



## B.3 National Ocean Service (NOS)

NOAA's National Ocean Service (NOS) strives to ensure that the Nation's coastal areas and resources are productively and wisely used. The NOS preserves, protects, and restores U.S. coastal and ocean environments; reduces the social, economic, and natural resource risks from natural hazards such as storms; and provides navigation and spatial reference services that are essential to the Nation's transportation and communications systems.

NOS is comprised of five program offices and two centers:

1. National Geodetic Survey (NGS)
2. Office of Coast Survey (OCS)
3. Office of Ocean and Coastal Resource Management (OCRM)
4. National Centers for Coastal Ocean Science (NCCOS)
5. Office of Response and Restoration (ORR)
6. Center for Operational Oceanographic Products and Services (CO-OPS)
7. Coastal Services Center (CSC)

### *Future Data Gathering*

Many environmental data gathering programs within the NOS are expected to remain relatively stable in the near-term. NOS expects to see an increasing emphasis on the real-time acquisition and application of data during storm, tsunami, and hazardous material spill events. The Physical Oceanography Real-Time System (PORTS) program is rapidly expanding, and is expected to grow by an order of magnitude over the next several years.

With the many recent advances in technology, significantly larger data sets will be acquired during the performance of hydrographic surveying. Currently, there are large-volume, multibeam sonar data sets (up to 15 megabytes of data per day, per vessel) that are of interest to the scientific community. Investigation is underway to determine the best method to distribute and archive the digital side scan sonar and bottom backscatter data sets that are being acquired (up to 600 gigabytes of data per day), which are of interest to the Department of Defense, fisheries studies, geologists, and many other users.

NOS will continue to support and investigate efforts to address significant environmental issues as they emerge in the future. These issues can occur at global, national, and/or regional scales and, as in the past, involve massive data acquisition and management efforts.

*NOS collects, analyzes, shares, and disseminates a variety of data and information, including:*

- *Geodetic control points*
- *Highly accurate shorelines*
- *Coastal aerial photography*
- *Water depths*
- *Underwater wreck and obstruction locations*
- *Navigational aids*
- *Coastal watershed conditions*
- *Land-use changes*
- *Harmful algal bloom features*
- *Precise water levels*
- *Water current measurements*
- *Hazardous material spill impacts*
- *Environmental Sensitivity Index maps*

## Characterization of NOS Digital Data

DATA SET	DATA SOURCE	Data Set Size (GB)		ACCESS*	METADATA**
		CURRENT	GROWTH/YR		
Coastal Monitoring and Assessment	Various	275	80	+	+
Geodetic Control	Geodetic surveys	94	23	•	•
Nautical Charts	Various	72	19	•	•
Hydrographic Surveys	Sonar and manual soundings	205***	4	+	+
Water Levels and Currents	Water level stations current meters, meteorological sensors	26	6	•	+
Coastal Imagery	Emulsion camera	120***	20	X	+
Shoreline	Aerial photography to stereo plotter	410***	0.2	+	•

• CAN DO WITH CURRENT RESOURCES      + NEED INCREMENTAL RESOURCES  
 X REQUIRES SUBSTANTIAL ADDITIONAL RESOURCES  
 \* Effort required to make data accessible to all appropriate internal and external users  
 \*\* Effort required provide FGDC or equivalent metadata      \*\*\* Estimate when rescue is complete

### Data Rescue

Some of NOS's invaluable data holdings acquired since the early 1800s are in danger of being lost due to deterioration of records. Also, much of the data are unable to be widely accessed due to their present media such as paper records, books, and drawings. NOS has begun an effort to rescue these data sets as resources permit; however, it is an immense undertaking.

The Office of Coast Survey will continue to partner with NGDC to make their hydrographic data holdings accessible and safe for future use. Presently, less than 50 percent of hydrographic surveys are available in a digital format that could be used with Geographic Information Systems (GIS) or other software that manipulates point data. It is critical that these surveys be digitized to support the development of the electronic navigational charts and to supply information for GIS applications for other users, such as coastal zone managers. Scanning of the hydrographic smooth sheets and descriptive reports also needs to be completed in order to preserve these valuable documents.

