COMPARISONS AMONG UNIQUE CONTINENTAL SLOPE HABITATS OFF OF NORTH CAROLINA

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In cooperation with

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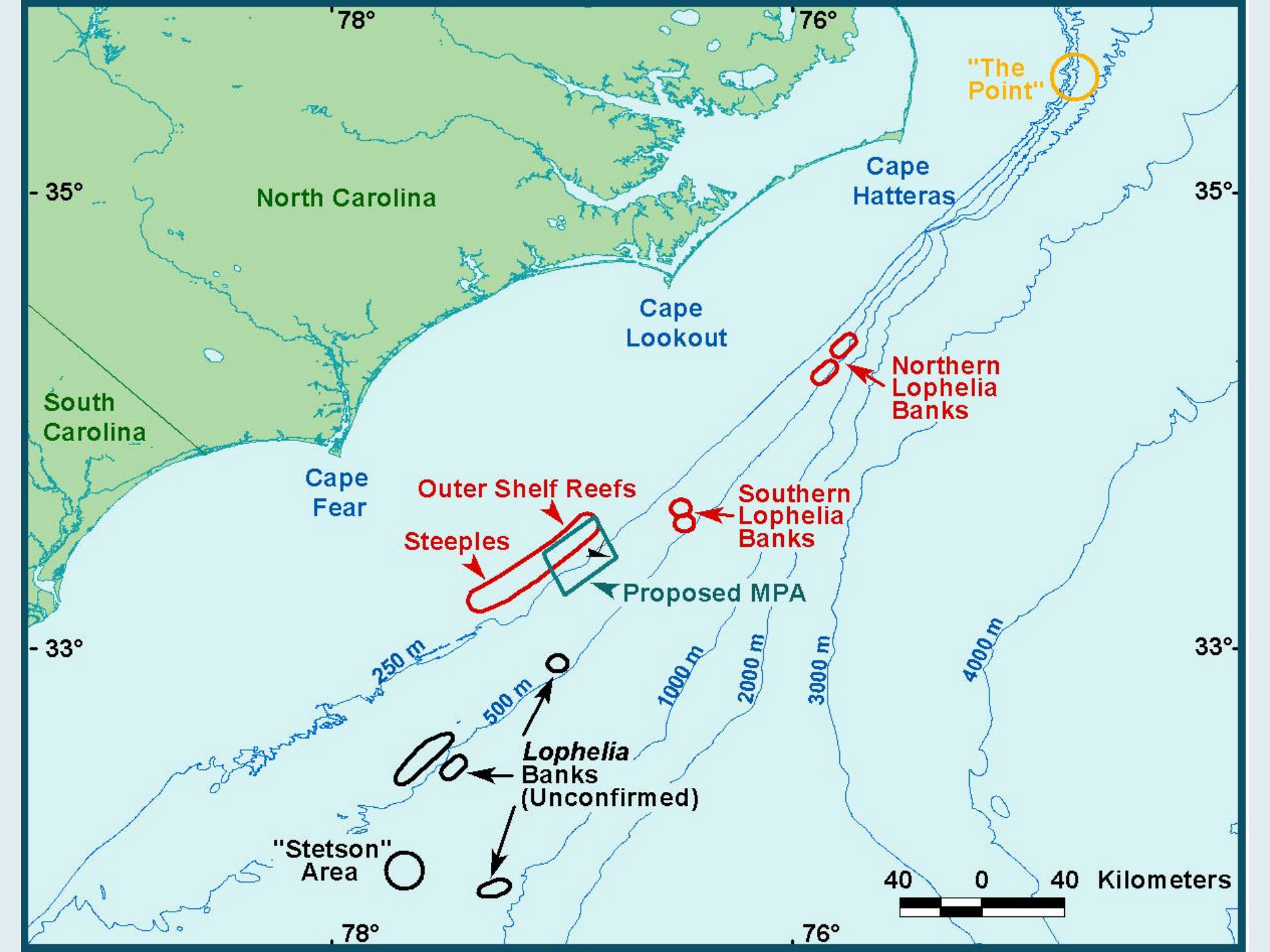
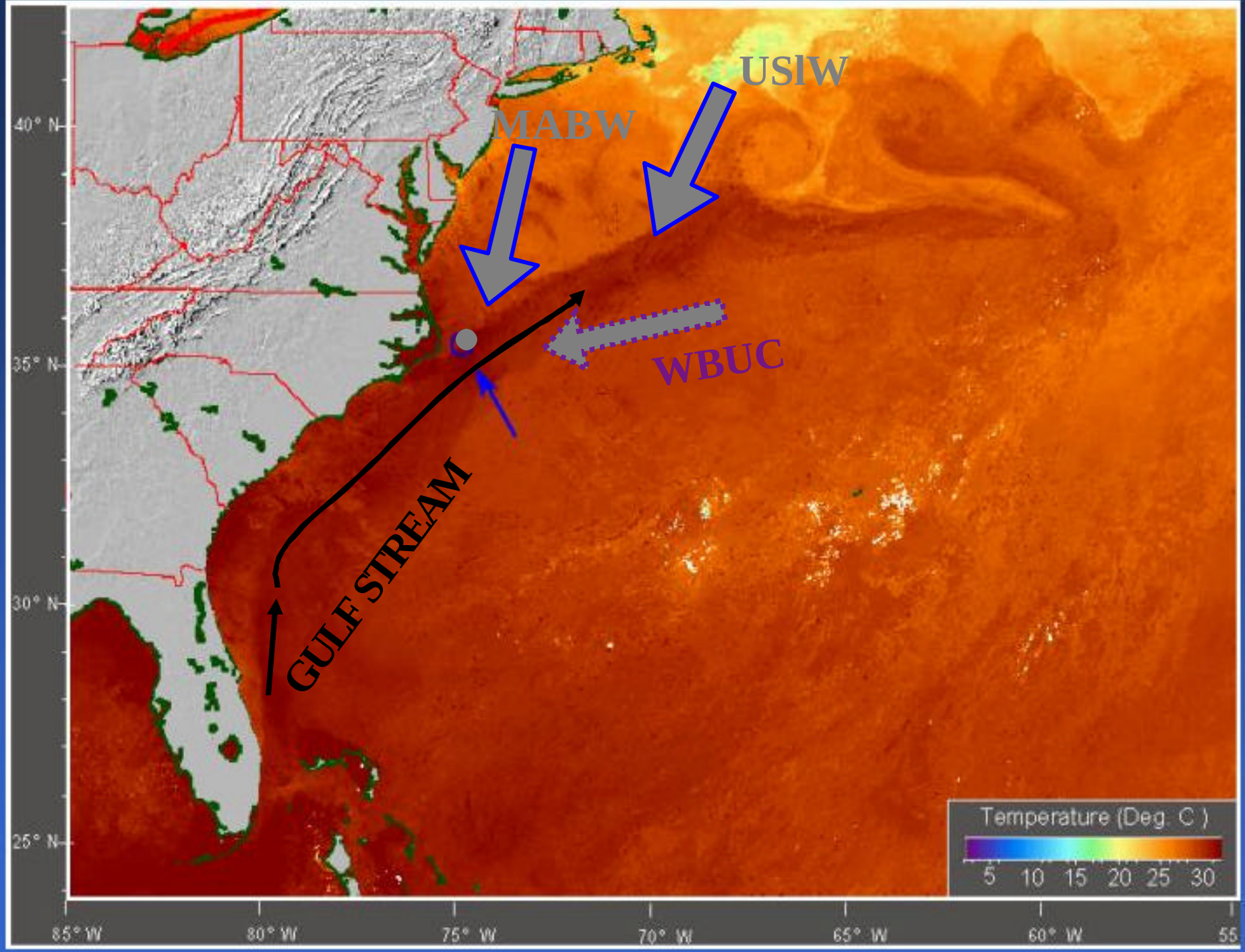
US Geological Service

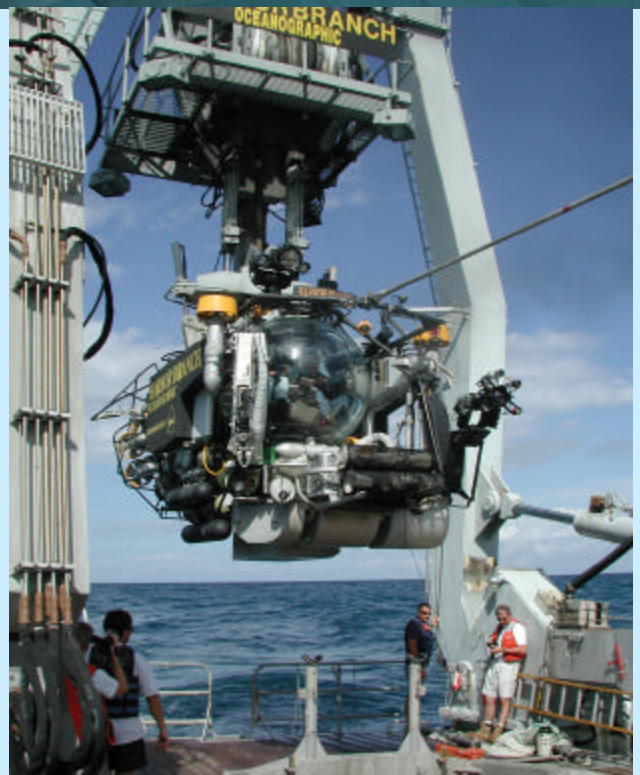
Project Support from: NURC (UNC-W), NC State Legislature, NC Coastal Reserve, USGS, NOAA OE, NC State Museum

