National Fish Habitat Action Plan (NFHAP) Coastal Assessment: Developing a Spatial Framework and Indicator Dataset

PROPOSED DRAFT Statement of Work – version 10.1.09
FY 2010 NCCOS Project Number 10M00140

To be completed by NOS Center for Coastal Monitoring and Assessment's Biogeography Branch for NMFS Office of Science and Technology.

BACKGROUND

The National Fish Habitat Action Plan (NFHAP) was launched in 2006 with the overall mission to protect, restore, and enhance the nation's fish and aquatic communities through partnerships that foster fish habitat conservation. This mission includes the completion of a National Fish Habitat Assessment in 2010 – covering freshwater, estuarine, and nearshore marine waters (NFHAP-SDC 2008). Significant progress has been made in the assessment of watersheds and streams nationwide by a team at Michigan State University (MSU), but the estuarine and coastal component needs substantial work. Both NMFS (F/ST and F/HC) and NOS (N/SCI1) have been active in planning the coastal component, and NMFS' Regional Laboratories in Sandy Hook NJ and Seattle WA will be working on regional components of the Assessment in FY'10. In addition, the need has emerged for specific work to be completed by NOS/CCMA in the remainder of FY'09 and continuing into FY'10. To some extent, this work will be modeled after a project that CCMA completed in 2009 – Assessment of Existing Information on Atlantic Coastal Fish Habitats (NOAA 2009) – in which existing habitat indicator information was fit into a defined spatial framework. However, this work will also require careful coordination with the NMFS Regional Labs to ensure that sufficient attention is given to the Gulf of Mexico and other regions, and with the MSU team to ensure that the inland and coastal components of the Assessment are compatible. All of these components will need to be integrated into the larger National Fish Habitat Assessment.

GOAL

The overarching goal of this project is to develop a National scale coastal spatial framework and database of existing indicators of fish habitat quality to support the completion of the National Fish Habitat Action Plan 2010 Assessment.

OBJECTIVES

Several objectives that must be met in order to achieve this project's goal include:

1. With guidance from NFHAP Coastal Assessment Team, develop a work plan with specific tasks and deliverables that can be feasibly completed by October 2010.

2. Create a digital geospatial framework from existing sources of data including NOAA's Coastal Assessment Framework and Marine Cadastre for the Atlantic, Pacific, and Gulf of Mexico coastal waters.
3. To the extent feasible, create a functional spatial framework for coastal waters of Alaska, Hawaii, and U.S. Caribbean and Pacific Territories.
4. Develop database of indicators of coastal habitat conditions, based on existing sources, and linked to the spatial framework.
5. Prepare results for further analysis and incorporation into the 2010 National Fish Habitat Assessment.

TASKS

The objectives can be met with the completion of these six inter-related tasks:

Task I. Develop Work Plan

With guidance from NFHAP Coastal Assessment Team, develop a work plan with specific tasks and deliverables that can be feasibly completed by October 2010.

Due date: August 31, 2009

This Statement of Work provides a starting point for planning the project. However, additional planning is needed to coordinate efforts and allocate tasks between NOS, NMFS HQ and Regional Laboratories, NFHAP and other partners. It is essential that all all regions receive sufficient attention, and this must be reflected in the work plan. For example, NMFS Regional Laboratories in Seattle and Sandy Hook will have post-doctoral fellows working on Pacific Coast and Atlantic Coast components of the assessment. This would suggest that the NOS team ensure that other regions receive additional effort, in addition to providing a National-scale knitting together of the regional components. We propose to complete a work plan by the end of August 2009, with sufficient detail to immediately launch the project, but providing enough flexibility to take advantage of opportunities as they arise, and to adapt to lessons learned through the course of the project.

Task II. Develop digital spatial framework in a Geographical Information System for Continental U.S.

Create a digital geospatial framework from existing sources of data including NOAA's Coastal Assessment Framework and Marine Cadastre for Atlantic, Pacific, and Gulf of Mexico coastal waters

Due date: October 31, 2009

NOAA's Coastal Assessment Framework (http://coastalgeospatial.noaa.gov/) provides a series of base layers – readily available as shapefiles - which will be invaluable in developing this GIS. The base map will include coastal watersheds and estuaries for the entire U.S. Atlantic, Pacific, and Gulf of Mexico Coasts, represented as vector polygons. Spatial attributes will include categories such as Region (North Atlantic, Mid-Atlantic, Southeast, etc), State, and waterbody (e.g. Chesapeake Bay). Figure 1 depicts the spatial extent of the Coastal Assessment Framework, illustrating that it is

based on USGS HUC-8 watershed units, and is useable at either a National or regional scale (Seaber et al. 1987, USGS 2008). Other spatial features included in the CAF, but not depicted, include estuarine salinity zones (tidal fresh, mixing zone, seawater), other physical and hydrodynamic parameters (e.g. freshwater inflow), estuarine bathymetry (digital elevation models), coastal land use, shellfish harvest classification, estuarine eutrophication, agricultural fertilizer and pesticide use, and human population density.