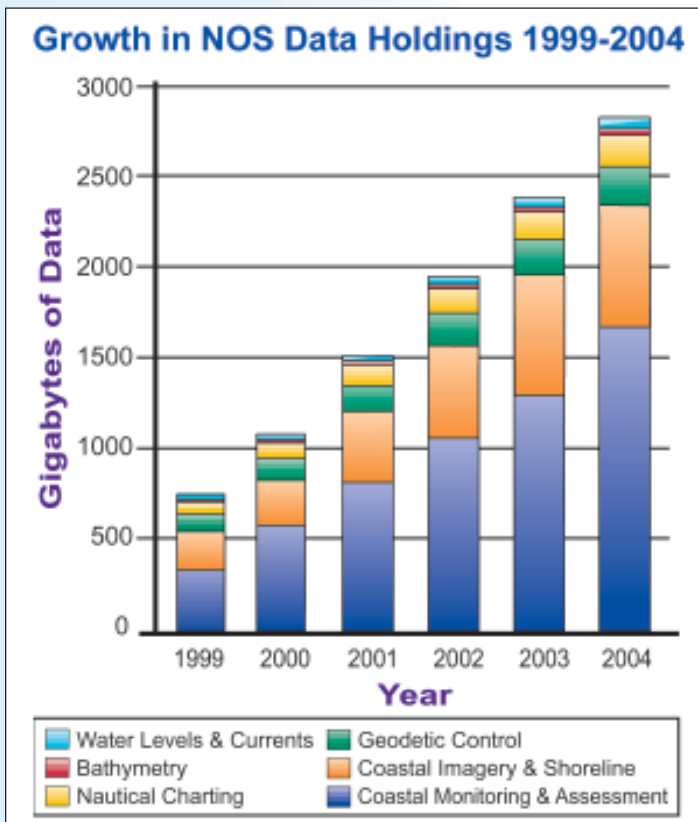
Paper nautical chart and source data archives need to be scanned, geographically rectified, catalogued, supplemented by metadata, and

made accessible for internal and external customers to facilitate environmental research and resource management before these documents deteriorate. Also, all electronic navigational chart data must be archived for historical and litigation purposes.

The Center for Operational Oceanographic Products and Services has historical data that contain tide and water-level gauge heights and water currents on paper and microfiche. Obtaining digital data sets from their analog versions has been the subject of data rescue and recovery efforts over the past decade. However, much remains to be done. Scanning of documents and keypunch entry of information are required before the records deteriorate beyond recovery.

Within the National Geodetic Survey, rescue efforts are underway to convert more than 10,000 historical shoreline maps into digital format. However, rescue of the 600,000 aerial photographic images of coastal areas, airports, and some sites of natural disasters has not yet been addressed.

In addition, the National Centers for Coastal Ocean Science and the Office of Ocean and Coastal Resource Management have numerous smaller-scale data rescue requirements that include media such as photos, old handwritten logs, or records damaged due to tropical weather and storms.



### *Integration of Needs and Information Technology Planning*

The continuing evolution of the Internet will lead to an increasing demand for specialized data services, such as event-specific home pages for hurricanes and oil spills. Within NOS, there is also a continuing trend towards dynamic linking of data sets, such as the connections made between NGS vertical benchmark elevations and positions and the CO-OPS tide station elevations.

In order for NOS to reach its data management goals, it should ensure that all NOS data are documented using the appropriate FGDC standard, available through the FGDC Clearinghouse, and both archived at—and accessible from—the Data Centers or Centers of Data. NOS will continue to investigate hardware and software requirements to maintain and improve our ability to serve the Nation’s environmental data management needs.

### B.3.1 NATIONAL GEODETIC SURVEY (NGS)

The National Geodetic Survey (NGS) is responsible for maintaining and distributing data and information that relate to the shape, size, and gravitational attraction of Earth's surface. These data include a variety of products and data sets that describe the horizontal (normally latitude and longitude), vertical (either geocentric, orthometric, or geoidal) height, and gravitational properties of Earth's surface. Also, NGS is officially responsible (under the National Archives and Records Act) for the permanent archive of these data.

NGS works very closely with other Federal government agencies and sets standards for the collection, analysis, and exchange of geodetic data through the Federal Geographic Data Committee (FGDC).