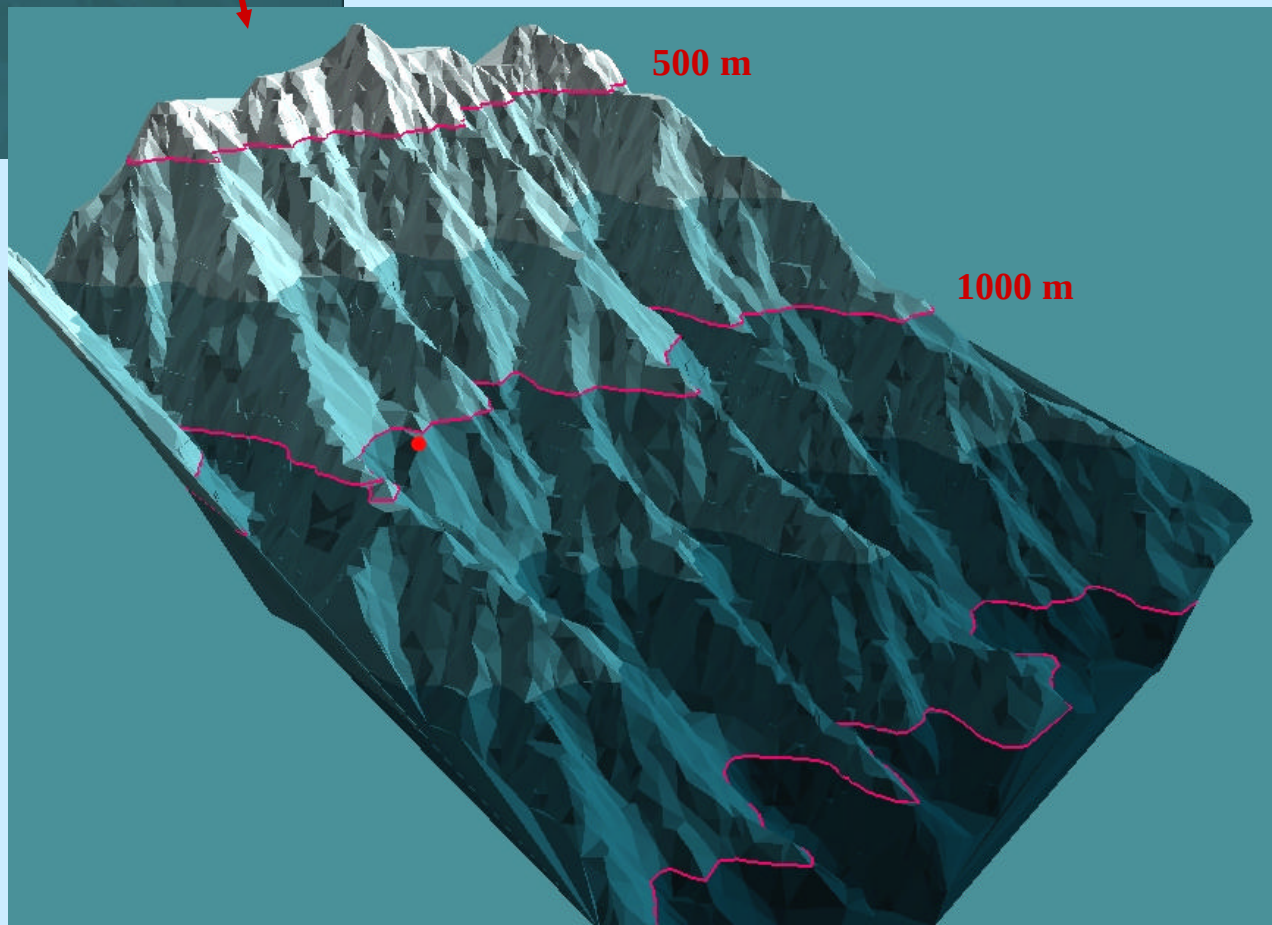

78°
76°
"The Point"
35°
North Carolina
Cape Hatteras
Cape Lookout
Northern Lophelia Banks
South Carolina
Cape Fear
Outer Shelf Reefs
Steeples
Southern Lophelia Banks
Proposed MPA
33°
250 m
500 m
1000 m
2000 m
3000 m
4000 m
Lophelia Banks (Unconfirmed)
"Stetson" Area
40 0 40 Kilometers


USlW
MABW
WBUC
GULF STREAM
Temperature (Deg. C)
5 10 15 20 25 30
40° N
35° N
30° N
25° N
85° W
80° W
75° W
70° W
65° W
60° W
55

CAPE
HATTERAS

Detailed bathymetry (SeaBeam survey) of “The Point” area.





The Point - A Review

- Physically unique area
  - Very rugged bottom, diverse currents, high turbidity
- High benthic productivity, high carbon deposition
- High surface usage by wide variety of migratory animals (birds, mammals, turtles)
- Very productive pelagic fishery (upper water column)
- Area of interest for hydrocarbon exploration

➢ Anomalous benthic fish community

Cory shearwater

Pilot whales

We observed 14 bird spp. during our cruises of the 49 spp. known from the area.

Seabirds are common here year round, and some migrate large distances to use this area.

There are conservation concerns for 17 spp. using “The Point”.

Marine mammals use “The Point” area for various activities: some pass through while others concentrate there to feed.

During our recent cruises we observed 6 of the 22 spp. known from the area.

Benthic Fish Community at The Point

- Large numbers of few species
- Smaller mean sizes of individuals in most species compared to other areas
- Sedentary benthic species dominant, benthopelagic species lacking or rare
- Expected species lacking (synaphobranchid eels, sharks, +)
- “Unusual” concentrations of mesopelagics near/on the bottom

➢ We hypothesized that habitat limitations explain these observations, explicitly hypoxia (supported by Moser, Ross, Sulak 1996. MEPS)

(see Sulak and Ross 1996. J. Fish. Biol.)

CURRENT PROJECT OBJECTIVES

- Primary - Characterize feeding patterns & trophic structure of dominant nekton from birds to benthos (3000 ft).

(H: Mesopelagic fauna is a conduit between surface & benthic communities.)

- Secondary - Describe basic biology, habitat associations, community structure, relative abundance.

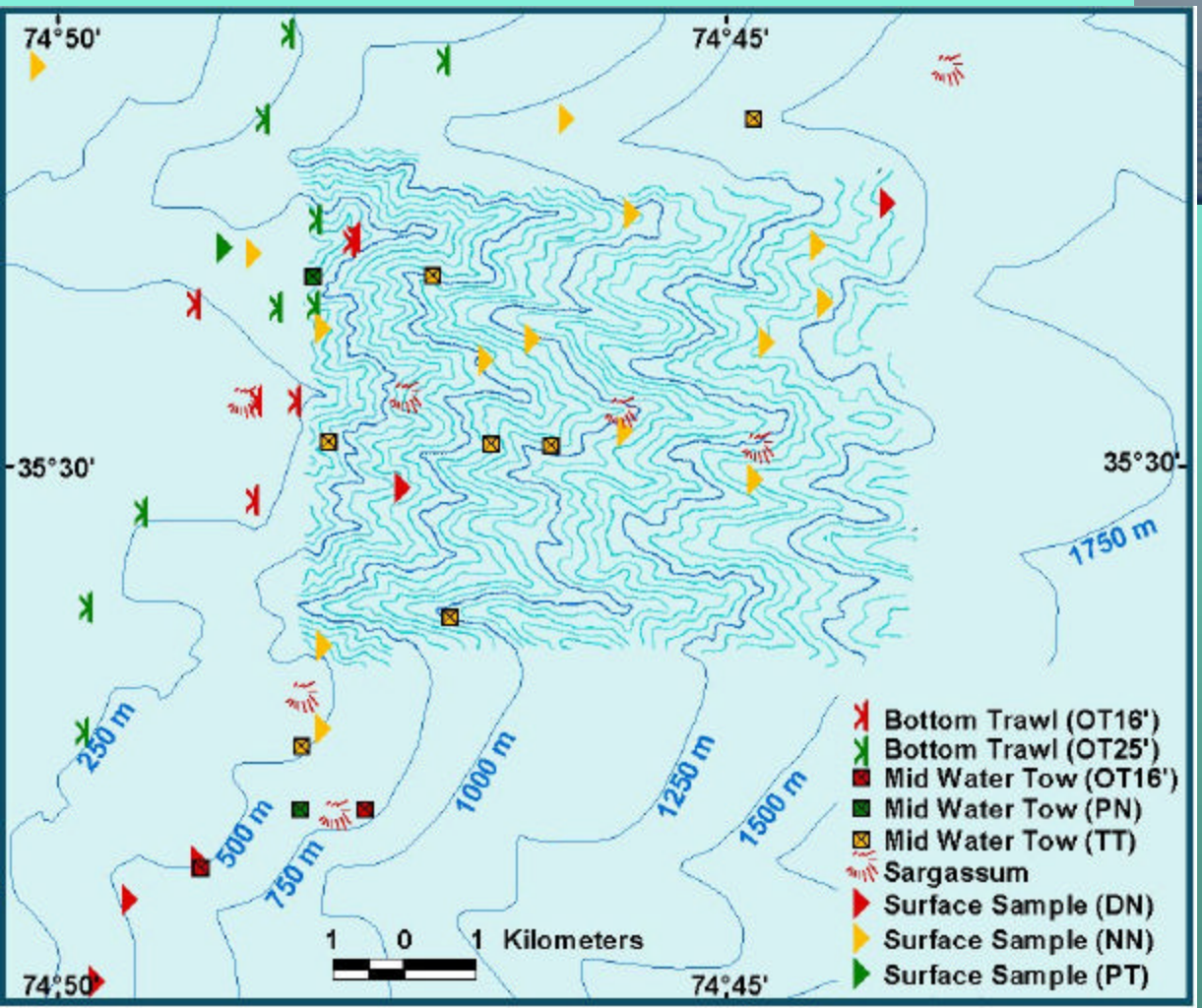
Target Habitats/Communities

- Air/water interface (bird community)
- Surface (top 5 m)