The Coastal Assessment Framework, however, does not provide a functional zonation scheme for marine waters of the Continental Shelf. Therefore, we propose to develop GIS layers from existing sources such as the U.S. Marine Cadastre (NOAA/CSC 2008) to delineate zones at an appropriate scale for coastal and offshore marine waters. The "appropriate scale" will become more coarse father offshore, and will take into account both jurisdictional (e.g. state vs. federal) and biogeographic (e.g. Carolinian vs. Virginian) zonation schemes (NOAA 2004, Spalding et al. 2007). The Atlantic Coastal Fish Habitat Partnership (ACFHP) project (NOAA 2009) provides a starting point for this work by developing a functional spatial framework extending from coastal watersheds to the continental shelf. Lessons learned from the development of the ACFHP spatial framework will be invaluable in crafting a framework at a National scale – but different regions may require different approaches to subdividing marine waters based on jurisdictional or biogeographic boundaries. Since the spatial framework is a prerequisite to organizing all of the indicator data, its completion is targeted as the first priority after developing the work plan.

Task III. Develop spatial framework for other regions of the U.S.
To the extent feasible, create a functional spatial framework for coastal waters of Alaska, Hawaii, and U.S. Caribbean and Pacific Territories.

Due date: January 2010

NOAA's Coastal Assessment Framework covers the Continental U.S. (Atlantic, Gulf, and Pacific Coasts). Other regions (Alaska, Hawaii, Pacific and Caribbean Territories) are not represented. However, indicator data exist for these regions – and a spatial framework can be developed for organizing and displaying these data. The digital spatial framework would be built based upon existing sources including the Marine Cadastre and regional studies, and in consultation with regional representatives active in the NFHAP Science and Data Committee. Alaska and Hawaii have been targeted as areas for inclusion, and therefore a spatial framework is required. Such a framework may be based upon existing spatial data sets such as USGS 8-digit HUCs. A spatial framework for other regions (Puerto Rico, U.S. Virgin Islands, Pacific Territories) can be developed if feasible and if warranted for organizing available indicator data.

Task IV. Develop Indicator Database
Create a comprehensive database of selected indicators of habitat quality from existing sources of information.

Due date: January 2010

Compile existing information and assemble a comprehensive database on coastal habitat conditions. Components include water quality, sediment quality and contaminants, benthic characterization, and condition of specific habitat types such as SAV, corals, wetlands, and shellfish beds. Data sources will be documented in a spatial bibliography, where the "spatial footprint" and scientific content of each study or data set will be recorded. Data tables will be developed within Microsoft Excel – but crafted to be linked to the spatial framework in ArcGIS or other applications using common key fields such as waterbody, reference, etc. Some of the requisite data sources on Coastal Conditions (U.S. EPA 2008) and Impaired Waters (U.S. EPA 2009), Eutrophication (Bricker et al. 2007), and Contaminants (Kimbrough et al. 2009), were acquired and incorporated into the ACFHP Assessment completed in July 2009. Other data sources were referenced in Appendix 6 of the NFHAP "National Framework" document (NFHAP-SDC 2008), or identified by the Seattle team. On a regional basis, individual Fish Habitat Partnerships (Atlantic Coastal, Alaska, Southeast) may be able to contribute data or provide guidance. An example of some potential indicators and their utility in assessing coastal fish habitat is provided below in Table 2.

Task V. Generate results, analyses, and work products
Prepare results for further analysis and incorporation into the 2010 National Fish Habitat Assessment.

Due Date: May 2010

If the assessment database is developed in Task IV is sufficiently robust, then it will be feasible to use it to generate useful summaries and analyses at various scales. Some indicator data will be best summarized at regional scales, and displayed descriptively using maps, charts, tables, etc. Other data may warrant analysis using statistical and geospatial analytical methods – especially for local and regional case studies. These analyses will be planned in cooperation with the NFHAP Coastal Assessment Team, and will contribute directly to the NFHAP National Assessment. To enable the NFHAP National Assessment to be published in October 2010, we intend to complete the requisite analyses by May of 2010. Because the Seattle team will be focusing on the U.S. West Coast, and the Sandy Hook lab on the U.S. East Coast, the Silver Spring team will likely need to focus on the Gulf of Mexico, Alaska, Hawaii, and other U.S. waters to ensure equitable regional coverage.

