries:** Fishing – *if not well managed* – probably represents the most immediate and direct threat to the living resources and habitats in submarine canyons including Hudson, particularly as demand increases, access to and abundance of coastal resources decline, and deepwater fishing technologies advance. Not all fishing gears are equal: Trawling can be particularly damaging to benthic habitats, especially to slow-growing deepsea corals, and derelict gear (from both commercial and recreational fisheries) can continue ghost fishing for years. Hudson Canyon has been characterized as a fisheries “hot spot” (V. Guida pers. comm.; Rona *et al.* 2015). At least 45 of the hundreds of fish and invertebrates recorded from the Hudson Canyon are reported in the landings of commercial and/or recreational fisheries. These fisheries are under federal and state management authorities including NMFS Highly Migratory Species Division, the Mid-Atlantic Fishery Management Council (MAFMC) (some species are jointly managed with the New England (NEFMC) and South Atlantic (SAFMC) Fishery Management Councils, and the Atlantic States Marine Fisheries Commission (ASMFC), and are subject to fishery management plans and essential fish habitat (EFH) designations.

In recent years, the MAFMC has had an excellent record managing fisheries in the region, with only one species subject to overfishing (summer flounder). In addition, the MAFMC has recently taken strong precautionary management measures by passing 1) a Deep Sea Coral Amendment (2015) that prohibits the use of all bottom-tending gear in 15 Mid-Atlantic canyons, including Hudson, which will protect 61,000 km<sup>2</sup> (38,000 mi<sup>2</sup>) of canyon habitat; and 2) an Unmanaged Forage Omnibus Amendment (2016) that prohibits new or expanding fisheries for

unmanaged forage species until science-based management can be put in place. Therefore, WCS believes that fishing should continue in this economically valuable area, especially in light of these recent proactive measures taken to protect deep sea corals and forage species. A Sanctuary can complement these and other management efforts, for example, by supporting research and excluding incompatible uses.

**Climate Change:** Despite their scale, depth, and remoteness, deep sea canyons are not immune to the effects of climate change. The ocean serves as a natural sink for carbon dioxide (CO<sub>2</sub>) and absorbing anthropogenic CO<sub>2</sub> has led to ocean acidification (OA). OA reduces the saturation of calcium carbonate, especially in colder waters of the deep sea, which puts calcifying species like stony corals, mussels, and sea stars most at risk (Ramirez-Llodra *et al.* 2011). Warming ocean temperatures, in addition to their direct thermal impacts on Canyon fauna, could potentially destabilize methane hydrates from deep sea sediments, triggering release of large amounts of methane (a potent greenhouse gas itself) into ocean waters and possibly into the atmosphere thereby increasing ocean acidification and depleting oxygen levels (Biaosoch *et al.* 2011). Off the Northeast U.S. coast, evidence is mounting that large-scale warming is causing shifts in species distribution northward and/or to greater depths (Nye *et al.* 2009). A Hudson Canyon Sanctuary could serve as a sentinel site for a long-term study of the links between methane and climate change, and provide an early warning system of these and other anthropogenic impacts on species composition and distribution in deep sea canyon systems.

#### **Consideration 4: A national marine sanctuary would provide unique conservation and management value for this area or adjacent areas.**

Currently, there is no National Marine Sanctuary, National Monument, or other federal protection offshore (other than the deep sea coral zone) in the Mid-Atlantic region, from Rhode Island to Virginia. A National Marine Sanctuary would provide unique conservation and management value for a diversity of biological and physical resources in and around the Hudson Canyon. Such a designation would supplement, complement, and build upon existing efforts through the Mid-Atlantic Fishery Management Council (MAFMC), Mid-Atlantic Regional Planning Body (RPB), as well as through the states of New Jersey and New York. The MAFMC recently established a deep sea coral protection zone that includes Hudson Canyon. The Sanctuary designation would build on these conservation efforts by permanently protecting the Canyon and region from oil, gas, and mineral development. Because impacts of drilling can be far-ranging, particularly due to currents and noise pollution in ocean environments, designation would also benefit areas beyond the Sanctuary boundaries, for example, by triggering NEPA (National Environmental Policy Act) review of impacts to Hudson Canyon Sanctuary resources from proposed drilling in the region.