  Sargassum, open water
- Pelagic (upper water column - upper 50 m)
- Mesopelagic (migrating community of fishes, shrimps, squids)
- Benthic & near benthic (300-900 m, mud canyon habitat)

- Over 240 total fish taxa collected in the area (1999 - 2001)

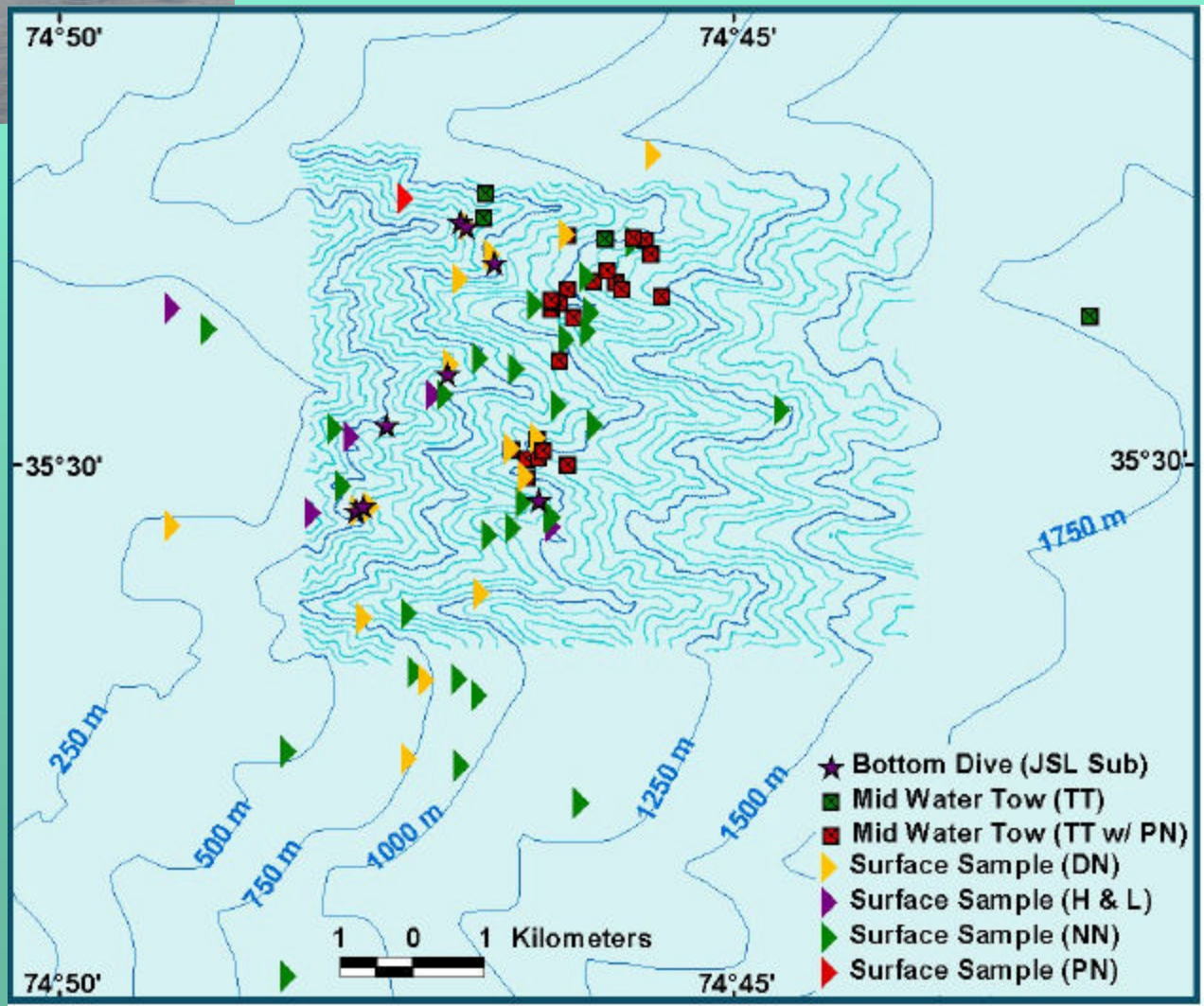
1999 station map - 57 stations, 1-8 Aug



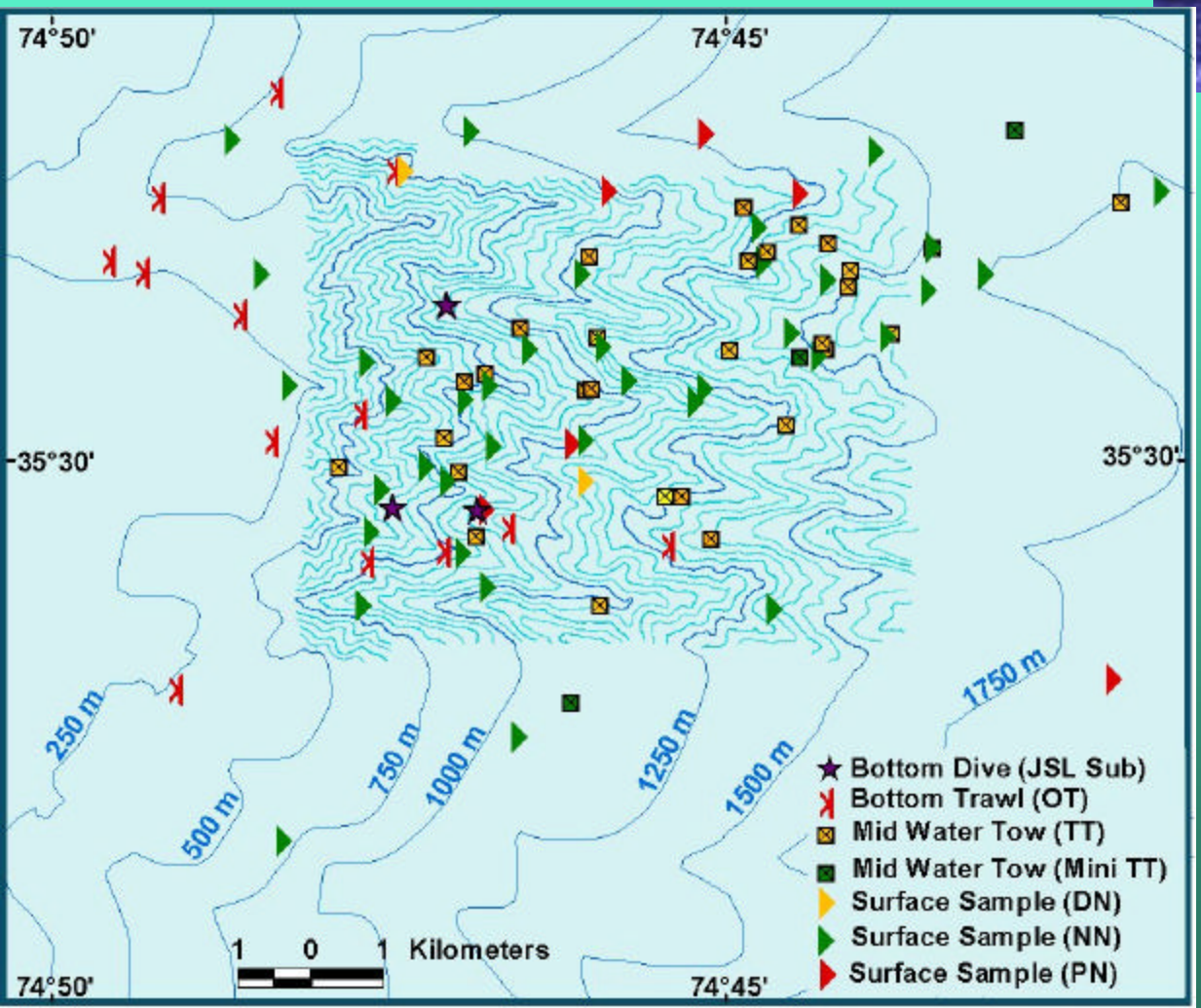
Cruise focus: Surface, Bottom upper slope, Mesopelagic