Task VI. Management, Coordination, and Professional Presentation
Manage work flow, coordinate efforts within the NFHAP Coastal Assessment Team, present results in appropriate professional venues and publications.

Due Date: Ongoing through Autumn 2010

Making sure that Tasks I-V remain on course and on schedule requires close supervision and careful coordination between NOS, NMFS, and the NFHAP Coastal Assessment Team. In addition to the 2010 National Fish Habitat Assessment – results will likely be presented at other venues such as American Fisheries Society (AFS), Estuarine Research Federation (ERF), Restore America's Estuaries (RAE), and other professional societies. Components of the assessment will likely be suitable for

publication as a separate peer-reviewed publication, and the approach and results of the NFHAP National Assessment may be applicable to other assessment efforts as well. These efforts will continue throughout the course of the project and beyond.

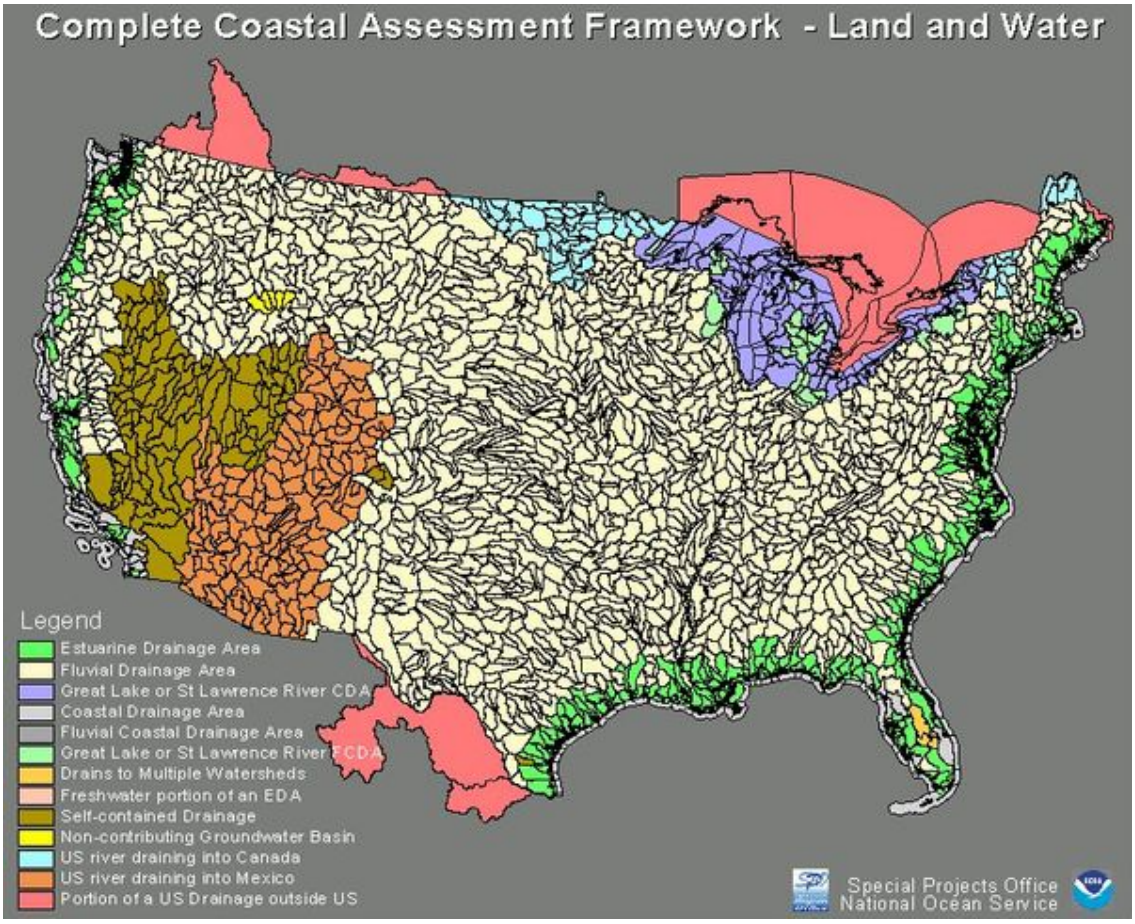

Figure 1. Coastal Assessment Framework – watersheds and estuaries of the lower 48.

