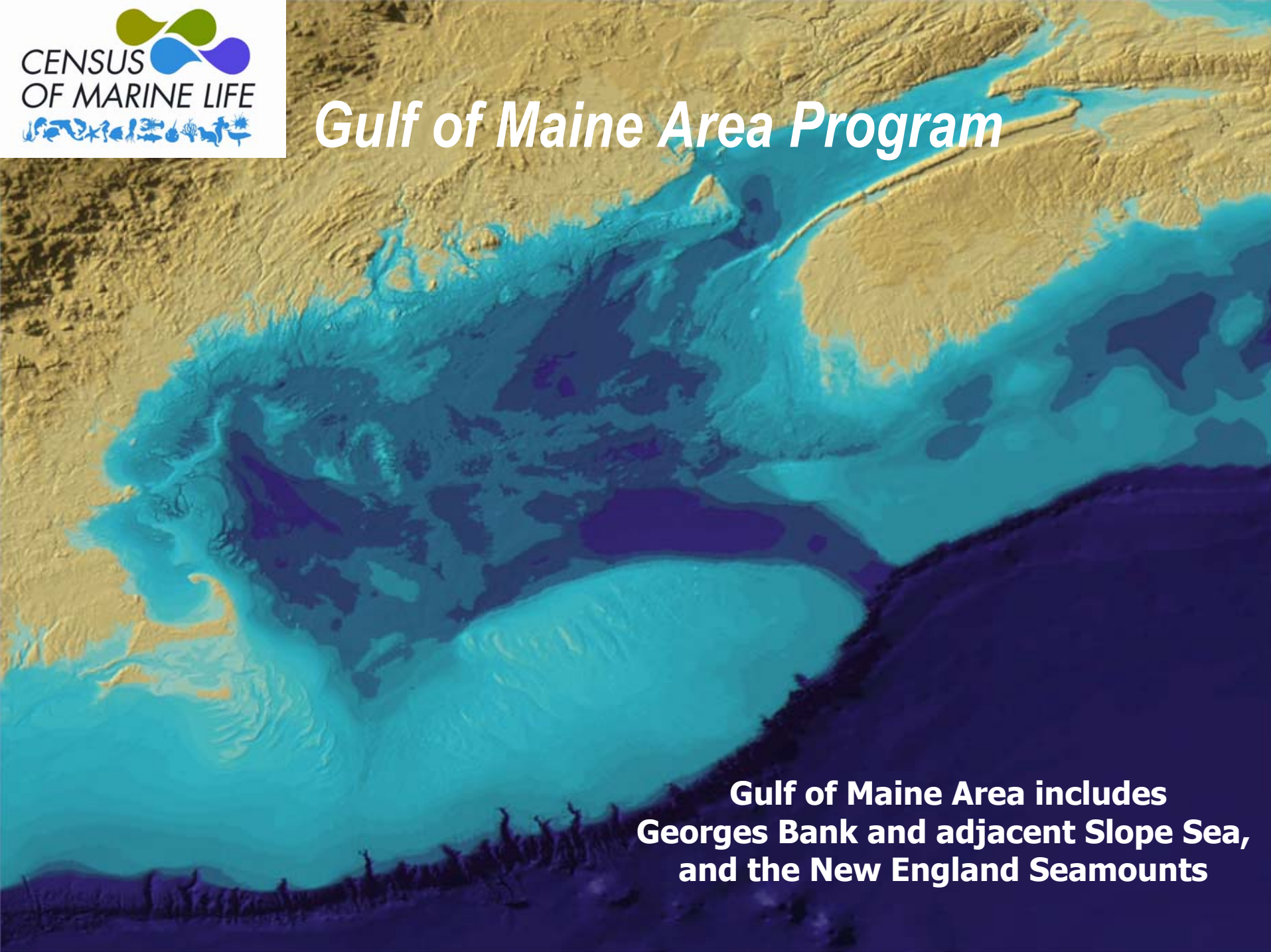
CENSUS OF MARINE LIFE

Gulf of Maine Area Program



Gulf of Maine Area includes Georges Bank and adjacent Slope Sea, and the New England Seamounts

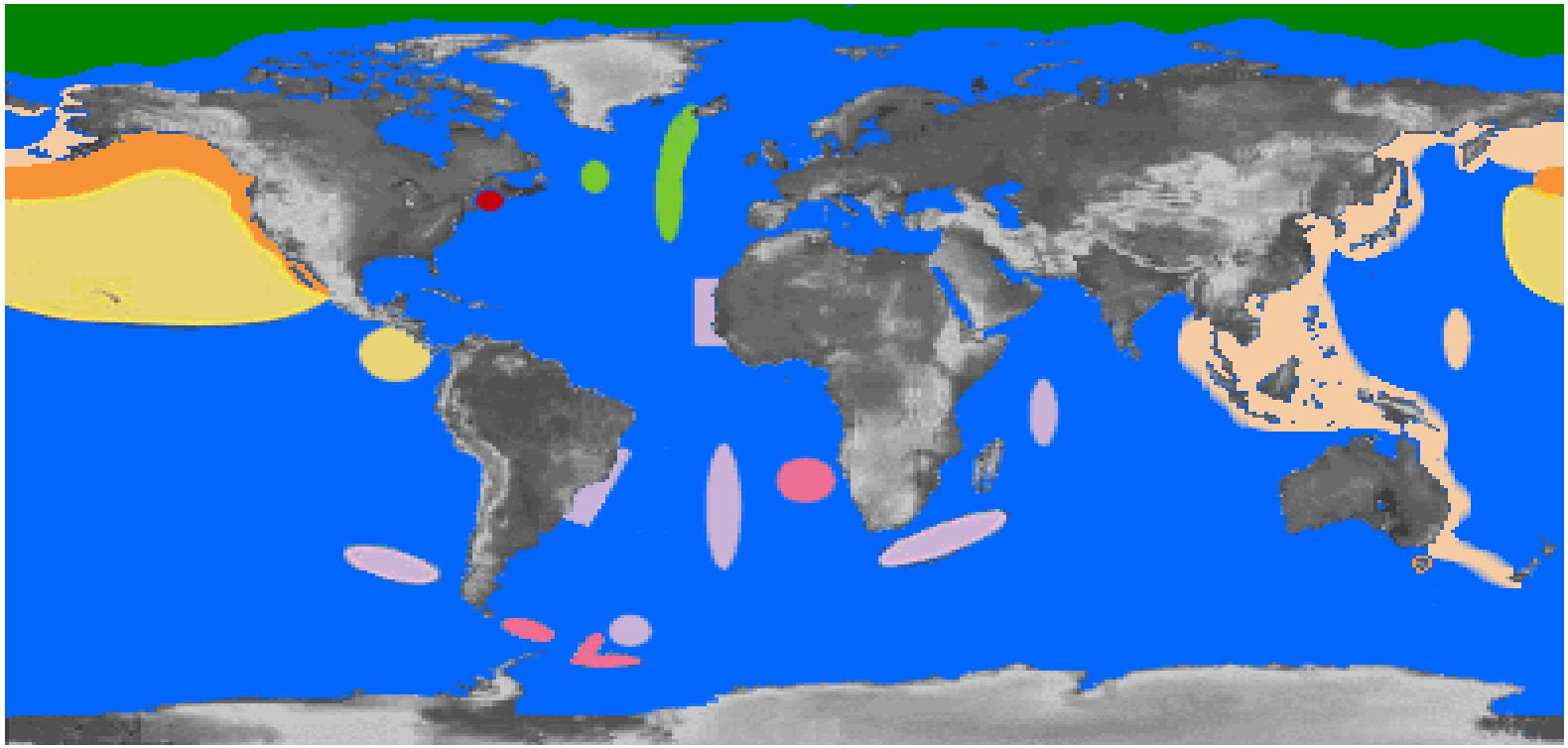
CENSUS OF MARINE LIFE

The Census of Marine Life is a growing global network of researchers in more than 70 nations engaged in a ten-year initiative to assess and explain the diversity, distribution, and abundance of marine life in the oceans - past, present, and future.

Census of Marine Life

- What lived in the oceans?
- What lives in the oceans?
- What will live in the oceans?