2000 station map - 82 stations, 20-29 Jul

Cruise focus:
Bottom mid-slope (submersible),
Mesopelagic,
Surface

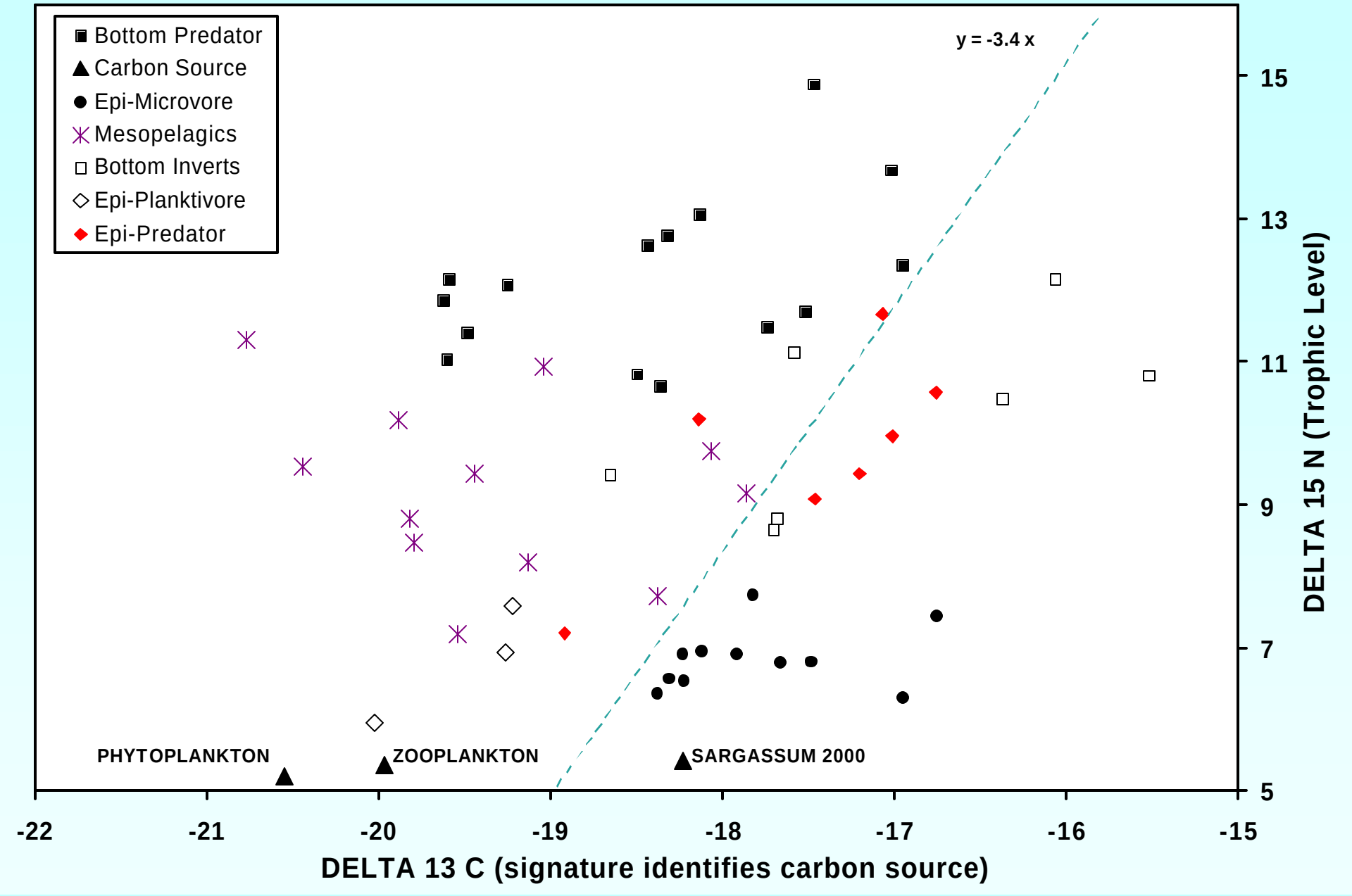


2001 station map – 110 stations, 22-30 Aug & 18-26 Sep

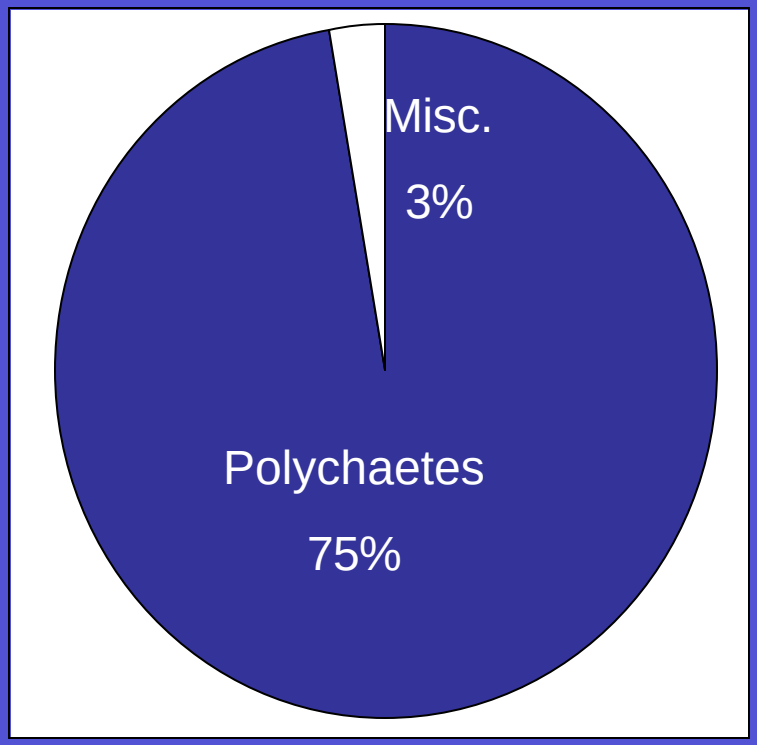


SUMMARY:

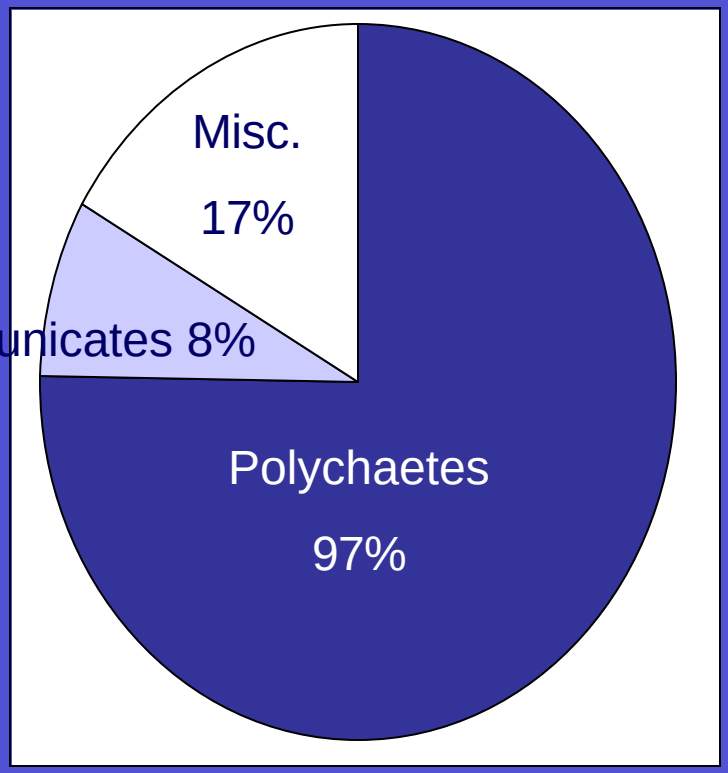
4 CRUISES > 249 STATIONS

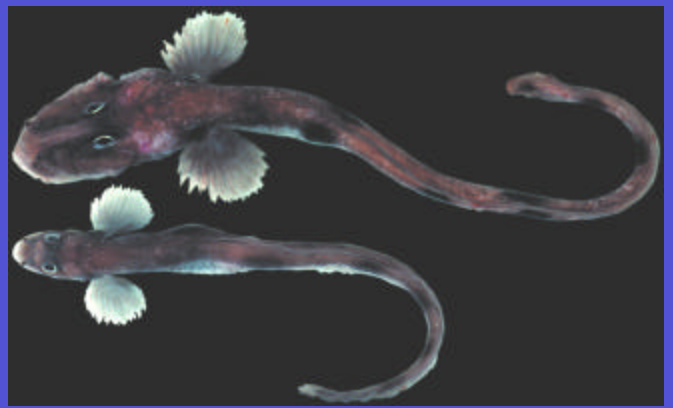

Bottom Predator
Carbon Source
Epi-Microvore
Mesopelagics
Bottom Inverts
Epi-Planktivore
Epi-Predator
y = -3.4 x
PHYTOPLANKTON
ZOOPLANKTON
SARGASSUM 2000
15
13
11
9
7
5
-22
-21
-20
-19
-18
-17
-16
-15
DELTA 15 N (Trophic Level)
DELTA 13 C (signature identifies carbon source)