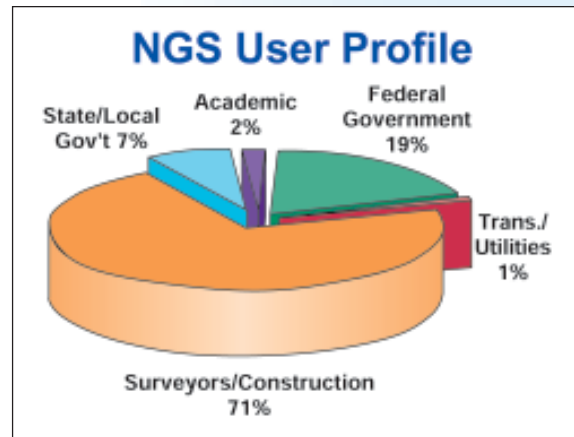
A sampling of specific products that the NGS provides includes the following:

- Geodetic “data sheets” for the 750,000 NGS control survey points
- Global Positioning System (GPS) Continuously Operating Reference Stations (CORS) data
- GPS precise orbits
- Calibration Baseline data
- Aerial photography used in shoreline mapping activities
- Aeronautical data used to develop airport runway approach procedures and airport obstruction charts
- Geoid and deflection of the vertical data and models.

These data are available from the NGS on CD, and on-line through the Internet.

### B.3.2 OFFICE OF COAST SURVEY (OCS)

The Office of Coast Survey (OCS) is responsible for providing up-to-date information to support safe navigation in the waters of the United States and its territories. Nautical charts, hydrographic surveys, and their supporting documentation are legal documents that are often referenced in court cases dealing with vessel groundings or other mishaps at sea. As such, all chart editions,

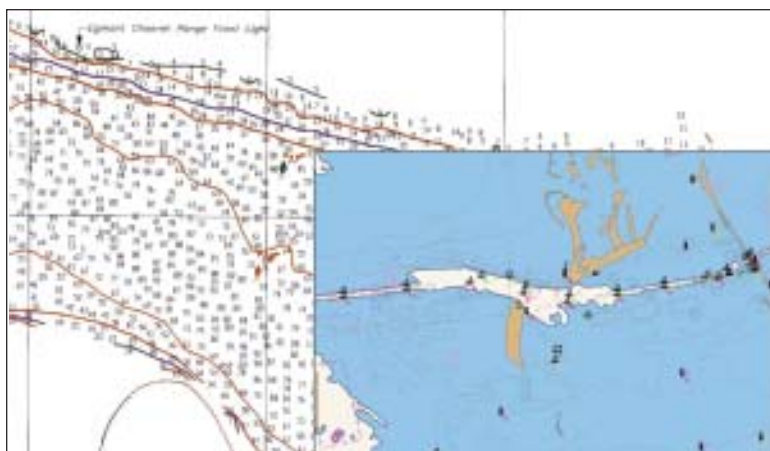


surveys, and documents must be preserved, archived, and they must be made readily retrievable.

OCS produces and maintains a suite of approximately 1,000 nautical charts in paper and raster formats, and nine *United States Coast Pilot* volumes. Also, OCS is responsible for acquiring and archiving hydrographic survey data. During 1999, OCS released the first nautical charts in a vector format. This product line will be gradually expanded to cover the entire chart suite.

A Web page allows public viewing, and, in some cases, the downloading of nautical charting information such as product catalogs, reduced resolution copies of the nautical charts for use as trip-planning aids, wrecks and obstruction data sets, and Exclusive Economic Zone (EEZ) boundary coordinates. Also, the public can order paper copies of all hydrographic surveys that include depths and marine features for a specified area, and copies of descriptive reports for those surveys. Digital hydrographic data for many of the surveys can be obtained from the National Geophysical Data Center (NGDC).

Since 1998, OCS has provided public access via the Internet to more than 2,500 historical maps and charts that date from the 1800s to the early 1900s. Users can download full-size copies of the historical documents for use in research or home-computer systems. OCS, in partnership with the NOAA Library System, also provides computer workstations and plotters that are available at each NOAA Library across the country, for the free reproduction of the historical maps and charts.