Census of Marine Life projects around the globe



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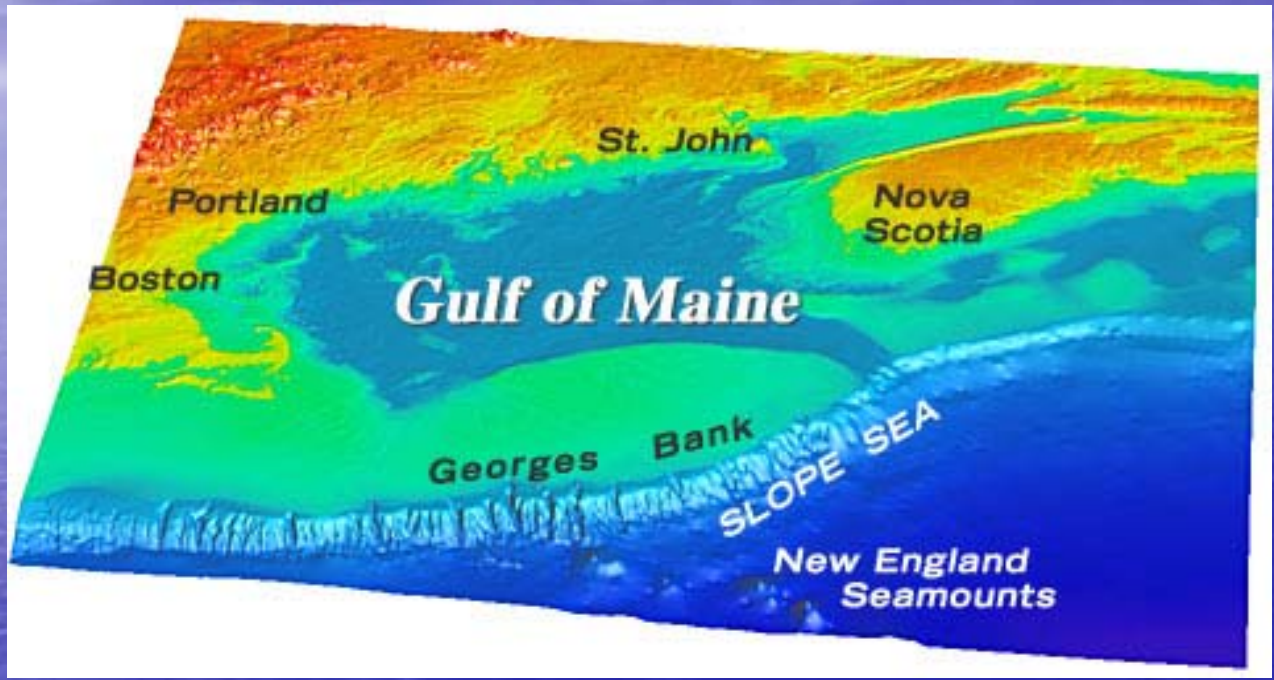
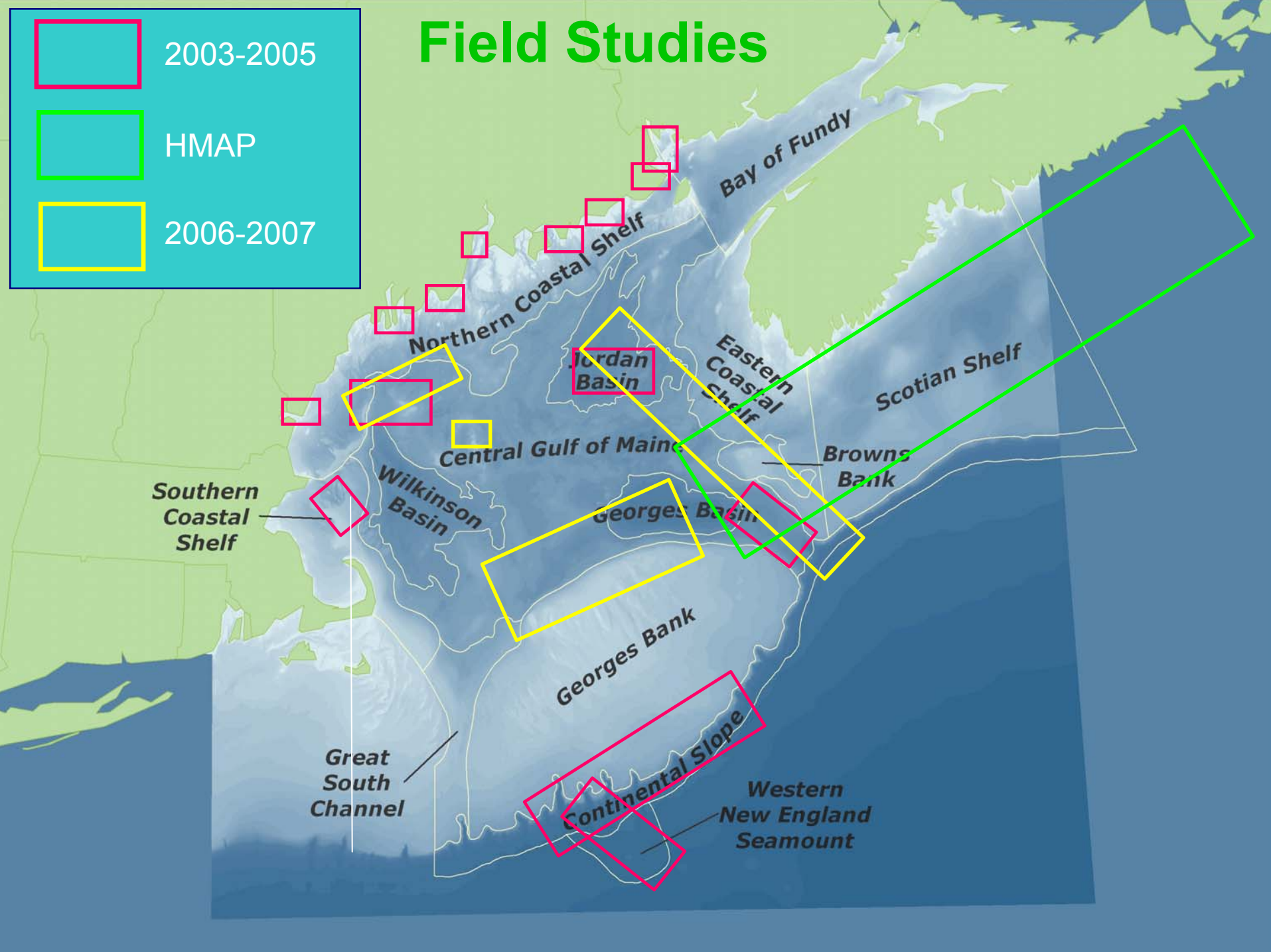
ICOMM CMarZ

(Global Projects)

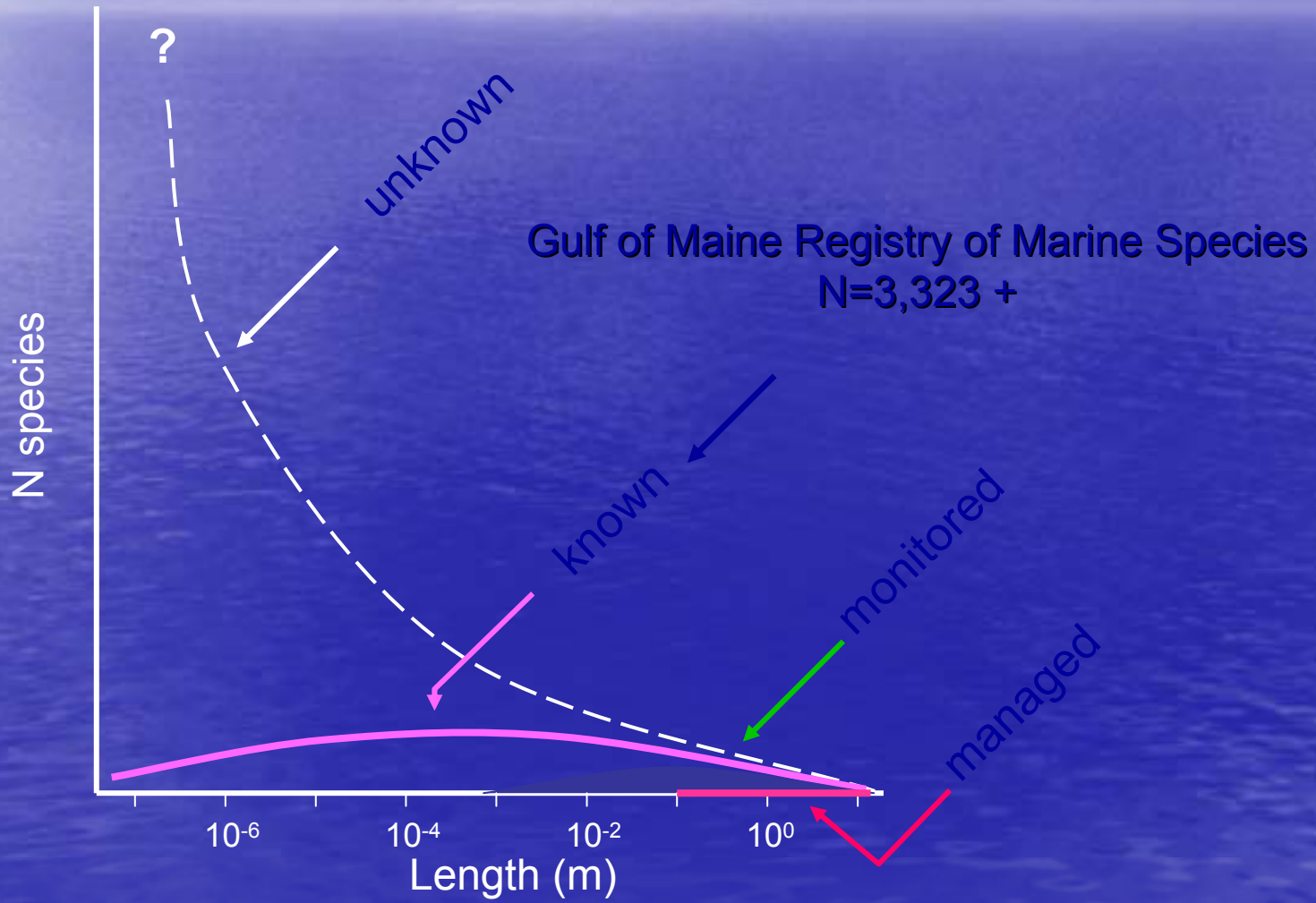
Gulf of Maine Area Program



Gulf of Maine selected as the *ecosystem pilot*


Field Studies
2003-2005
HMAP
2006-2007
Bay of Fundy
Northern Coastal Shelf
Jordan Basin
Eastern Coastal Shelf
Scotian Shelf
Central Gulf of Maine
Browns Bank
Southern Coastal Shelf
Wilkinson Basin
Georges Basin
Georges Bank
Great South Channel
Continental Slope
Western New England Seamount

First Official GoMA Census Count: 3,323 Species



Over-Arching Goals

1 - increase knowledge of the patterns and roles of biodiversity in the Gulf of Maine area; and

2 - construct a framework that enables ecosystem-based approaches to management (EAM)

Known, Unknown, Unknowable

- Accept that there aren't enough resources to convert all that is unknown to the known
- Accept that uncertainty and change – the unknowable – is central to dynamic marine ecosystems
- But narrow the gaps in knowledge and understanding sufficiently to enable science-based policy decisions (i.e., EBM)

"Science is a privilege, not a right…

One of the ways we earn that privilege is by communicating results."