Glyptocephalus cynoglossus

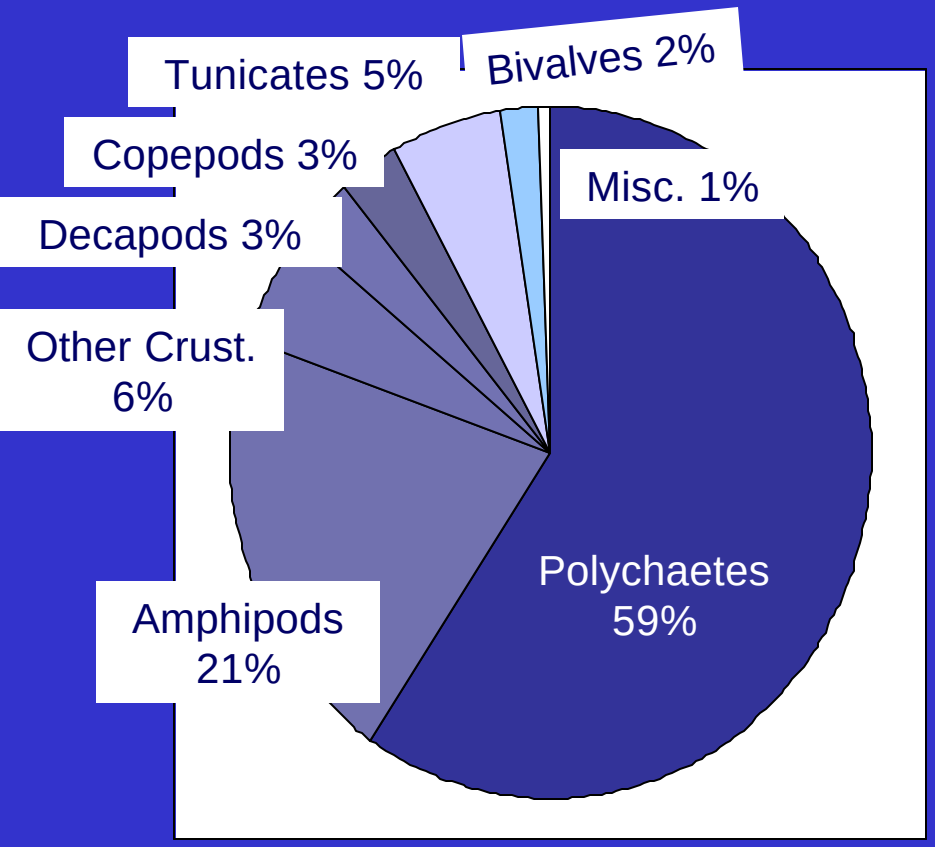


Lycenchelys verrillii

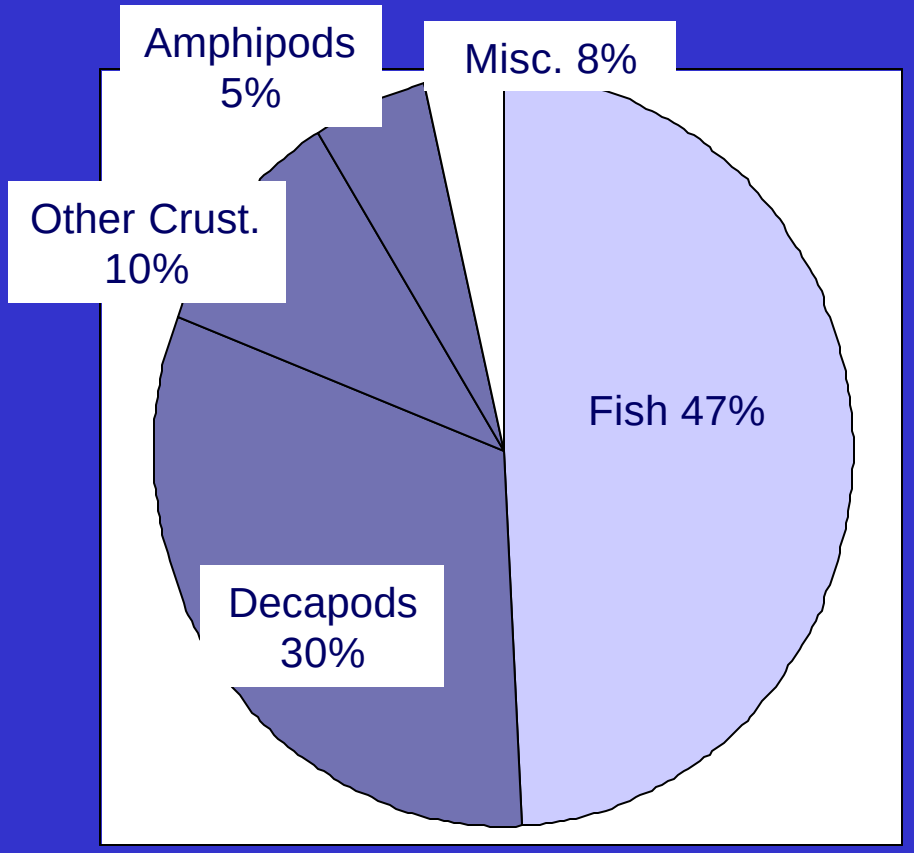


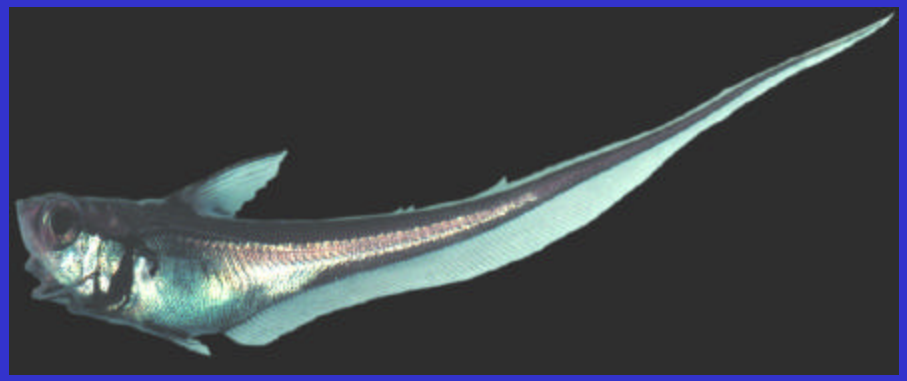


Nezumia bairdii



Urophycis regia

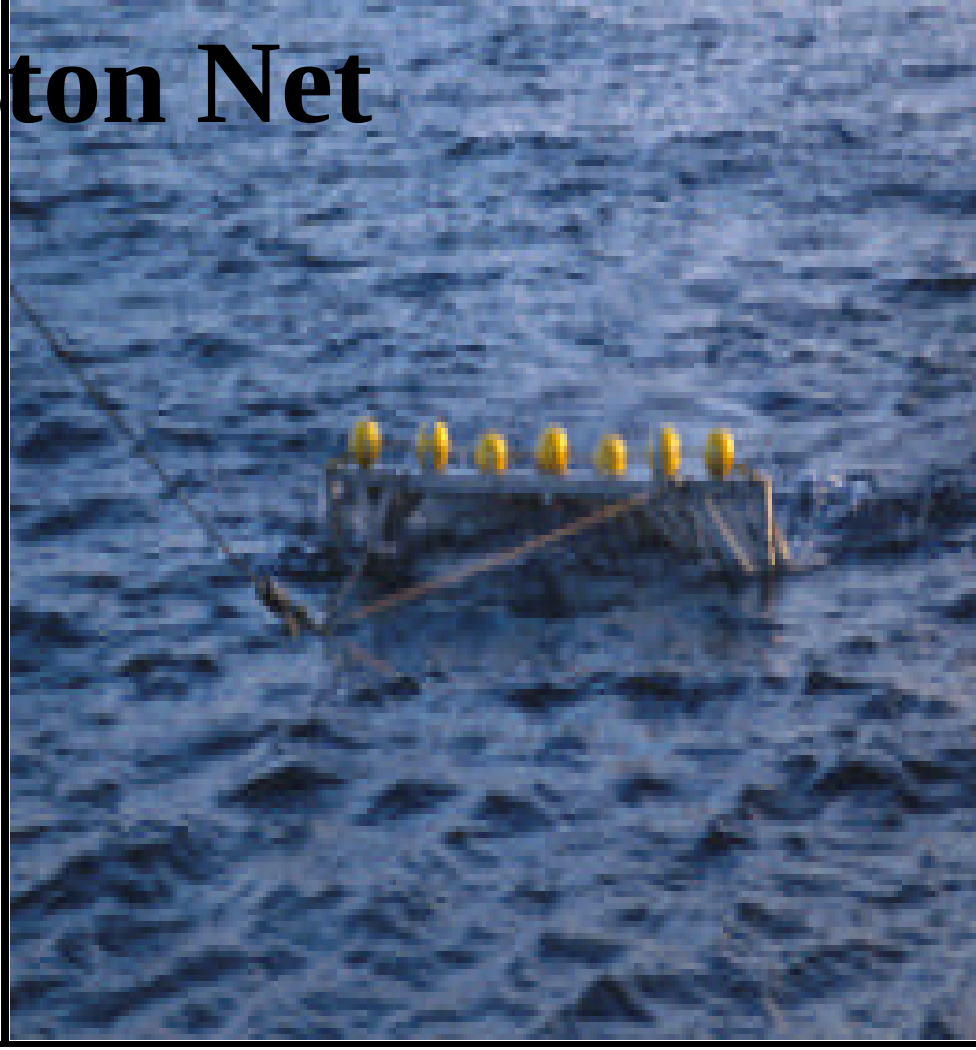




Conclusions

- High % of full guts = High abundance benthic food items
- High diversity of benthic food items
- Feeding differences among dominant fish species
  - more mobile fish have more diverse diets than sedentary fish
  - sedentary fish consumed primarily polychaetes but the species of polychaetes differed between fish species