*Hydrographic surveys contain some of the data necessary to produce NOS navigation products.*

### B.3.3 OFFICE OF OCEAN AND COASTAL RESOURCE MANAGEMENT (OCRM)

The Office of Ocean and Coastal Resource Management (OCRM) provides effective management of multiple uses of the Nation's coastal and ocean resources through its oversight and administration of the following three programs: (1) the Federal-State Coastal Zone Management system, (2) the Federal-State National Estuarine Research Reserve (NERR) system, and (3) the National Marine Sanctuary system. OCRM and its programs are producers and end-users of coastal data and information. Furthermore, OCRM works in conjunction with other parts of NOS (e.g., Special Projects, Coastal Services Center), NOAA (e.g., ESDIM), and its State partners to develop and disseminate data. Data products include the following:

#### *NERR System-Wide Monitoring*

The National Estuaries Research Reserves conduct base water quality and weather monitoring at each of their 22 sites. The data set includes water temperature, conductivity/salinity, dissolved oxygen, pH, turbidity, water depth, wind speed and direction, air temperature, relative humidity, rainfall, barometric pressure, and photosynthetically active radiation. Collected data are sent to the NERR Centralized Data Management Office (CDMO) at the Belle Baruch Laboratory in South Carolina where data are quality-controlled and then made available through the CDMO Web site.

#### *Protected Areas GIS (PAGIS) Program*

The NERRs and National Marine Sanctuaries are developing site-specific GIS data layers for each of their sites. Core base data layers include political boundaries, hydrography, bathymetry, and shoreline. All field site data layers are duplicated and will be available at the CDMO Web site.

#### *Sustainable Seas Expeditions*

The Sustainable Seas Expeditions is a 5-year project of ocean exploration and research at America's marine sanctuaries, performed in partnership with the National Geographic Society. Since April 1999, the Sustainable Seas Expeditions project has conducted deep-water exploration and research missions in the National Marine Sanctuaries. A standard set of specific offerings is planned for each sanctuary including satellite imagery of sea-surface temperature, turbidity, and chlorophyll; maps of the tracks of the submersible from onboard tracking software; and selected photographs of new species. Additionally, there will be specialty products that are derived directly from the work associated with the expedition at each Sanctuary.



NOAA vessels serve as platforms for sophisticated sampling techniques at the Channel Islands National Marine Sanctuary.

OCRM requires that all geospatial data developed by its three Programs comply, at the maximum extent practicable, to the Federal Geographic Data Committee (FGDC) standards. Data and products developed by the three Programs are shipped to the Coastal Services Center for tabulation, integration, and distribution to the general public.

### **B.3.4 NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE (NCCOS)**

#### *Center for Coastal Monitoring and Assessment (CCMA)*

Located within the National Centers for Coastal Ocean Science (NCCOS), the Center for Coastal Monitoring and Assessment (CCMA) monitors and assesses the status and trends of the environmental quality of U.S. coastal and estuarine waters. CCMA manages and implements projects that measure and/or assemble data and information regarding levels of contaminants, nutrients, biodiversity, ecological condition, habitat characteristics, and related properties in biota, water, and sediments of the Nation's coastal, estuarine, and Great Lakes areas. These data are used to establish baselines of environmental quality to enable detection of changes over time and/or space in environmental conditions, and correlative relationships among various environmental and stressor properties. The data are archived in a national database to ensure their general availability in computer-compatible formats.

Within the CCMA are three major programs. These programs provide extensive national databases, GIS, coastal assessments, and more than 700 books, atlases, journal articles, and agency technical memoranda published regarding coastal monitoring and assessment to the CCMA.

#### ***National Status and Trends Program***

This is the longest running Federal government coastal environmental quality-monitoring program in the U.S. Activities include:

- Conducting long-term monitoring of toxic contaminants and other environmental conditions at more than 350 sites along U.S. coasts
- Carrying out regional surveys to determine the magnitude and extent of the biological effects caused by these conditions
- Partnering with other agencies in a variety of environmental activities

*The Brown Pelican, an endangered species, has made a comeback since the chemical DDT was banned. There are now permanent nesting colonies at Channel Islands National Marine Sanctuary. (Photo credit: Shane Anderson.)*



- Advising and participating in local, regional, and international projects related to coastal monitoring and assessment.

### ***Biogeography Program***

The Biogeography Program provides managers and scientists with information on living marine resource distributions and ecology throughout the Nation's marine, coastal, and estuarine environments—for improved decision-making regarding coastal ecosystem sustainability and resource management. The Biogeography Program is focused on developing information on the distribution of living marine resources, habitats, and the affinities of species for particular habitats. In Federal agency partnerships, Quantitative Habitat Suitability and Habitat Affinity Indices models, coupled with digital maps of environmental parameters, have been integrated via GIS technology. The coupling of GIS with biogeography enables the characterization of essential fish habitats to aid in the management of marine fisheries. This work utilizes information from the Estuarine Living Marine Resources Program in which more than 6,000 species estuary data sheet combinations have been compiled and peer-reviewed for 135 species in 122 continental U.S. estuaries. This information has many applications and is available in digital map and tabular formats.