Jesse Ausubel, Program Director
International Census of Marine Life
Frankfurt, Germany November 2005

How do we meet these lofty goals?

Get scientists and managers talking:

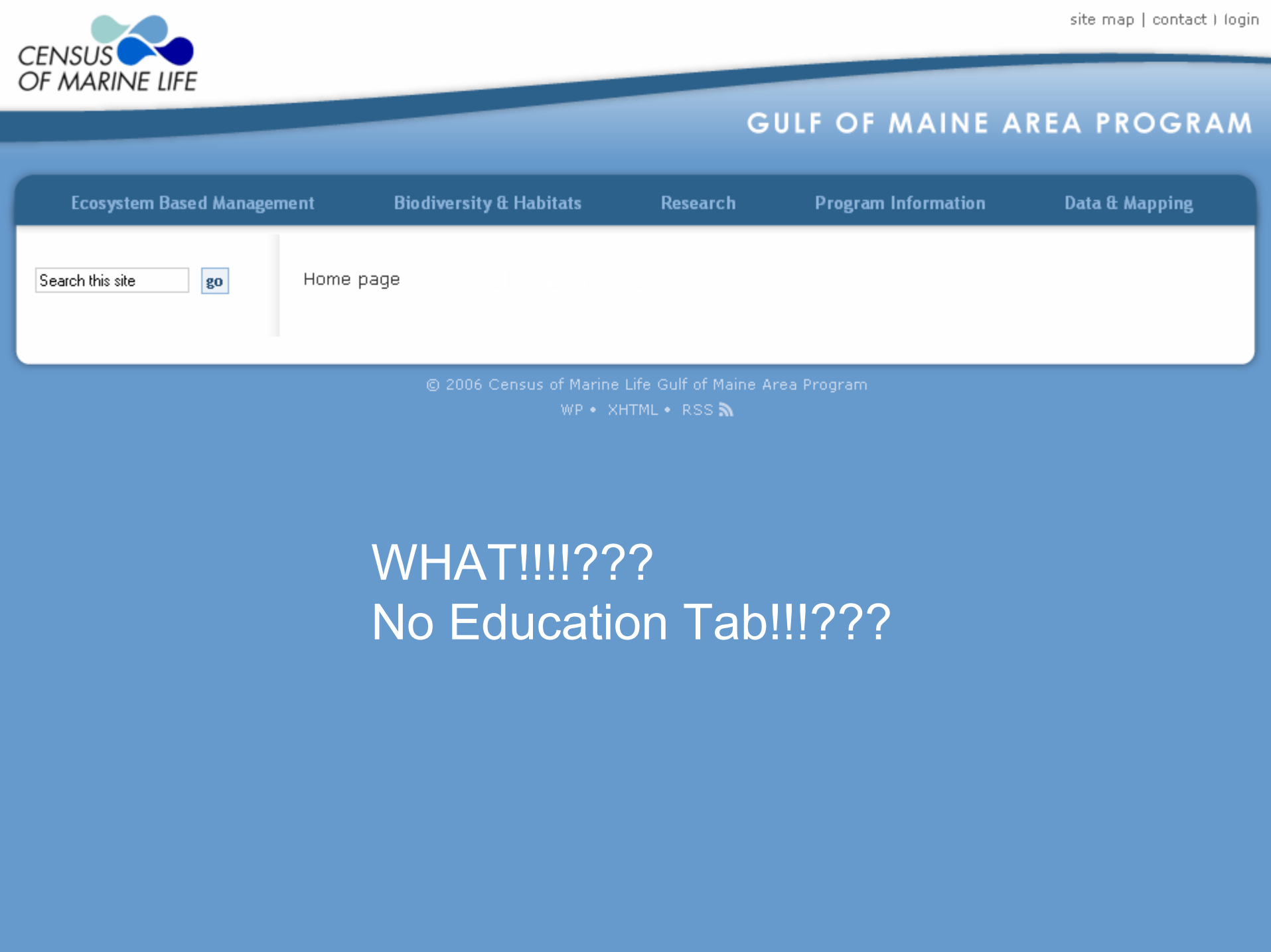
- Gulf of Maine Ocean Data Partnership
- Working Groups
- Conferences

Centralize data and knowledge:

- OBIS
- Dynamic Atlas
- Metadata Clearinghouses (GCMD)

Share Results and Interpretations:

- Traditional (Pubs, Conferences)
- Media
- Website


site map | contact | login
CENSUS OF MARINE LIFE
GULF OF MAINE AREA PROGRAM
Ecosystem Based Management
Biodiversity & Habitats
Research
Program Information
Data & Mapping
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Home page
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WP • XHTML • RSS
WHAT!!!???
No Education Tab!!!???

Geography & Characteristics

Biology

Species Distribution

Communities

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Biodiversity & Habitats

Biodiversity is most commonly thought of as the *number of species in an area*. However, biodiversity also exists at two other important levels: *genetic diversity* within a population, and diversity in the types of *communities** in a larger area or ecosystem.

The extant biodiversity of ecosystems is a legacy of life on earth that should be preserved for practical as well as ethical reasons. At the simplest level, biodiversity represents the reservoir of options that a system possesses to respond to changes over time, and a reservoir of information about life itself. We do not understand the role of everything today. Seemingly minor species or hidden aspects of biodiversity may play surprisingly important, but still unknown, roles in today's ecosystems. Moreover, we cannot predict what aspects of today's biodiversity may emerge as important in the future. At a higher level, patterns of diversity determine how systems function–for example, in storing and recycling nutrients, fixing inorganic carbon, producing fish, and supporting other species of special interest. In addition to these important roles in "life support", biodiversity presents us with opportunities for new and potentially important discoveries (for example, in the area of medicine), and a wealth of aesthetic wonders.

Understanding and conserving biodiversity are goals that integrate across many human needs and values. Knowledge of biodiversity and the ways that it influences ecosystem functions are thus central to the development of ecosystem-based approaches to management.

What is the Role of Biodiversity?

Because threats to biodiversity are increasing globally, the need to understand what is there and how biodiversity contributes to the functioning of ecosystems is urgent, but it is not straightforward. How do we measure biodiversity in a useful way? How do we conserve biodiversity when so much of it remains

Geography & Characteristics
Geology
Physioregions
Bathymetry
Biology
Species Distribution
Communities
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Physioregions

Click on the map bel

http://research.usm.maine.edu - Gulf of Maine Census » Northern Coastal Shelf - Mozilla Firefox

Northern Coastal Shelf

Overview

Ranging from Cape Ann in the western Gulf of Maine to the Bay of Fundy in the east, the Northern Coastal Shelf encompasses a heterogeneous variety of habitat types and bathymetry. The coast is incised with a great variety of embayments and estuaries; intertidal areas are characterized by sand beaches, mudflats, saltmarshes and rocky shores. Like other shallow areas of the Gulf, where tidal action provides a steady supply of nutrients to well lit surface waters, the Northern Coastal Shelf is highly productive. Once supporting fisheries for groundfish, lobster, herring, and other species, the Northern Coastal Shelf is now dominated by lobster fishing. Coastal development has resulted in habitat destruction and pollution.[1]

Surface area (percentage of total)

7,456 mi^2 9%

Depth

Intertidal zone to 100 m.