By increasing federal investment in research, public outreach, and education, the Hudson Canyon Sanctuary would strengthen existing state and federal conservation and management regimes. For example, the MAFMC has made great strides in advancing habitat conservation in

the last couple years by facilitating the conservation of deep sea corals and the sustainable management of commercially valuable fisheries. A Sanctuary designation would build on these efforts by, for example, permanently eliminating the threat of oil, gas and mineral exploration and extraction in the Canyon, as well as increasing investment in the protection of Threatened and Endangered species that live in or migrate through the Canyon.

A Hudson Canyon National Marine Sanctuary and associated NOAA program office would be able to organize a critical multi-stakeholder, bottom-up, clearing house for the development of a comprehensive Hudson Canyon science program. Comprised of both research and monitoring activities and supported by internal and external funding, the Sanctuary could channel federal, state, and private dollars into existing and new programs aimed at enhancing the conservation and management of the Canyon. Synchronized with the regional science research agenda being developed by the Mid-Atlantic Regional Planning Body, as well as research priorities within New York and New Jersey academic, state, and other research institutions, the Sanctuary would help fill knowledge gaps about the ecological and biological health of the Canyon.

Recently, NOAA has released its Ocean Noise Strategy, which outlines a plan to manage impacts of ocean noise on marine wildlife and their habitat in U.S waters (Gedamke et. al. 2016). Many of the key issues and approaches around ocean noise have emerged from efforts of the National Marine Sanctuary Program, although only four sanctuaries currently have long-term monitoring systems in place (Hatch *et al.* 2016). The Sanctuary would help build public and stakeholder awareness, and encourage management and monitoring of ocean noise impacts to sensitive marine species and habitat in these busy waters.

Of critical importance, a Sanctuary designation would also offer federal recognition of New York and New Jersey's ocean waters as a place of national significance. The Sanctuary Program would foster an unprecedented level of visibility, public engagement, outreach, and education in marine science, conservation, and management in the New York Bight. The National Marine Sanctuary designation is, in effect, a national brand designed to elevate important ocean sites to help amplify public awareness, support sustainable economic use and conservation, and serve as a catalyst to strengthen place-based partnerships and programs. A Hudson Canyon National Marine Sanctuary Office would establish a multi-sector Sanctuary Advisory Council that would help coordinate this work. Visitor centers, kiosks, and exhibits (including at WCS's New York Aquarium) would provide numerous opportunities to raise awareness and spur public engagement. In addition to informal educational opportunities, the Sanctuary Office could help develop and disseminate K-12, college, and graduate STEM programming that would connect New Jersey and New York students to their ocean backyard. There would also be targeted stakeholder outreach. For example, the innovative "Sanctuary Classic," recreational fishing tournament in other sanctuaries, could engage the big game angling community on Long Island and the Jersey shores in a catch-and-release tournament in Hudson Canyon. Further, the Sanctuary Program would also be able to establish new relationships with New York-and New Jersey-based businesses and provide input to the National Marine Sanctuary Business Advisory Council.

**Consideration 5: The existing regulatory and management authorities for the area could be supplemented or complemented to meet the conservation and management goals for the area.**

As in most U.S. marine waters, a vast array of overlapping regulatory agencies and regulations co-exist to manage the use of marine resources. Over the last several decades, government regulators have made great strides to advance conservation and management of ocean waters, including in the New York Bight. For example, Congress banned the practice of ocean dumping of sewage sludge and industrial waste in 1988 and New York City terminated its offshore dumping in 1992 (Specter 1992). More recently, New York State released its Offshore Atlantic Study (NYSDOS 2013), a comprehensive study on the physical, biological, wildlife, and geographic characteristics of the Atlantic Ocean, and is finalizing its inaugural New York Ocean Action Plan (NYS DEC 2016). The goal of both of these is to ensure the long-term health of coastal and ocean ecosystems in the New York Bight while sustaining our local ocean-based economy.

The following are a few of the existing authorities that could be complemented by a National Marine Sanctuary in the New York Bight, which would help ensure the long-term health of the Hudson Canyon ecosystem and surrounding waters.

The Bureau of Ocean Energy Management (BOEM) oversees offshore oil and gas development. Perhaps the most important conservation gain for the Hudson Canyon that can be afforded by a sanctuary designation is its capacity to preclude development and extraction of oil and gas and other mineral reserves in the area. This would help protect this ecological hotspot – including threatened species and those of high economic value – from oil spills, noise impacts, and loss of critical habitat. It would also benefit other authorities responsible for the health of coastal ecosystems, along the New York Bight coastline, which supports the largest population center and one of the most important shipping ports in the U.S., from potential long-term damage from massive oil spills, which have plagued other coastal regions from the Santa Barbara oil well blow-out in 1969 to Deepwater Horizon in 2010. While there are currently no operational wells, nor plans to explore or drill *at the moment*, there is a long history of interest and exploration from the federal government and petroleum industry in this region (see Consideration 3).