### ***Physical Environments Characterization Program***

This program collects, synthesizes, and analyzes data on the physical and hydrological features of the Nation's estuaries and coastal areas. The program maintains and updates information that characterizes freshwater inflow, salinity, susceptibility to nutrient inputs, and eutrophication potential within U.S. estuaries.

### ***Center for Coastal Environmental Health and Biomolecular Research (CCEHBR)***

The Center for Coastal Environmental Health and Biomolecular Research (CCEHBR) is located in Charleston, South Carolina, in addition to a satellite research facility—the Cooperative Oxford Laboratory—located in Oxford, Maryland. The mission of CCEHBR is to provide scientific information that is required to resolve coastal ecosystem health issues associated with the goals of NOS. Chemical, biomolecular, microbiological, genetic, and histological methods are developed and used in both laboratory and field studies to describe, evaluate, and predict the controlling factors—including land-use practices and natural and anthropogenic influences—in marine and estuarine habitats.

Biological, chemical, physical, and spatial data are generated from the CCEHBR research programs. Data sets are developed in testing



research hypotheses. As questions are answered, related but different research is initiated and information is generated. Some research, including interagency projects, produce information as part of larger and longer-term studies. Thus, due to the variety of investigations, the data systems used vary among CCEHBR Programs—from relational databases to basic PC software for smaller data sets. A CCEHBR-wide Laboratory Information Management System is being developed to improve access to data within the NCCOS, as well as access to data created by many external research and management partners.

Types of coastal environmental data from CCEHBR research programs include the following:

***Marine Biotechnology***

Molecular genetics data that are developed and used for differentiating marine species, stocks, and populations, and for determining biomarkers of environmental exposure and effect.

***Ecotoxicology***

Biological data for several keystone Southeast estuarine species that are challenged with pesticides, metals, Polycyclic Aromatic Hydrocarbons, and Polychlorinated Biphenyls in the laboratory; controlled mesocosms; and natural estuarine systems.

***Marine Mammals and Sea Turtles***

Southeast marine mammal strandings and necropsy contaminant and histopathological data. Also, biopsy and live capture tissue and blood data, as well as biomolecular genetic and health indicator data used for developing a bottlenose dolphin health assessment database.

***Marine Forensics***

Morphologic, biochemical, genetic, and marine lipid data sets that predominantly support law enforcement actions addressing managed and protected species.



### ***Pathobiology***

An updated marine disease registry and associated histopathological and microbiological data collected through long-standing shellfish research.

### ***Marine Biotoxins***

Data sets on all major classes of marine biotoxins and their causative algal agents in the areas of improved laboratory and field assay development, molecular structures of toxins, biomarkers indicating toxin exposure, and the role of bacterial-algal interactions in bloom dynamics and toxin production.

### ***Risk Analysis and Information Management***

A developing Shellfish Information Management System that includes the goal of a GIS-enabled national, relational database of shellfish resources in coastal waters, as well as area classifications for shellfish harvesting and supporting information.

## ***Center for Coastal Fisheries and Habitat Research (CCFHR) at Beaufort, North Carolina***

The Center for Coastal Fisheries and Habitat Research (CCFHR) is a unique laboratory that is comprised of NOS and National Marine Fisheries Service (NMFS) employees. Located within the NCCOS, CCFHR conducts research addressing fisheries and protected-species biology. Also, CCFHR studies the ecological value of coastal and estuarine fish habitats. Data are collected and used to understand and protect Essential Fish Habitat, in order to manage fisheries and to protect endangered and threatened species. NMFS staff produces and maintains long-term fish survey data sets on menhaden and snapper/grouper resources.

The Menhaden Program maintains fishery-dependent data sets and a fishery-independent data set. Biostatistical (length, weight, and fish age; up to 20,000 records per year) and catch (landings; up to 6,000 records per year) information from the menhaden purse-seine fisheries have been collected on the Atlantic Coast since 1955 and on the Gulf Coast since 1964. These data are digitized and reside at Beaufort. Catch records from individual menhaden companies are proprietary information; biostatistical data have been deemed proprietary because catches can be tied to specific locations.