Bathymetry including key features

The bathymetry of the nearshore reflects in many cases the topography of the adjacent shoreline: bedrock peninsulas extend underwater as bedrock features, sandy beaches are matched underwater by gently sloping areas, waters offshore of cliffs reach steep depths quickly, and marshes and mud flats are mirrored by subtidal deposits of fine sediments.[2]

Jeffrey's Ledge is a glacial deposit that forms a curving shoal 33 miles long at the western terminus of the Northern Coastal Shelf. From 40-70 m deep, the topography of Jeffrey's Ledge creates an upwelling zone that attracts a wide variety of marine life.[3,4]

Substrate

Substrate in this area of the Gulf of Maine is extremely heterogeneous; it includes bedrock, sand, gravel, silt and mud, and an almost infinite range of combinations, occurring at a variety of scales. Sixty meters marks the point of lowest sea level since the last ice age. The passage of sea level through this depth range removed many of the unconsolidated sediments; as a result, bedrock predominates in much of the shallow waters of the Northern Coastal Shelf.[5]

Relationship to large-scale circulatory patterns of the Gulf of Maine

The oceanography of the Northern Coastal Shelf is dominated by coastal currents that flow southwesterly along the coast. These currents are a component of the counterclockwise gyre that dominates gulf-scale circulation.[6,7]

Information on average (seasonal/annual) oceanographic conditions

The spring freshet strengthens the coastal current in April through June and results in a decrease in salinity. The eastern portion of this current is relatively fast moving and somewhat colder than the western portion of the current. Where the two meet, at the mouth of Penobscot Bay, the faster moving

Geography & Characteristics

Geology

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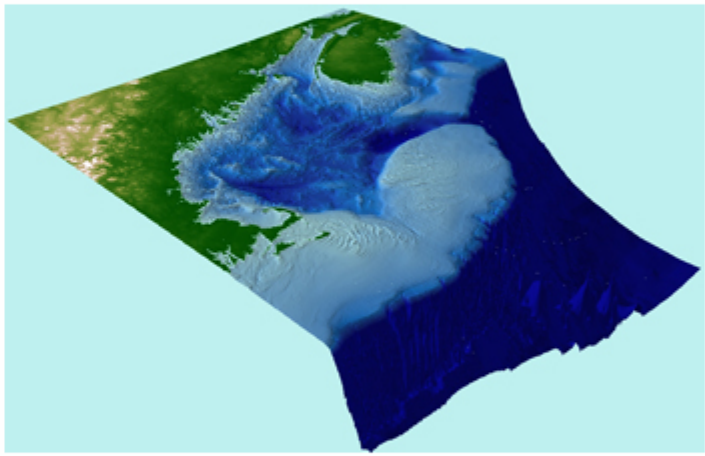
Biodiversity & Habitats › Geography & Characteristics › Bathymetry

Bathymetry

Introduction



Thousands of years ago glaciers, some over a mile thick, sculpted the Gulf of Maine. These glaciers carved deep basins, channels and banks as they scoured the area. Rivers, interacting with dramatic changes in sea level, further shaped the Gulf. (See the Geology section for more information).

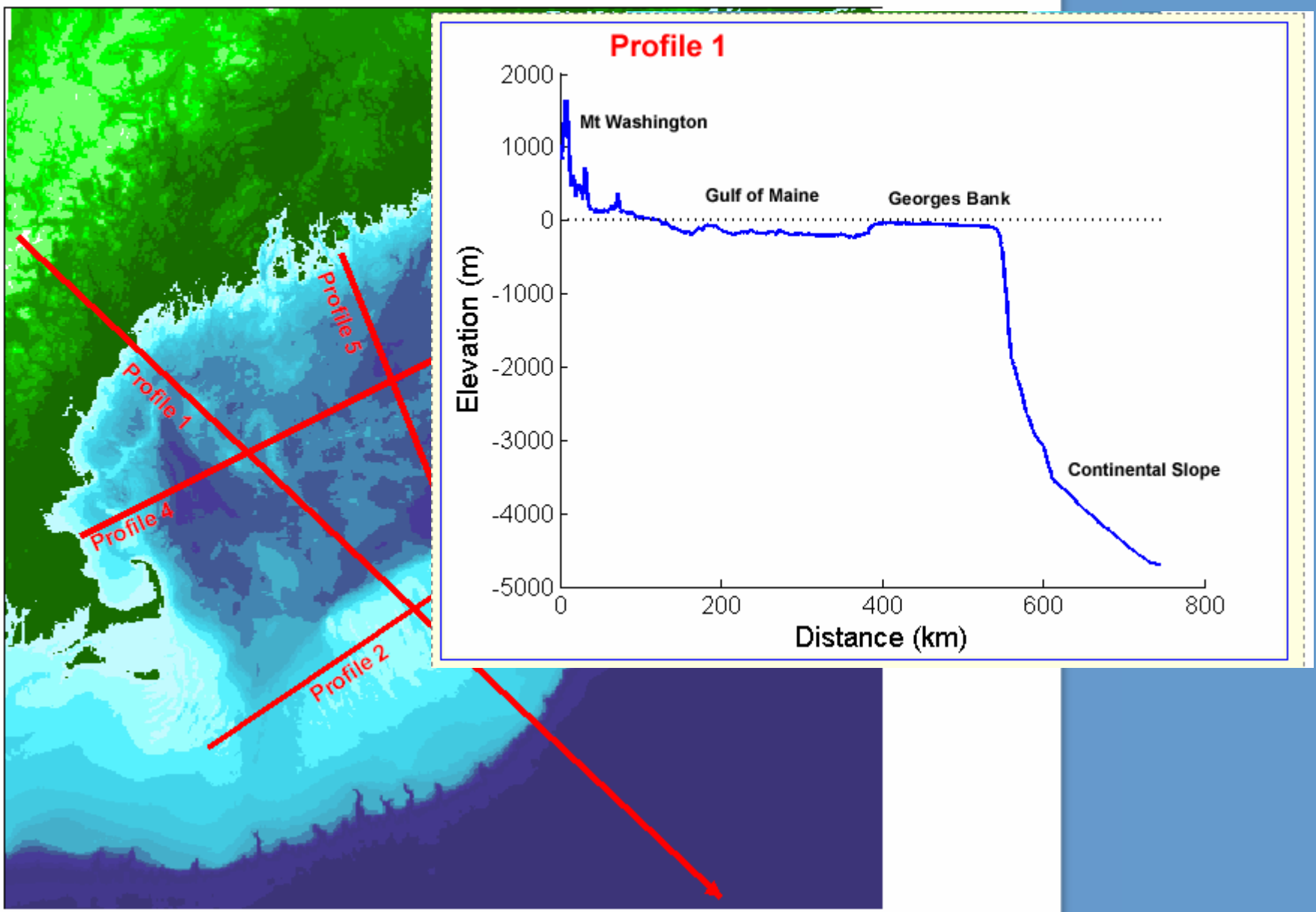
Some of the deep basins have begun filling with muds and other sediment, but much of the bedrock and boulders scoured by the glaciers remain exposed today, giving the Gulf of Maine its rocky reputation. Although these rocks and ledges have worried sailors and fishermen for generations, they play an influential role in maintaining the Gulf's biodiversity.

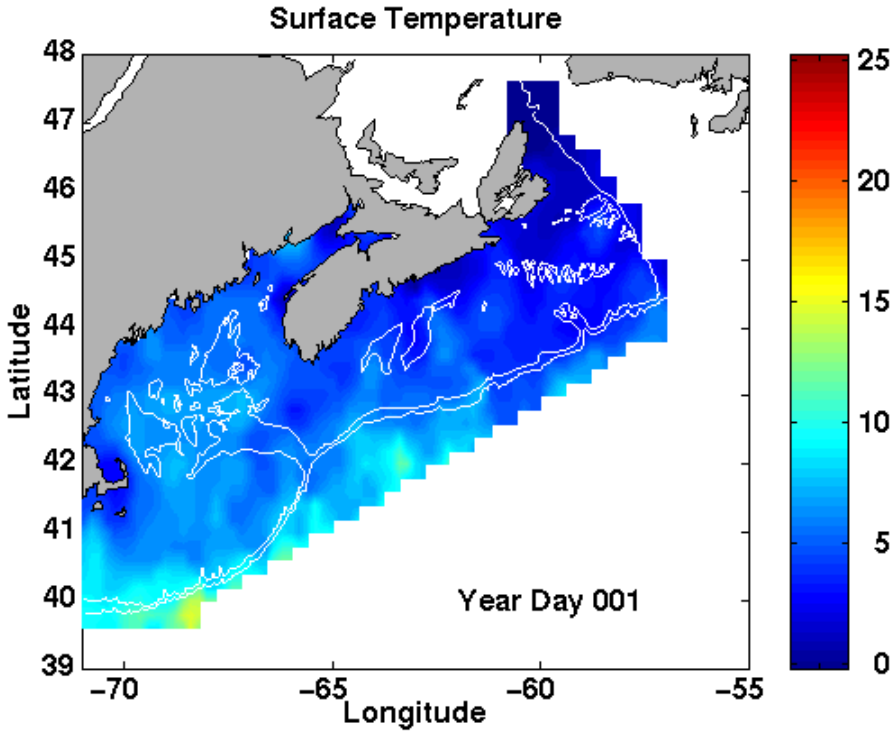
The many bottom features affect the Gulf's currents which in turn influence the distribution and abundance of plankton. Also, the many rocks and crevices provide refuges and habitats for the Gulf's plants and animals. It has long been shown by ecologists that areas of higher rugisity, a measure of surface roughness, have higher abundances and greater diversity of animals such as fish and crustaceans. So, we can thank the glaciers for creating such a heterogeneous environment, an ideal home for the Gulf's diverse and abundant life.