1 x 3.2m Neuston Net

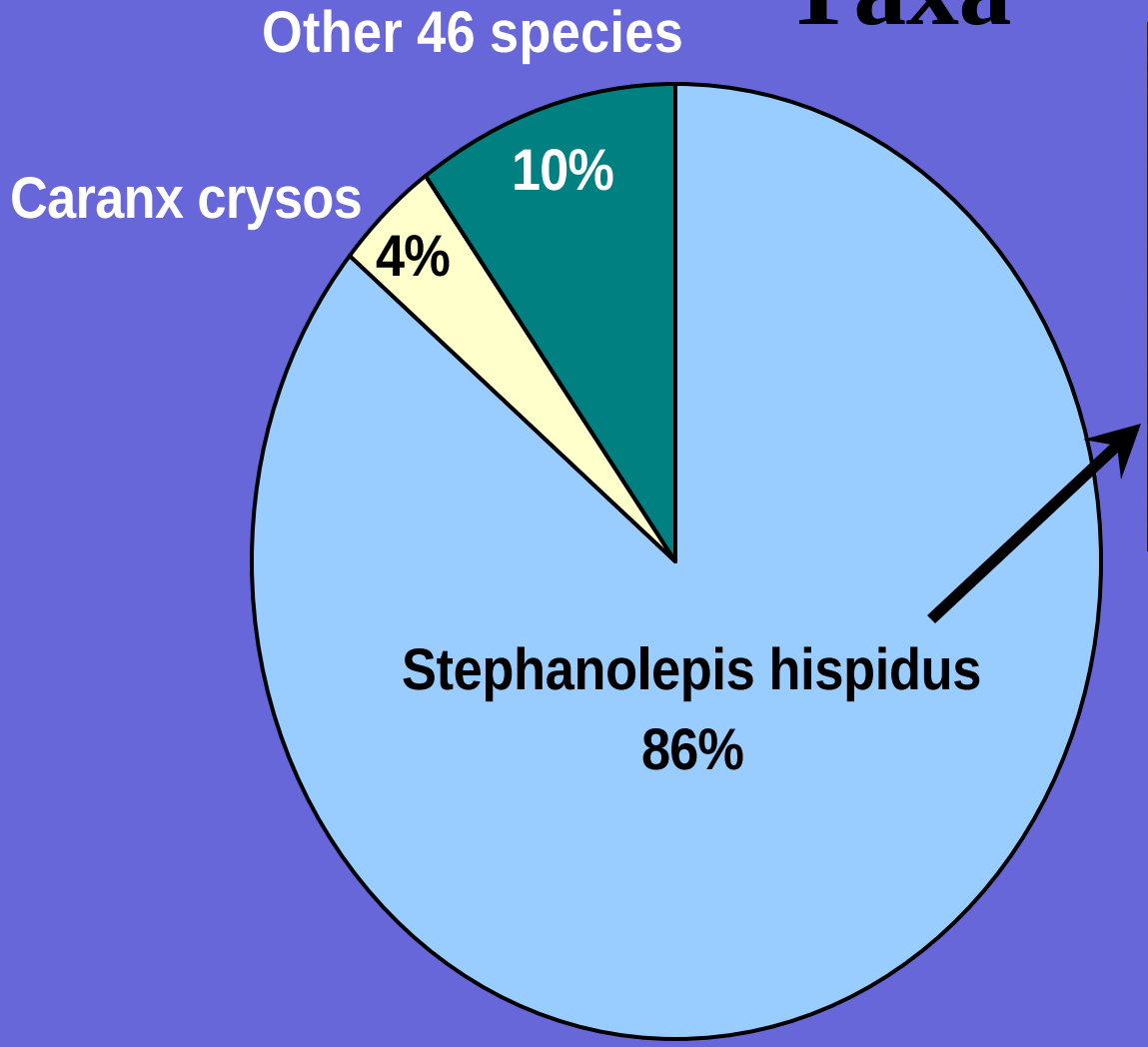


24-hour operations, 15-30 min tows, Catch sorted/preserved

≥ 1 kg *Sargassum* in catch = "*Sargassum* station"

<u>Supplemental Data</u>: dipnet stations, underwater video stations

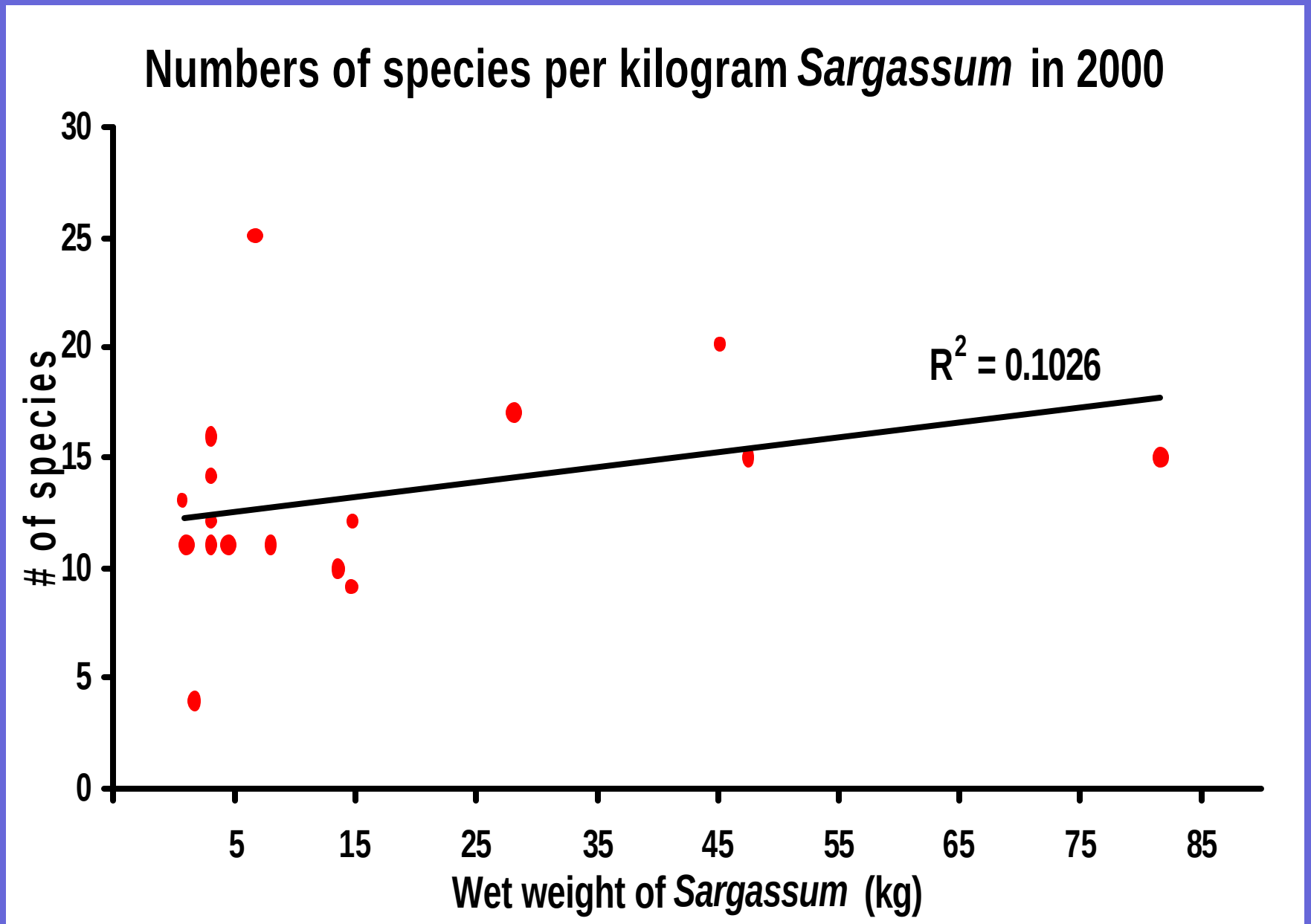
2000 *Sargassum* Dominant Taxa

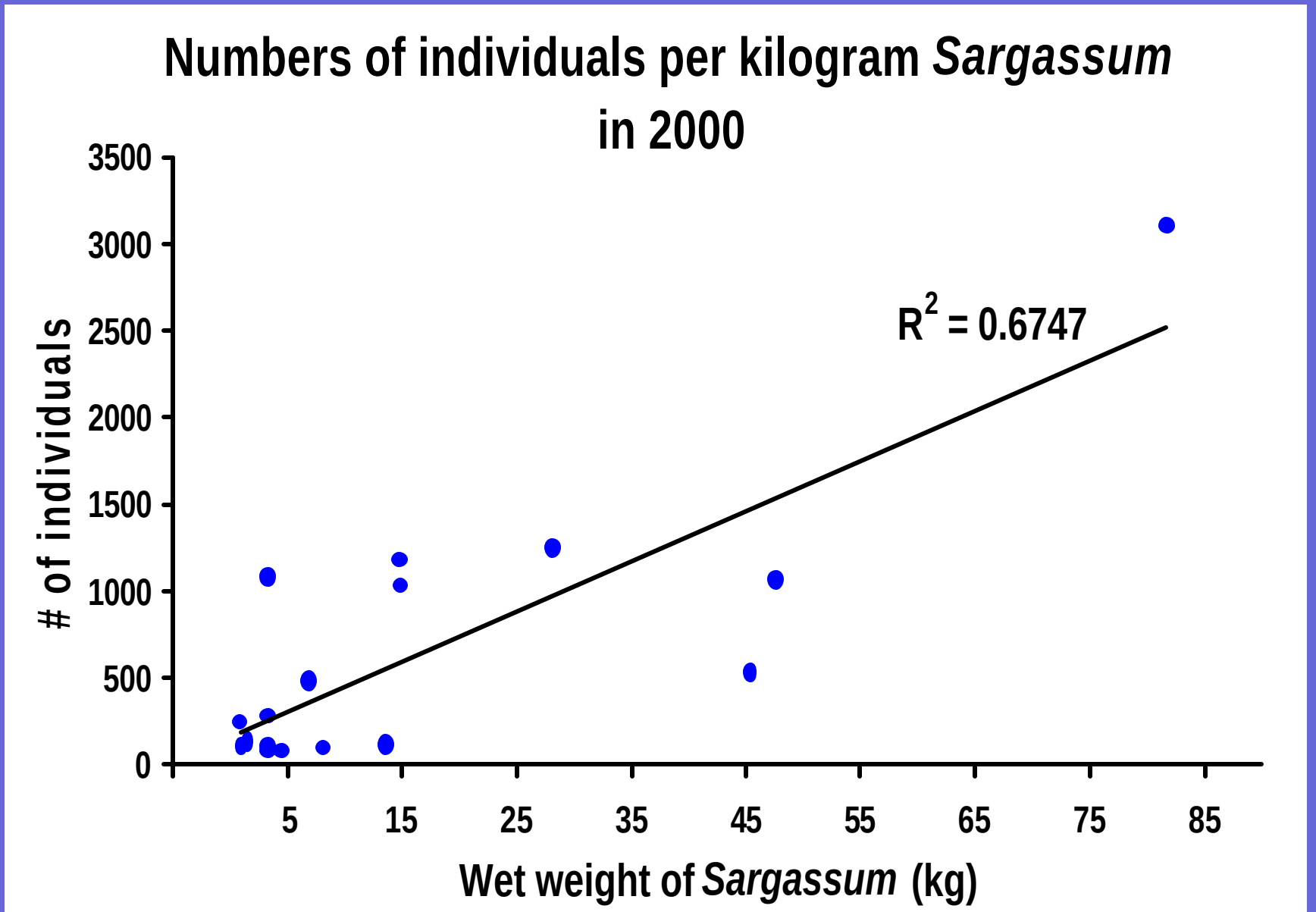


Dominant Families

Monacanthidae

Carangidae


Numbers of species per kilogram Sargassum in 2000
30
25
20
15
10
5
0
# of species
R2 = 0.1026
5
15
25
35
45
55
65
75
85
Wet weight of Sargassum (kg)