PROPOSED TIMELINE FOR COMPLETION OF TASKS

In addition to the five tasks described above, the NOS team will coordinate closely with NMFS and the NFHAP Coastal Assessment Team to review progress and ensure that efforts are complementary and not duplicative.

We propose a fairly aggressive time line to meet the schedule of the overall National Fish Habitat Assessment, with these targeted completion dates:

August 2009 – Develop work plan
October 2009 – Develop spatial framework for Contiental U.S.
January 2010 – Develop extended spatial framework for Alaska, Hawaii, other regions
January 2010 – Develop indicator database
Spring 2010 – Generate results and analyses
Summer 2010 – Professional presentation of results

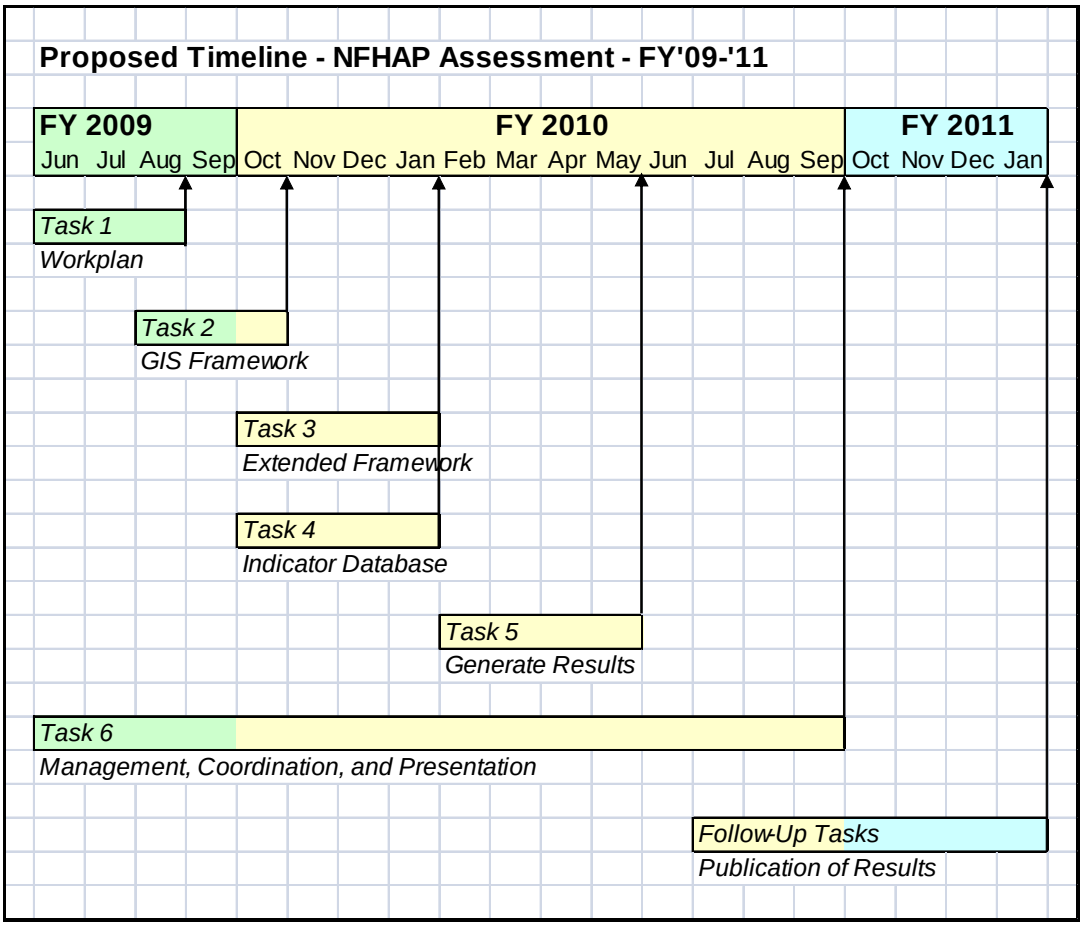

Figure 2. Proposed timeline for completion of NFHAP Coastal Assessment tasks.

BUDGET

We propose to complete the scope of work as described within a budget of $75,000. The primary cost will be staff time in completing the six tasks. There will likely be other costs associated with computer hardware and software (e.g. ArcGIS and extensions), printing and supplies, and travel to meetings to coordinate efforts with NOS, NMFS, and NFHAP staff.

Table 1. Proposed budget.