Statistics and Hypsometry

Vertical Profiles

Click on one of the transects at below for a vertical profile of the underlying bathymetry




Surface Temperature
Latitude
Longitude
Year Day 001
48
47
46
45
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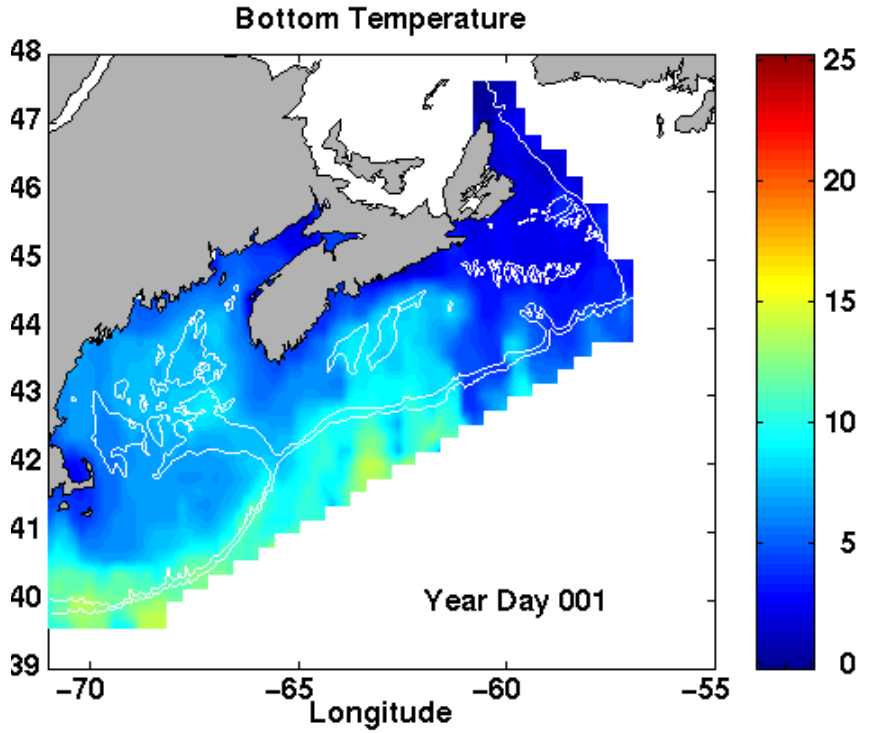
Bottom Temperature
Longitude
Year Day 001
48
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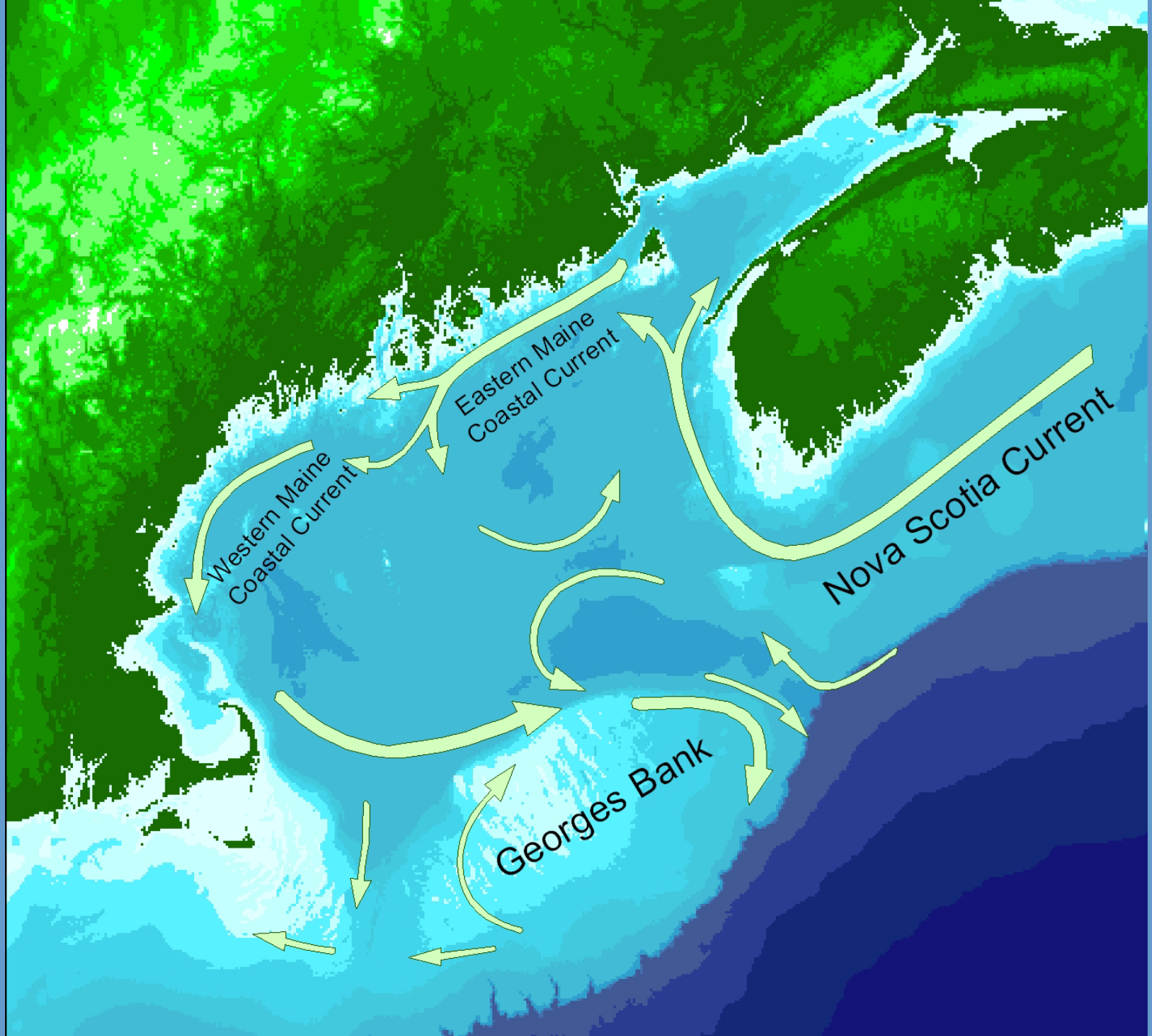
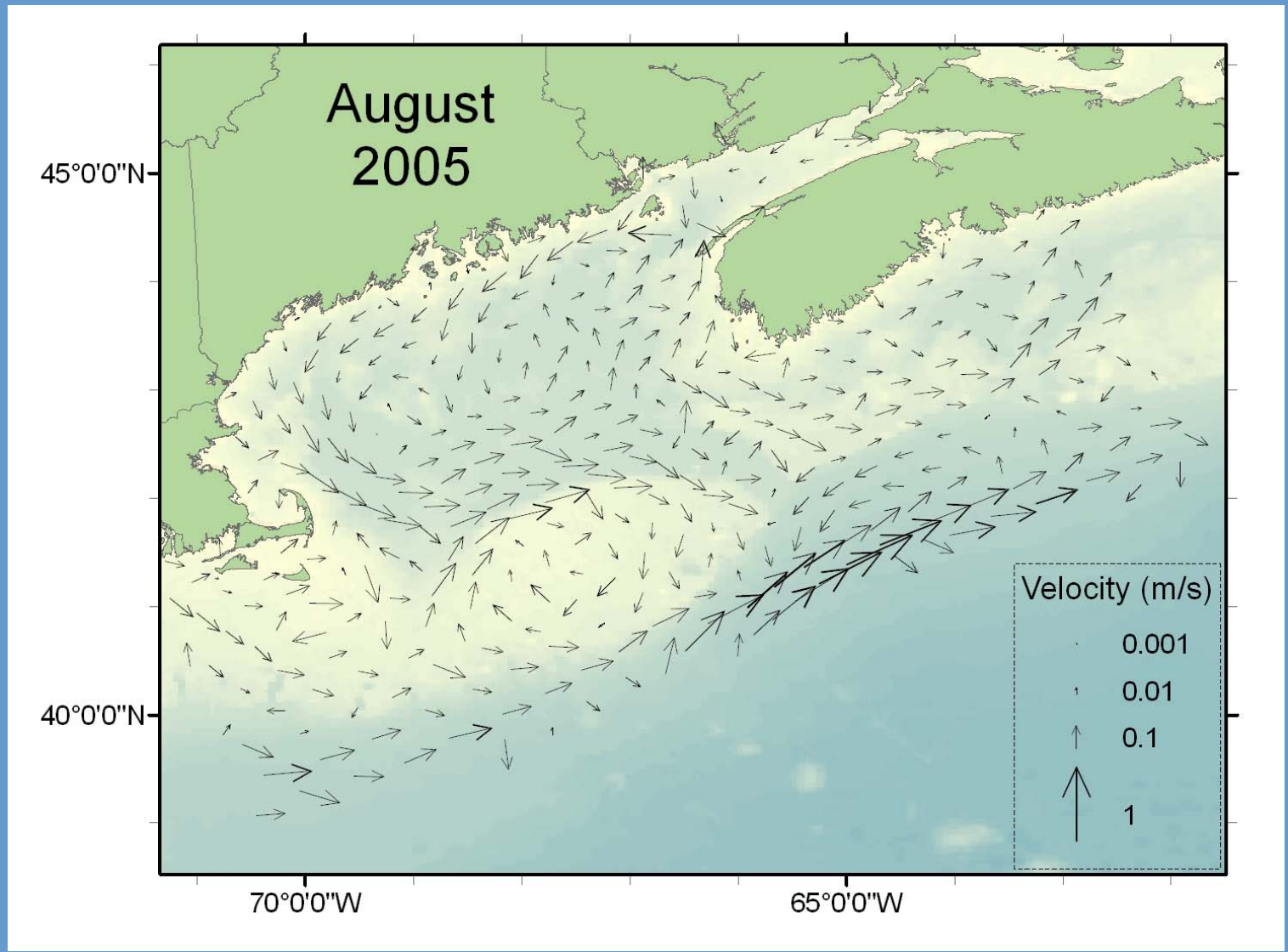

Eastern Maine
Coastal Current
Western Maine
Coastal Current
Nova Scotia Current
Georges Bank


August
2005
45°0'0"N
40°0'0"N
70°0'0"W
65°0'0"W
Velocity (m/s)
0.001
0.01
0.1
1

Geography & Characteristics

Biology

Invasives

Known and Unknown

Underwater Tour

Taxonomy

Species Distribution

Communities

Search this site go

Biodiversity & Habitats › Biology › Taxonomy › Illustrated Taxonomy for the Gulf of Maine

Illustrated Taxonomy for the Gulf of Maine

Organisms that occur in the Gulf of Maine are listed both by family name and by common name. Images for particular organisms can be obtained by clicking on the common name.