Captains' Daily Fishing Reports (CDFRs) are daily deck logs of fishing activity by the Atlantic and Gulf menhaden purse-seine fleets. Among other items, CDFRs enumerate date, time, size of catch, and catch location of purse-seine sets made by vessels in both fleets. Both analog and digital data are available.

The reef-fisheries effort includes the South Atlantic Headboat Survey (1972 to present) and the Gulf of Mexico Headboat Survey (1986 to present). Coverage is from Brownsville, Texas, to Morehead City, North Carolina. Each survey includes Bioprofile and Catch Record data. These collections are ongoing, are digitized as received, and stored at Beaufort. The original paper data forms require scan digitizing for effective archival storage. Landings, both number and weight, are for more than 300 species. These landings include more than 80 species that are managed under the South Atlantic Snapper Grouper Fishery Management Plan and the Gulf of Mexico Reef Fish Fishery Management Plan. Since the data are proprietary, published data summaries must include data from a minimum of three headboats, to protect the information provided by individual headboat operators.

### B.3.5 OFFICE OF RESPONSE AND RESTORATION (ORR)

The Office of Response and Restoration (ORR) is responsible for responding to spills of oil and hazardous materials, and for restoring the environment when such events occur in the coastal zone or in navigable waters. ORR works through its network of 15 field offices, which are located around the coastal U.S. In order to respond quickly and effectively, ORR works with other Federal agencies, States, and the private sector to collect and manipulate data and information into formats that are used to determine solutions to operational problems that arise during such emergencies. Such planning activities include the following:

*Natural and human-induced disasters (such as the oil spill shown below) increase the need for real-time information.*



- Identification, ranking, and geographic depiction of environments and resources that are unusually sensitive to oil impacts
- Development of models that estimate the path and behavior of oil spills, including databases that contain the physical-chemical characteristics of more than 900 petroleum oils
- Development of air dispersion models that estimate the plume footprint for more than 900 hazardous chemicals
- Compilation of databases that contain the physical-chemical characteristics of more than 4,000 chemicals and the appropriate emergency-response procedures.

ORR also provides technical expertise and develops computer tools to assist in the decision-making associated with the cleanup of hazardous materials waste sites in the coastal zone. Additionally, ORR has developed a computer-based assessment tool that integrates

data on sediment contaminant distribution and toxicity (and other environmental parameters) to assist in the decision-making involved in environmental restoration. Data have been compiled for more than 13 marine watersheds. ORR also conducts natural resource damage assessments to support the restoration of coastal environments that have been injured by releases of oil and hazardous materials. Data collected through these efforts are publicly available.

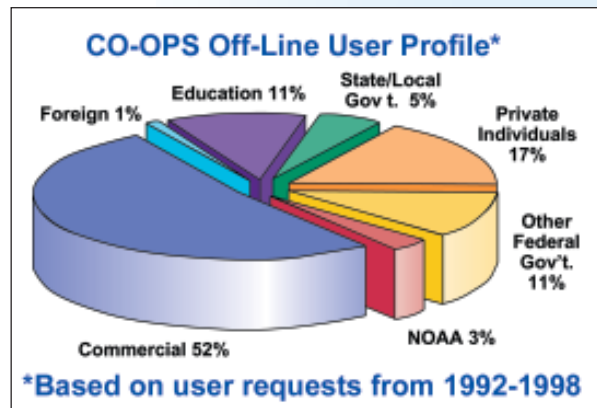
### B.3.6 CENTER FOR OPERATIONAL OCEANOGRAPHIC PRODUCTS AND SERVICES (CO-OPS)

The Center for Operational Oceanographic Products and Services (CO-OPS) is authorized to implement and operate a national quality-control system for real-time tide and current data, and to design, install, and manage real-time tide and current data measurement systems.

CO-OPS is responsible for the management of the U.S. National Water-Level Observation Program and the emerging U.S. National Physical Oceanographic Real-Time System Program (PORTS). The foundation of the U.S. National Water-Level Observation Program is the National Water-Level Observation Network (NWLON), a network of approximately 175 continuously operating stations in the U.S. coastal ocean, including the Great Lakes and connecting waterways, as well as Pacific and Atlantic Ocean island possessions. With many data series greater than or close to one century in length, NWLON is a unique and valuable geophysical data set.