BOEM also oversees the development of renewable offshore energy sources including wind energy areas. In June 2016, BOEM and the Department of the Interior announced the proposed lease sale and Environmental Assessment for 81,130 acres of seafloor off of New York and New Jersey for commercial wind energy leasing (BOEM 2016a). Although the site of the proposed Sanctuary is much farther offshore than current wind-harnessing technology or economics can support, wind energy development in the proposed and future lease sites off New York and New Jersey will likely impact migratory species of fish, marine mammals, turtles, and especially sea birds. The Sanctuary could support needed research, in collaboration with the NOAA and the

U.S. Fish and Wildlife Service, to monitor the timing and pathways used by migratory species, including seabirds, as they traverse the New York Bight and Hudson Canyon.

NOAA's National Marine Fisheries Service (NMFS) is charged with the management of commercial and recreational fisheries in the federal waters surrounding the Hudson Canyon. A number of fishery management plans for economically valuable species are implemented by the Mid-Atlantic Fishery Management Council, NMFS's Highly Migratory Species Division, and the Atlantic States Marine Fisheries Commission, as well as by the New Jersey and New York state marine fisheries divisions for coastal species that may use the Canyon during part of their life history. The Sanctuary could help inform and protect habitat for about 50 federally managed species whose EFH designations overlap the Hudson Canyon.

The MAFMC has an excellent record in recent years managing fisheries in the region with regard to stock status and recovery under its purview (none overfished and only one species experiencing overfishing (NMFS 2015). It has also implemented proactive conservation amendments, such as protecting deep sea coral communities from destructive bottom trawls in 15 Mid-Atlantic canyons (2015) and preventing the development of new fisheries for unmanaged forage species until science-based management is in place (2016). We therefore recommend that fishing should continue in this economically valuable area. A Sanctuary can complement these and other management efforts, for example, by assisting with enforcement of the Council's amendments, raising awareness, and serving as a sentinel site to monitor other anthropogenic impacts on fishery resources, including shifting patterns of species distributions correlated with large-scale warming and climatic conditions (Nye *et al.* 2009).

NOAA's Office of Protected Resources is responsible for promoting the recovery of Threatened and Endangered marine species in the Atlantic. This includes the highly Endangered North Atlantic right whale and other species protected under the Marine Mammal Protection Act and the Endangered Species Act, as well as those with prohibited status under various fishery management plans that are known to migrate through and/or depend on canyon-related resources. Recent predictive models suggest highest densities of beaked and sperm whales along the continental slope and in and around submarine canyons, while baleen whales concentrate near the shelf break and on-shelf ledges (Roberts *et al.* 2016). The Sanctuary can augment ongoing efforts by NYS DEC and WCS to track, monitor and protect these species in the New York Bight, channel research funding, and raise public awareness about threatened marine resources in the region.

For example, whale strike is a growing problem in the New York Bight, and poised to get worse with the larger Panamax and associated vessels entering the NJ-NY Harbor. The Sanctuary Program has worked with managers, shipping industry representatives, marine mammal scientists, and conservation organizations to modify shipping lanes adjacent to the Ports of Los Angeles and Boston. Although the vessel separation scheme in the New York Bight does not extend over the Hudson Canyon, the Sanctuary could help gather and analyze the appropriate whale sighting data and, when appropriate, facilitate a similar discussion between the Port of New York and New Jersey, stakeholders, and the International Maritime Organization

concerning ship traffic over and near the Canyon. In addition, vessel traffic through the Sanctuary would be subject to guidance provided by NOAA's Ocean Noise Strategy (Gedamke *et. al.* 2016).

NOAA, U.S. Geological Service (USGS), and a large number of academic institutions have been supporting research into the bathymetry, current and sediment flows, deep sea coral communities, methane seeps, migration patterns of protected resources, fisheries, and others in and around the Canyon. Sanctuary designation can help raise awareness and channel public and private funds to augment the research efforts by these institutions.