Fishes

Sea Turtles

Seabirds

Cetaceans

Showy bristlemc
Boa dragonfish S
Stomias *Stomias*
Threelight dragc
Lovely hatchetfi

Order Syngnat

Longspine snipe
Northern pipefisl
Sargassum pipet
Lined sea horse,
Trumpetfish, Co

Order Tetraodc

Gray Triggerfish
Planehead filefis
Fringed filefish,
Orange filefish, I
Scrawled filefish
Northern puffer,
Burrfish, Porcupi
Ocean sunfish, S
Sharptail mola, S

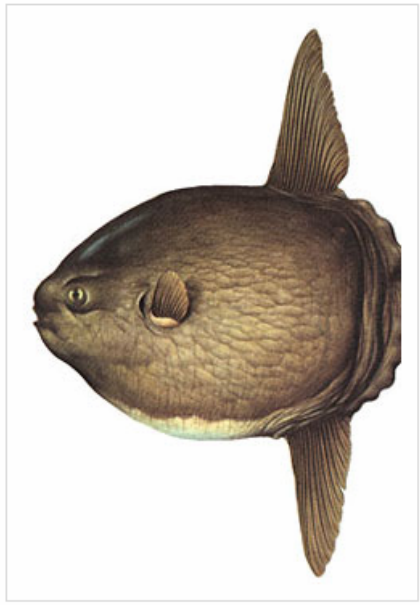
Order Torpedin

Atlantic torpedo

Order Zeiforme

Silvery John Dor
Grammicolepid *X*

http://research.usm.maine.edu - Gulf of Maine Census » Detail Page - Mozilla Firefox



Courtesy of Vineyard Press Books

Family: Molidae
Common Name: Ocean sunfish, Sunfish

Size: to 332 cm TL (male/unsexed); max. weight: 2,000 kg.

Habitat: Pelagic; marine; depth to 300 m. Seen drifting at the surface lying on its side, or swimming upright near the surface so its dorsal fin projects above the water.

Range: Tropical and temperate seas; northward to northern Norway in the eastern Atlantic, to the Newfoundland banks, the Gulf of St. Lawrence, and the coast of Nova Scotia in the western Atlantic.

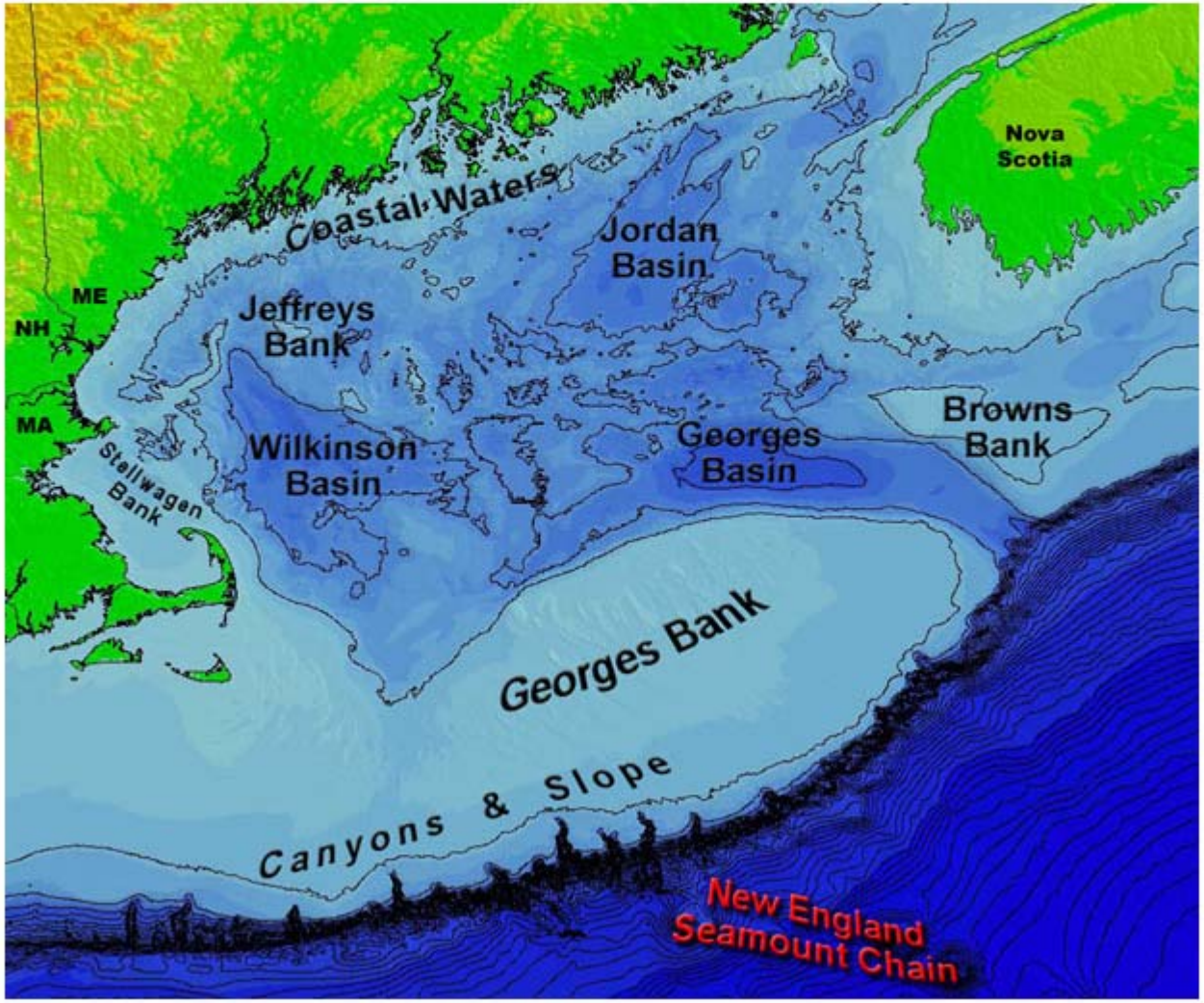
Diet: Fishes, mollusks, zooplankton, jellyfish, crustaceans, and brittle stars.

Reproduction: Numerous and small eggs (300 million in a female 1.5 m long). Three developmental stages : (1) tetraodontiform-body rather elongate, no spines, caudal fin present;(2) ostracioniform-body shortened, with some large spines on body plates;(3) molacanthiform (Molacanthus)-body short and high, skin rough with minute spines.

Done

An Underwater Tour of Seafloor Landscapes in the Gulf of Maine Region

Peer beneath the dark, turbid waters of the Gulf of Maine to view the diversity of marine life that inhabit its varied landscapes. This website provides a collection of still photographs and video that will take you on a virtual tour below the ocean surface. To explore these landscapes, use your mouse to click on interactive features of the map below.



An Underwater Tour of Seafloor Landscapes in the Gulf of Maine Region

Seamounts

Still Images

A large white sponge hosts two crinoids in search of food

Despite the name, black corals often have an orange coloration to the living tissue

Anemones filter food from the water column while brittle stars sift organic matter from the sand

Smalleyed rabbitfish (*Hydrolagus affinus*), a species of primitive chimaeroid

Delicate vase sponge is supported by a complex pattern of glass spicules

Coral fossil (D. cristagalli) can be used to measure climate change, by means of stable isotope dating

Northern cutthroat eel feeds on crustaceans, polychaetes, and small fishes near the seafloor

Bushy black coral, a type of antipatharian coral

A rattail grenadier can often be identified by its prominent first dorsal fin and long, tapered tail

Small urchin on the branch of a bamboo coral

Bamboo coral forest reaches high into the water column (more than 6 feet)