Numbers of individuals per kilogram Sargassum in 2000
# of individuals
3500
3000
2500
2000
1500
1000
500
0
R^2 = 0.6747
5
15
25
35
45
55
65
75
85
Wet weight of Sargassum (kg)

Sargassum Habitat

- Concentrates juvenile fishes
- Primary nursery area and major feeding habitat
- Dominant economically important species were dolphin, amberjacks and tuna
- Tropical to sub-tropical fishes are dominant
- Community structure highly variable
  - with patch size
  - with sea conditions
  - between years

Underwater video showed layering structure similar to observations made by Moser et al. (1998)

North Carolina *Sargassum* Fishes (juveniles)

No. species	Dooley (1978)	Moser et al. (1998)	Ross et al. (unpubl.)
74 (27 families)	28	27	62

Deep Coral (Lophelia/Dendrophyllia) Reconnaissance

Proceedings of the First International Symposium on Deep-Sea Corals

July 30 – August 3 2000

2nd International Symposium on Deep Sea Corals

First Circular

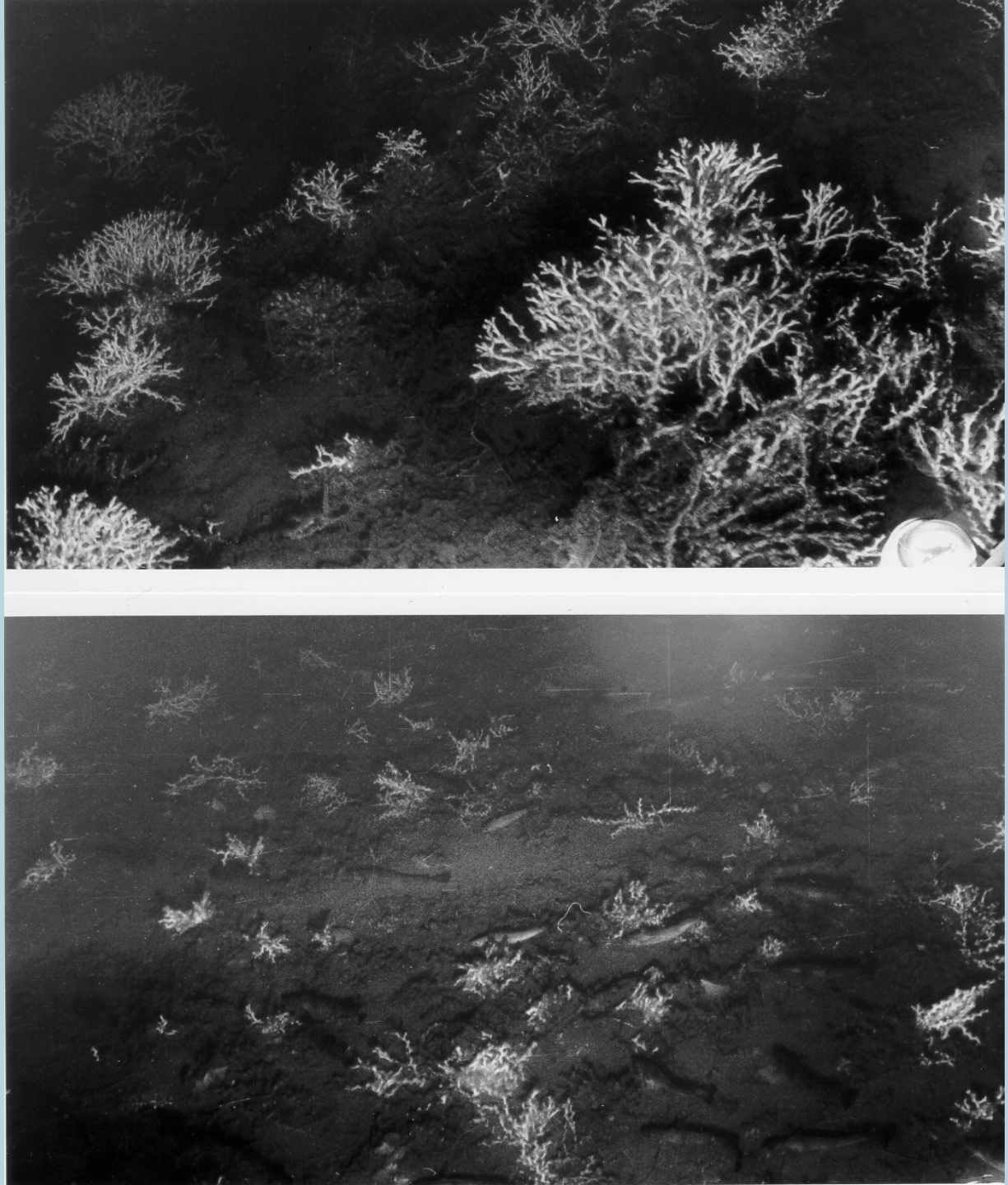
September 9 – 12, 2003
Erlangen, Germany

Organising Institutions

Institute of Paleontology,
University of Erlangen-Nuremberg
Germany

SAMS

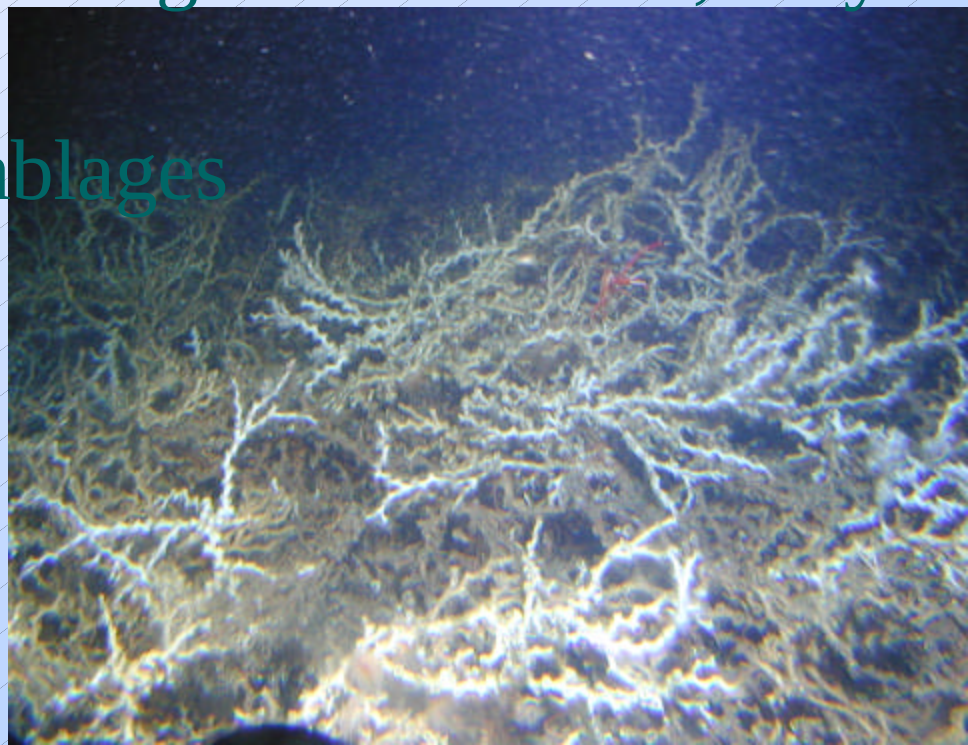
Scottish Association for Marine Science
Dunstaffnage Marine Laboratory, Oban
United Kingdom