In 2010, Obama signed Executive Order 13547 that established the National Ocean Policy and mandated the development of regional ocean action plans. The Mid-Atlantic Regional Planning Body, comprised of state, federal, and tribal government officials, is poised to finalize the first-ever Mid-Atlantic Regional Ocean Action Plan (ROAP) by the end of 2016 (White House Office of the Press Secretary 2010). The draft ROAP, released July 6<sup>th</sup>, 2016, sets out a healthy ocean ecosystem goal and a sustainable use goal, along with a range of interjurisdictional coordination actions to help achieve these goals, including "identify ecologically rich areas of the Mid-Atlantic Ocean and increase understanding of those areas to foster more informed decision making" (Mid-Atlantic RPB 2016). NY State is also close to finalizing its own New York Ocean Action Plan, which "seeks to promote restoration, conservation, resiliency, and sustainable use of New York's ocean ecosystem (NYS DEC 2016) for state waters, as well as its Atlantic Ocean Study (NYS DOS 2013). A Hudson Canyon National Marine Sanctuary would complement the goals and actions currently embodied in these inaugural plans.

Finally, by serving as an education platform to share the ecological treasures of our local waters, a Sanctuary will help support the work of multiple conservation organization and academic institutions dedicated to promoting ocean awareness and building a local marine conservation constituency among the very busy marine waters of the New York Bight.

**Consideration 6: There are commitments or possible commitments for partnerships opportunities such as cost sharing, office space, exhibit space, vessel time, or other collaborations to aid conservation or management programs for the area.**

The Wildlife Conservation Society is committed not only to the nomination and designation of Hudson Canyon but also to the long-term success of the Sanctuary in the years to come. We are now exploring opportunities for further engagement and partnerships to support Sanctuary operations and expand the reach of sanctuary programming, including:

- Providing the Sanctuary Program discounted/in kind office facilities on the grounds of the New York Aquarium (space permitting);
- Tapping WCS's New York Aquarium and the City of New York's \$150M investment in its new 57,000 sq ft *Ocean Wonders: Sharks* building (opening 2018) to deliver a unique commitment and ongoing opportunity to visualize and interpret the Hudson Canyon. The



“Canyon’s Edge” exhibit can function as a *de factor* ‘visitor center’ for the Sanctuary for decades to come;

- Leveraging its private and public funding streams to advance the marine science research priorities of the Hudson Canyon National Marine Sanctuary;
- Using the platform of the NY Aquarium, Bronx Zoo, Central Park Zoo, Prospect Park Zoo and Queens Zoo to reach more than 4.3 million visitors per year; and
- Developing K-12 and community programming across the New York metropolitan area, as well our online platform (Blue York) to raise awareness about and encourage engagement of the public in the educational, scientific and management efforts of the Hudson Canyon National Marine Sanctuary.

Many people, whether they are ocean enthusiasts or have never set foot in salt water, will never make it out to the Hudson Canyon itself because of its distance offshore and accessibility being restricted to a half-day boat trip. WCS has the unique opportunity to bring the wonder of the deep sea directly to millions of visitors each year through interactive exhibits within our parks. In particular, the New York Aquarium’s state-of-the-art Ocean Wonders: Sharks! Exhibit (completion date set for Spring 2018), will act as a place where visitors can access the mysteries of the Canyon and be inspired by this unique habitat from hundreds of miles away. The exhibit will feature shipwrecks and highlight local wildlife found in around the Hudson Canyon like sharks, skates and rays, whales, and deep sea corals.

**Consideration 7: There is community-based support for the nomination expressed by a broad range of interests, such as: individuals or locally-based groups (e.g., friends of group, chamber of commerce); local, tribal, state, or national elected officials; or topic-based stakeholder groups, at the local, regional or national level (e.g., a local chapter of an environmental organization, a regionally-based fishing group, a national-level recreation or tourism organization, academia or science-based group, or an industry association).**

The Wildlife Conservation Society has undertaken a broad outreach effort to build stakeholder support for this nomination (as demonstrated in the attached and forthcoming letters of support). Support for the proposed Hudson Canyon National Marine Sanctuary has been shown through a diverse New York and New Jersey stakeholders, including:

- Local, state and federal decision-makers
- Shipping industry representatives
- Coastal recreational businesses
- Conservation organizations
- Tourism operators
- Educators, scientists and academic organizations
- Aquariums and Zoos, and their visitors
- Nearly 18,000 NY and NJ residents and other ocean enthusiasts