Rattail grenadier displaying head-down behavior to find prey

Venus flytrap anemones can close their tentacles to entrap their prey

Bright yellow sponge and corals make a home on a basalt ridge

Deepsea red crab surrounding by a diversity of sessile invertebrates

An Underwater Tour of Seafloor Landscapes in the Gulf of Maine Region

Small urchin on the branch of a bamboo coral

Geography & Characteristics

Biology

Species Distribution

Habitat Use

Biophysical Articles and Maps

Products Based on NMFS Data

Communities

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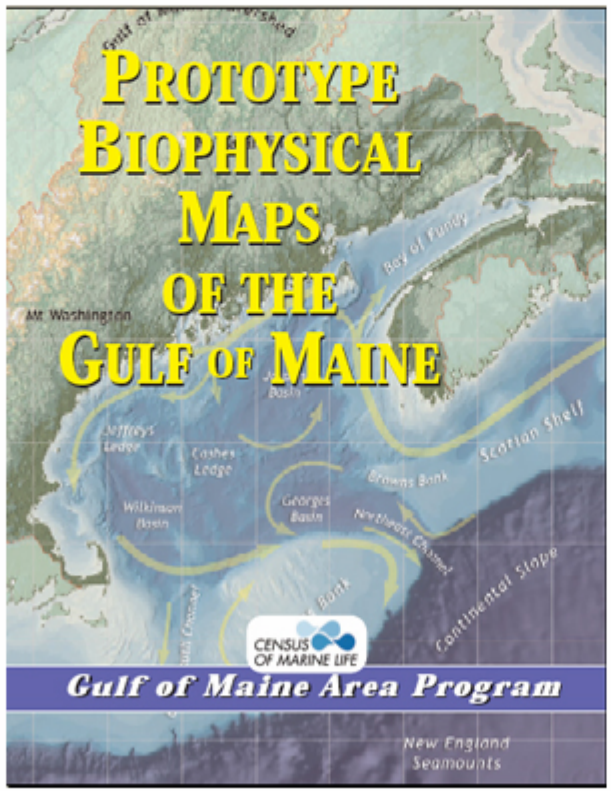
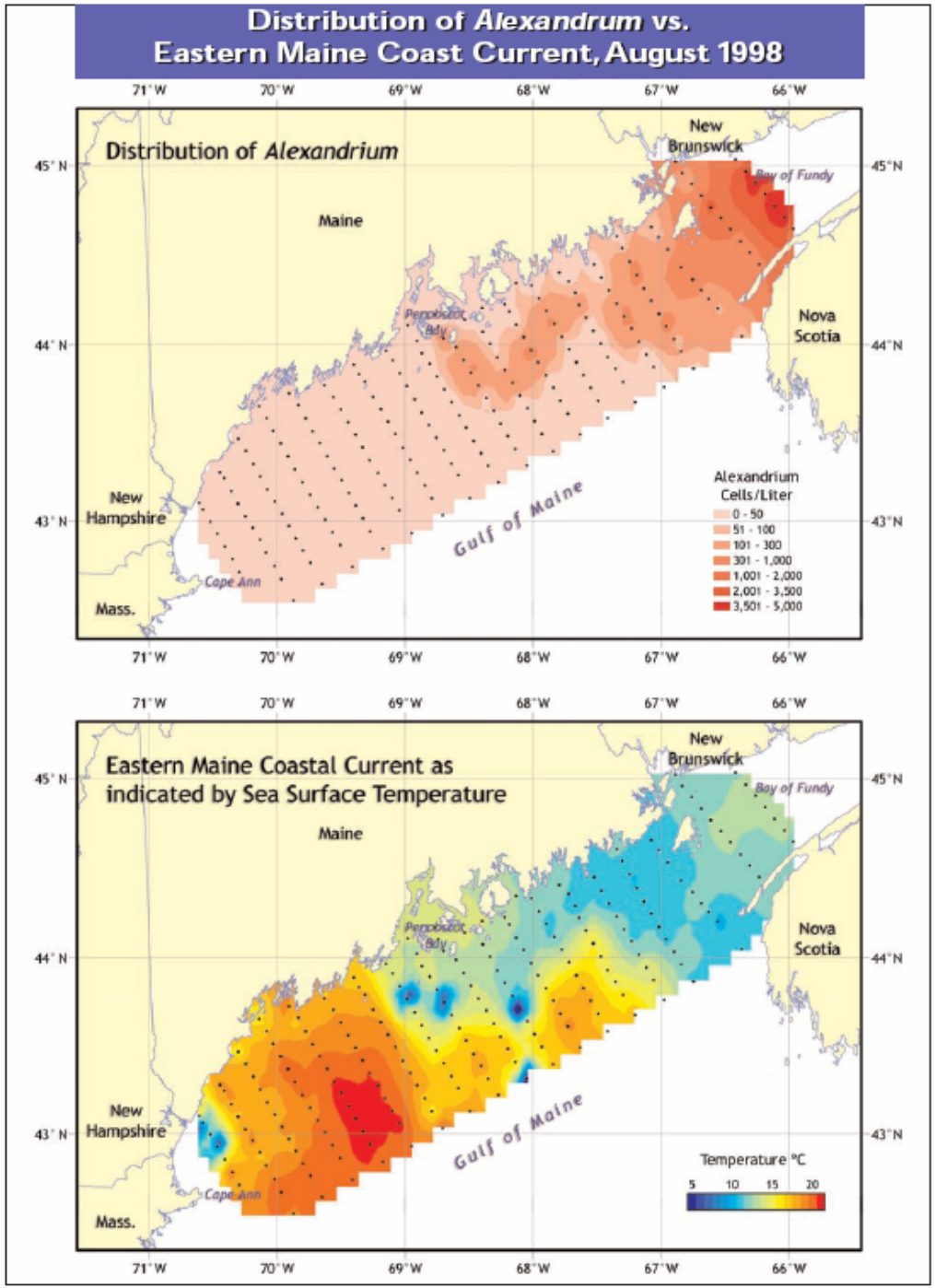
Biophysical Articles and Maps



Chapters include:

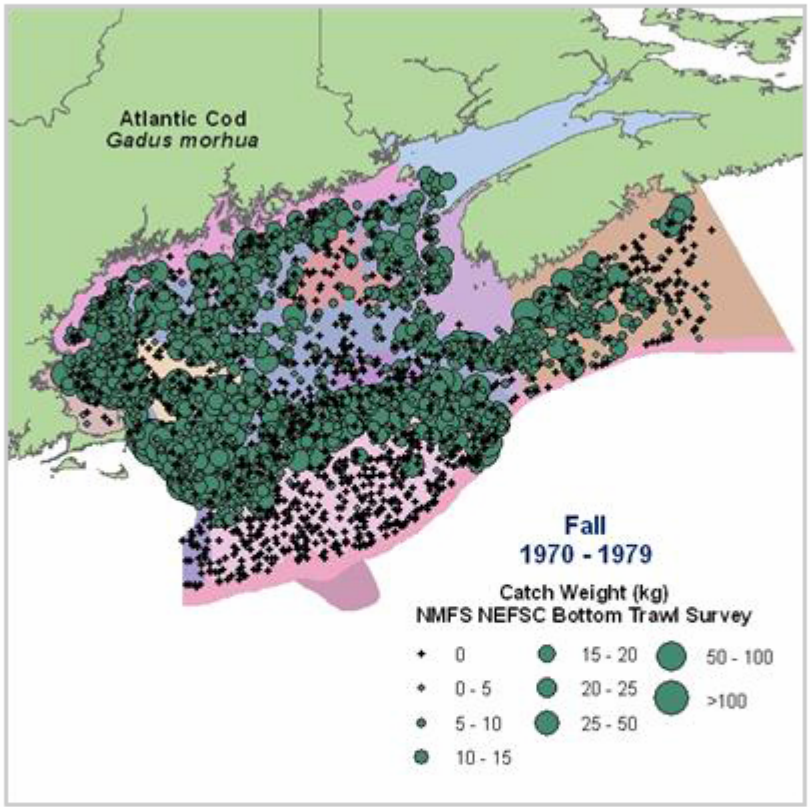
- Changes in right whale habitat utilization
- Distribution and movement in relation to habitat requirements
- "Churchill": The story of right whale #1120
- Paralytic Shellfish Poisoning: How Gulf-wide forces produce local effects
- Large-scale migratory movements
- Distribution of lobster postlarvae: Relationships to coastal currents & effects on lobster population dynamics
- Mapping the movements of egg-bearing famale lobsters and bottom temperatures
- Northern shrimp: How maps tell two stories

Download the full report (PDF 8,699kb)


Distribution of Alexandrum vs.
Eastern Maine Coast Current, August 1998
Distribution of Alexandrium
Maine
New Brunswick
Bay of Fundy
Nova Scotia
New Hampshire
Mass.
Cape Ann
Gulf of Maine
Alexandrium Cells/Liter
0 - 50
51 - 100
101 - 300
301 - 1,000
1,001 - 2,000
2,001 - 3,500
3,501 - 5,000
Eastern Maine Coastal Current as indicated by Sea Surface Temperature
Temperature °C
5 10 15 20
71°W 70°W 69°W 68°W 67°W 66°W
45°N 44°N 43°N

http://gmbis.iris.usm.maine.edu - codfall - Mozilla Firefox

File Edit View Go Bookmarks Tools Help



1970-1979

Gulf of Maine Area Program - Census of Marine Life

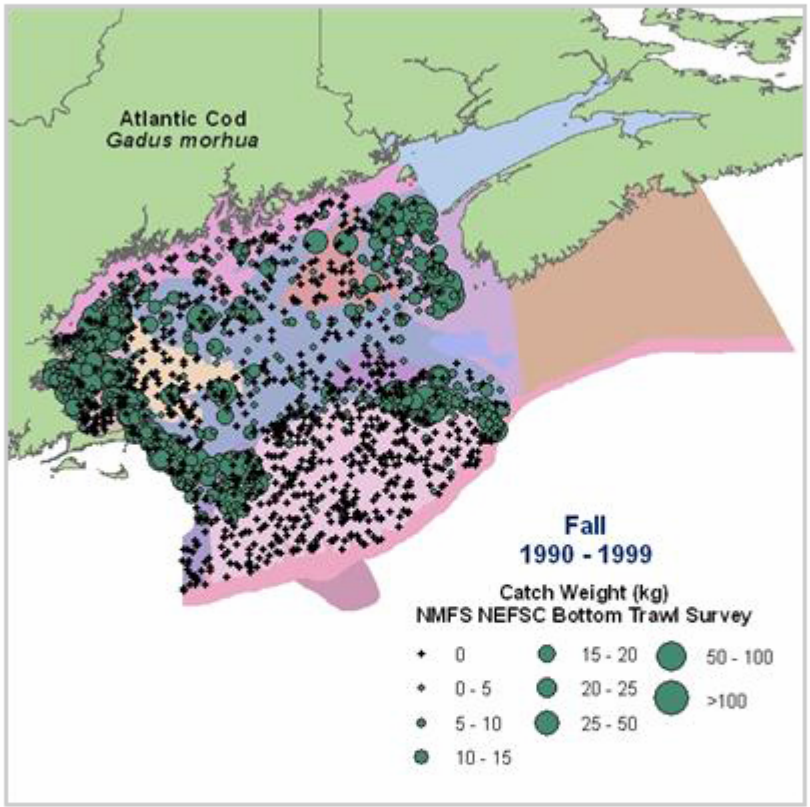
by year

by decade

Done

http://gmbis.iris.usm.maine.edu - codfall - Mozilla Firefox

File Edit View Go Bookmarks Tools Help



1990-1999

by year

by decade

Gulf of Maine Area Program - Census of Marine Life

Done

Geography & Characteristics

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Communities

Food Habits

Life in the Water Column

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Biodiversity & Habitats › Communities › Food Habits