In addition to NWLON, CO-OPS operates approximately 50 temporary, short-term water-level gauges each year in support of NOAA's nautical charting program and partnership programs with coastal States and the U.S. Army Corps of Engineers. As new PORTS locations are established, additional long-term water-level and current meter stations are being established as well. Data and information are also being made available from several thousand historical, short-term observation locations. These data are used for vertical reference information required for surveying and mapping, coastal engineering and construction, water-level regulation, marine boundary determination, tide prediction, storm-surge analyses, and the analysis of long-term sea-level variations and trends.

The CO-OPS Web site allows a user to view or download station-location information, data inventories, tidal data and benchmark information, and general information and reports on tides. The user can download preliminary, near-real-time water-level data, and can view PORTS data in near-real-time. Integrated



database queries allow a user to obtain long-term verified hourly heights, high and low water measurements, and monthly mean time series through the Internet interface. Ancillary meteorological and oceanographic data are also available at some sites.

Several years of data recovery efforts are now paying off; several long-term stations now have complete hourly height data sets available. Significant efforts are still required to ensure recovery of the hard-copy metadata associated with the data and the preservation of a few selected sets of paper marigrams from the longest operating stations. Links are also being put in place between the CO-OPS and the National Geodetic Survey databases for geodetic and tidal benchmark elevation information.

### B.3.7 COASTAL SERVICES CENTER (CSC)

The Coastal Services Center (CSC) connects its customers with the coastal data, information, and technology needed to help nurture the environmental and economic well-being of the Nation's coasts. To this end, CSC develops and distributes products that are derived from, and include, a variety of coastal data. These products and the supporting data are documented in accordance with the federally mandated FGDC standards, and they are available through both the FGDC Clearinghouse and the NOAA Server. To maximize the accessibility of coastal data, CSC also makes its products and data available on CD and via the Internet. CSC has established procedures with the NOAA National Data Centers (NNDC) for the archive of all CSC-produced data and data products.



*Gray's Reef National Marine Sanctuary, Georgia. Gray's Reef is one of the largest near-shore sandstone reefs in the southeastern United States, and contains a unique ecosystem.*

Much of the data and information available at CSC are derived from instruments that are carried on satellite or aircraft platforms. The types of data are varied. They include information on coastal hazards, land classification imagery, aquatic vegetation, wetland habitats, natural resources, coastal topography and erosion, harmful algal blooms, and coastal pollution.

Although these data are available separately, CSC emphasizes the potential uses and importance of the data by integrating them into products. There is an additional emphasis on the development or synthesis of data suitable for use by the coastal resource management community in decision-support geographic information systems.

A wealth of coastal data collected under the Coastal Zone Management Act are available in the publications of the Coastal Zone Information Center (CZIC) collection. CSC is taking steps toward making these data easily accessible by digitally scanning

select items from the CZIC collection, and making these documents available via the Internet. Tabular information in the publications is marked so that users can readily identify data items of interest.

CSC has developed a Coastal Information Directory (CID), which facilitates the location of coastal data, products, and information. The CID provides access to coastal data and information that are stored at CSC and other Federal agencies, as well as access to coastal data and information from State and local governments, educational facilities, and private concerns. The CID was developed in compliance with FGDC and NOAA directives. In addition, this directory taps directly into the on-line NOAA Catalog, which includes listings of coastal data and information stored in the CSC library, the NOAA Central Library, and 28 NOAA field libraries.

### NOS Data Rescue Needs

DATA SET	DATA SOURCE	VOLUME/MEDIA	RESOURCE EFFORT *	METADATA **
Coastal Monitoring and Assessment	Various	Text, maps, photos, data requiring keypunch entry	X	+
Nautical Chart and Historical Source Data	Various	7,200 paper charts and 900 rolls of microfilm	•	+
Hydrographic Surveys	Sonar & Manual soundings	8,600 survey sheets	X	X
Water Levels and Currents	Water level stations, current meters, meteorological sensors	Thousands of pages of text	X	+
Coastal Imagery	Emulsion camera	600,000 images	X	+
Shoreline	Aerial photography to stereo plotter	15,000 paper shoreline manuscripts	X	•

• CAN DO WITH CURRENT RESOURCES      + NEED INCREMENTAL RESOURCES  
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