Staff Time		$65,000
Task 1 – Work plan and coordination	1.0 months	
Task 2 – Basic spatial framework	1.0 months	
Task 3 – Extended spatial framework	1.0 months	
Task 4 – Indicator database	1.0 months	
Task 5 – Indicator analysis	1.0 months	
Task 6 – Professional presentation	1.0 months	
Travel		$5,000
Software, Printing, and Supplies		$5,000
	Total	**$75,000**

Indicators for coastal habitat condition					
Here, an indicator is defined as a single- or a group of variables that is hypothesized to link a threat / stressor with responding fauna by linear correlation					
Category	**Threat / stressor**	**Indicator** (Comprehends single-or groups of descriptive variables)	**Variables**	**Unit**	**Description**
Connectivity	Coastal construction: Dams, dikes, roads (stormwater), Dredging	Area accessible to fish	Number, area barriers, structures, presence/absence of passages/corridors	km	Number of barriers to fish passage from coast into tributary rivers.
Hydrology / Oceanography		Degree of alteration of freshwater inflow	Salinity, temperature, discharge	‰, °C, m³/yr	Freshwater withdrawals and hydrologic alterations
		Degree of alteration of tidal flow	Salinity, temperature, water exchange	‰, °C, m³/tidal cycle	Hydrologic alteration of tidal flow
		Degree of estuarine channelization	Hydrodynamics / current velocity, substrate composition, water clarity	m/sec., %, m secci depth	Degree of channelization and dredging in estuaries.
		Extent of shoreline armoring	Hydrodynamics / current velocity	m/sec.	Miles of shoreline armored or percent of total length of shoreline armored (regional)
		Percent change in impervious surfaces in watershed	Nutrient load, contamination, road density	kg/km², km	Percent of watershed land area covered by impervious surfaces, or total land area of impervious surfaces, or rate of land conversion to impervious survaces per year, decade, etc.
		Water clarity	Sediment load, suspended matter	kg/m³	Riverine sediment loads / input, erosion rates etc.
Water Quality	Eutrophication	Nutrient input	Nutrient level, Chlorophyll a, water clarity, dissolved oxygen	kg/m³, µg/l, %	Eutrophication Index (low to high): Dissolved inorganic nitrogen (DIN) and- phosphorus (DIP); chlorophyll a, water clarity
					Occurrence of hypoxia and anoxia - historic, real-time, and forecast.
		Harmful Algal Blooms (HABs)	Frequency & degree of HABs	rating	Occurrence of HAB events - historic, real-time, and forecast.
Geomorphology	Dredging, Sedimentation, Erosion	Status of Soft bottom habitat	Area, compositon of soft sediment	% / km²	Substrate composition (mud, sand, gravel), dredging activity
		Status of Hard Bottom Habitats	Area, composition of hard substrates	% / km²	Extent, composition of rocky shore habitats
Biotic Habitats	Habitat loss	Status of Coastal Wetlands	Area, composition of marsh	km²	Instantaneous rate of loss ("Z") of coastal wetlands (regional), total loss of coastal wetlands (regional or per estuary).
		Status of Submerged Aquatic Vegetation (SAV)	Area, diversity, density of seagrass & macro algae	km², % cover	Instantaneous rate of loss ("Z") of seagrass, kelp, or other regional SAV.
		Status of habitat forming invertebrates	Area, diversity, density of coral reefs & epibenthic bivalves	km², % cover	Reef rugosity, coral bleaching (degree heating weeks), percent live coral cover, status of live oysters on mapped oyster reefs.
Environmental Contamination	Pollution	Chemical contamination of sediments	Point/no-point discharge	lbs/yr, (mg/yr)	Contamination status ranked low to high - trend increasing, decreasing, or stable.
		Chemical contamination in fish and mollusks	(Shell)fish contaminant load	mg/kg	Metal and organic contamination status ranked low to high - trend increasing, decreasing, or stable.
Biodiversity / Energy flow	Habitat alteration, fishery, competion by N.I. species	Status of fishery species	Stock size, distribution	rel.abundance	Status of fishery stocks with habitat identified as a factor for decline, or with a habitat component of recovery plan.
		Status of key species	Stock size, distribution	rel.abundance	Status of individual key species (indicator, protected, sentinel, concern, keystone).
		Non-indigenous and invasive species	Number of species, abundance	rel.abundance	Number or dominance of non-indiginous species (all taxa), measured separately for invasive species.
		Benthos community	Benthic Invertebrate Index	rating	Benthic Index Score = good-fair-poor

Table 2. Potential indicators for assessing coastal habitat condition. Prepared by Patrick Polte, NOAA/NMFS, adapted from Appendix 6 of *A Framework for Assessing the Nation's Fish Habitat* (NFHAP-SDC 2008).

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