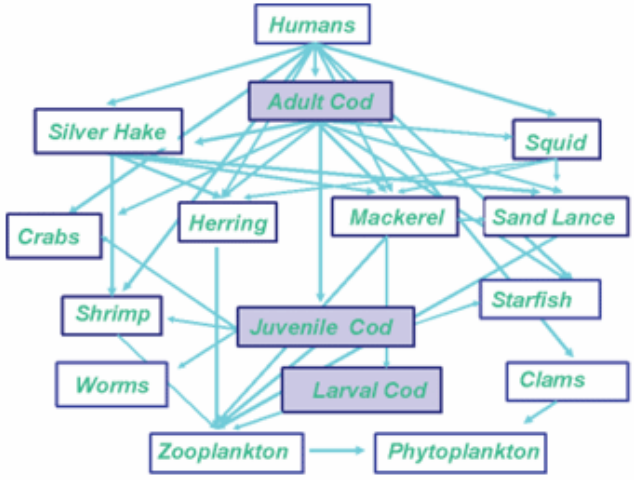
Food Habits

From NOAA's *NMFS Ecology of the Northeast Continental Shelf Toward an Ecosystem Approach to Fisheries Management*, courtesy of Michael Fogarty.

Download the entire document (PDF 994kb)

Cod preying on forage fish

Predator-prey interactions are an essential component of ecosystem structure and function. The flow of energy through an ecosystem depends on the interaction between predators and their prey. Preserving a balance between these ecosystem components is therefore essential.



The food web involving cod on the Northeast continental shelf. Cod prey on a wide variety of benthic and pelagic animals, including many that are commercially important*

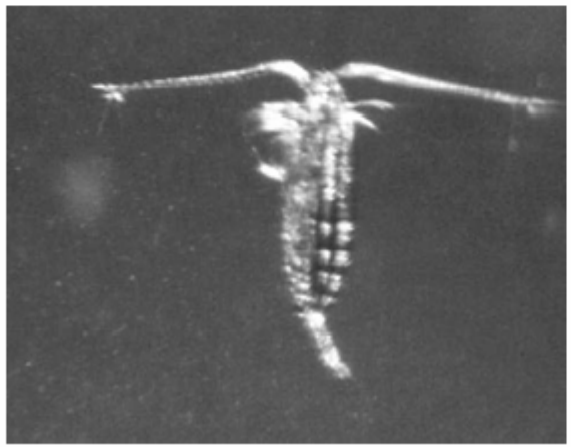
Who Eats Whom?

Looking at the diets of fish reveals a complex web of interactions among many parts of the system. Even examining a small part of the food web illustrates the large number of linkages possible. For fish, which grow in size over a thousandfold over their lifetime, the progression in the food items they consume is remarkable. As they grow, their diets shift dramatically, so that over the lifespan, a large network of interactions develops. For example, cod begin feeding on zooplankton as larvae and then as juveniles feed on an assortment of larger zooplankton species as well as benthic animals. As adults, they feed on these food items but

Video Plankton Recorder (VPR)

The Video Plankton Recorder attached to a winch cable on the deck of the R/V Atlantis at the WHOI dock. Credit: C. S. Davis ©Woods Hole Oceanographic Institution.

The Video Plankton Recorder (VPR) (Davis et al, 1992a, b) is an underwater video microscope that can be deployed in various ways to make observations of small organisms and other particles. In the newest VPR system, a high-resolution digital video camera is focused on a region 7-20 mm across (depending on magnification) at a working distance of 50 cm. Depth of field is determined via calibration and is typically 3-8 cm, yielding a sampling volume of 1-32 ml. Lighting is provided by a 20-W strobe, with a 1-µs pulse duration, aimed obliquely to provide dark-field illumination.



Calanus with oil sac. Credit: C. S. Davis ©Woods

Plankton, such as mesozooplankton in the size range 0.2 - 20 mm, can beimaged. These include such groups as copepods (which are among the most numerous animals on earth), jellyfish, worms, and larval forms of many species including starfish, barnacles, and crabs. The quality of images is sufficient to distinguish among these major taxonomic groups, and in some cases, distinct species can be identified. The images can be classified automatically, using a trained neural network, even at a video-image acquisition rate of 30 frames per second (30 Hz). Such automated classification effects a rapid reduction of a

Midwater or pelagic trawl

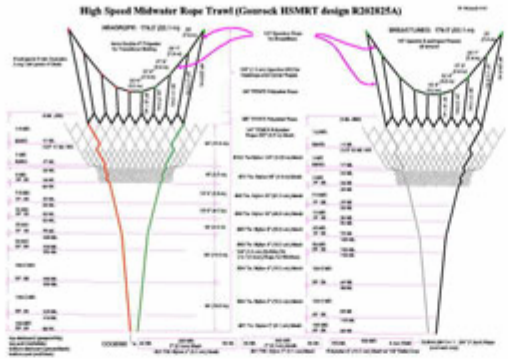


Figure 5. Schematic diagram of the High Speed Midwater Rope Trawl (Gourock HSMRT design R202825A). Credit: NEFSC Photo Archives. Click to enlarge

Figure 6. Emptying the cod-end of the High Speed Midwater Rope Trawl. Credit: NEFSC Photo Archives. Click to enlarge

A midwater trawl is a set of gear that is used to catch fish that are between the sea surface and bottom, generally staying clear of the bottom. Occasionally, midwater trawls are configured with floats to perform catching in the shallow-surface layer.

Midwater and bottom trawls have many parts in common, if differing in dimensions and shapes due to their different fishing objects and hydrodynamic regimes of operation. Midwater trawls are designed to catch fish in the midwater column, hence must be capable of rapid maneuvering while maintaining an open net mouth. This is reflected in differences in the body of the net, rigging, and even trawl doors.

A particular midwater trawl is shown in Fig. 5. This is the High-Speed Midwater Rope Trawl (HSMRT). This custom-designed trawl is used by NEFSC to provide essential ground-truthing data on species and size composition during the hydroacoustic surveys of Atlantic herring (Fig. 6) [Operations, Pelagic Trawling, NEFSC Fisheries Acoustics Research]. A profile of the path of the HSMRT during a particular tow is shown in Fig. 7.

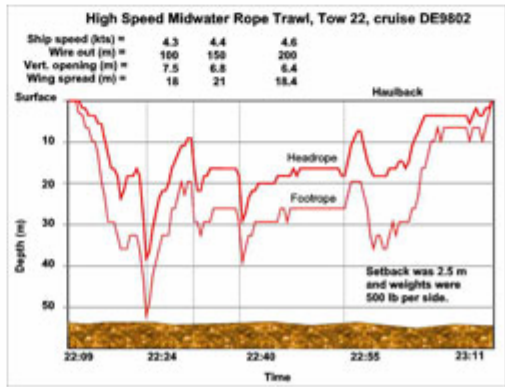


Figure 7. A profile of the path of the HSMRT

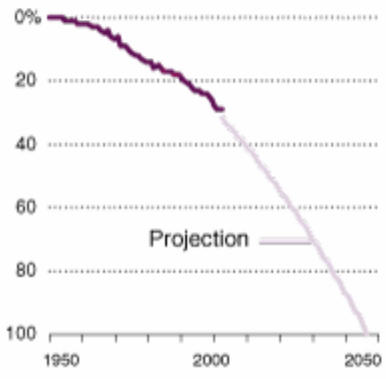
Study Sees 'Global Collapse' of Fish Species

By CORNELIA DEAN
Published: November 3, 2006

If fishing around the world continues at its present pace, more and more species will vanish, marine ecosystems will unravel and there will be "global collapse" of all species currently fished, possibly as soon as midcentury, fisheries experts and ecologists are predicting.

A Future Without Fish

A new study suggests that overfishing could lead to a catastrophic loss of marine species as soon as the middle of the century.



The scientists, who report their findings today in the journal Science, say it is not too late to turn the situation around. As long as marine ecosystems are still biologically diverse, they can recover quickly once overfishing and other threats are reduced, the researchers say.

But improvements must come quickly, said Boris Worm of Dalhousie University in Nova Scotia, who led the work. Otherwise, he said, "we are seeing the bottom of the barrel."

"When humans get into trouble they are quick to change their ways," he continued. "We still have rhinos and tigers and elephants because we saw a clear trend that was going down and we changed it. We have to do the same in the

Conclusion:

http://www.usm.maine.edu/gulfofmaine-census/

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