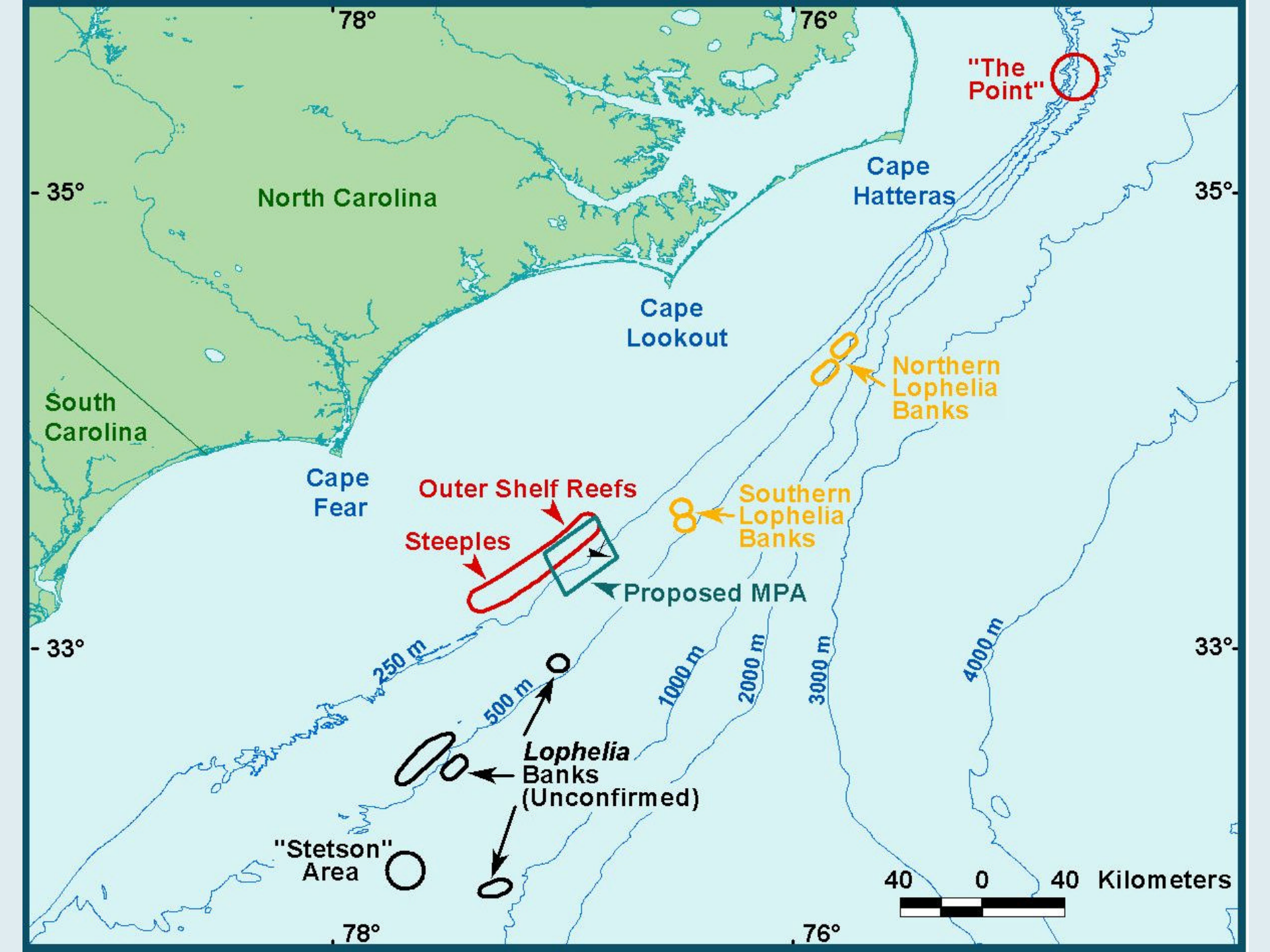


R/V Eastward
drop camera
station 4937,
June 1966
off Cape Lookout
- 475 m

Lophelia pertusa banks

- Wide distribution in deep and/or cold waters of the Atlantic Basin – W. Atl. distributions poorly known
- “Reef” building but no symbiotic algae
- Very slow growing but age data are lacking
- Form banks capped with living & dead corals, very fragile structure
- Dense invertebrate assemblages in the corals
- Fish communities poorly described

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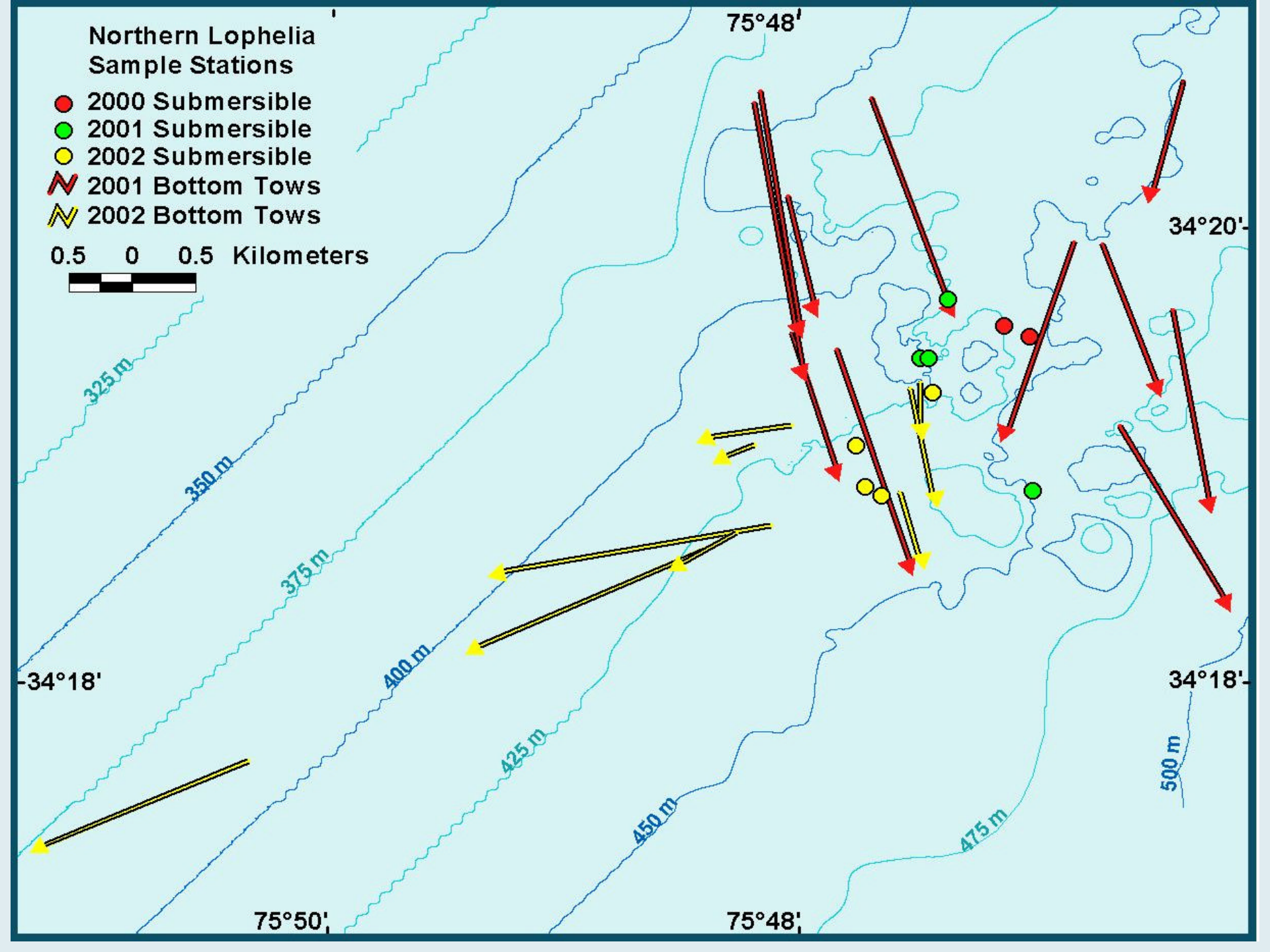
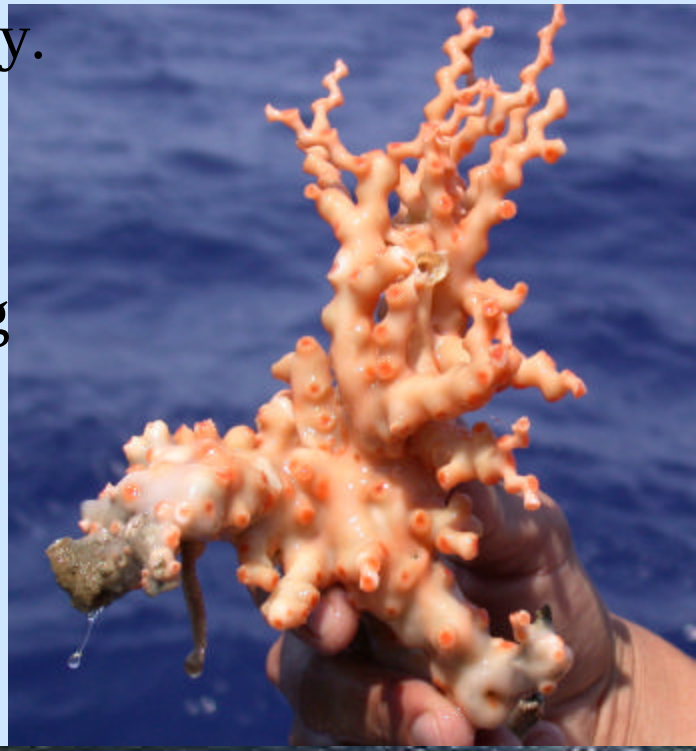
Proposed MPA
33°
250 m
500 m
1000 m
2000 m
3000 m
4000 m
Lophelia Banks (Unconfirmed)
"Stetson" Area
40 0 40 Kilometers

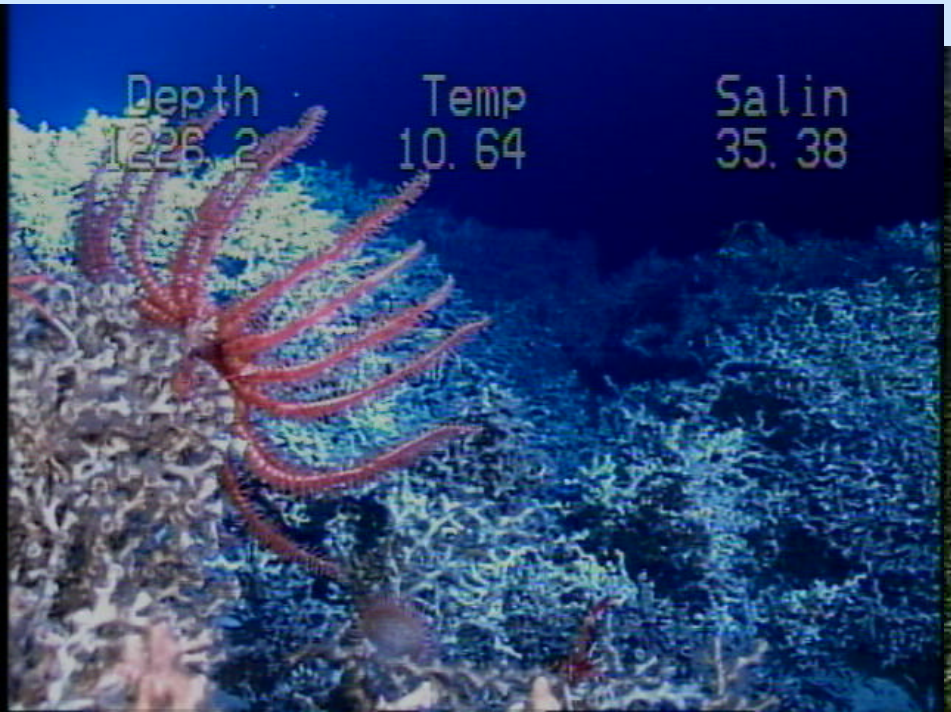
PROJECT OBJECTIVES

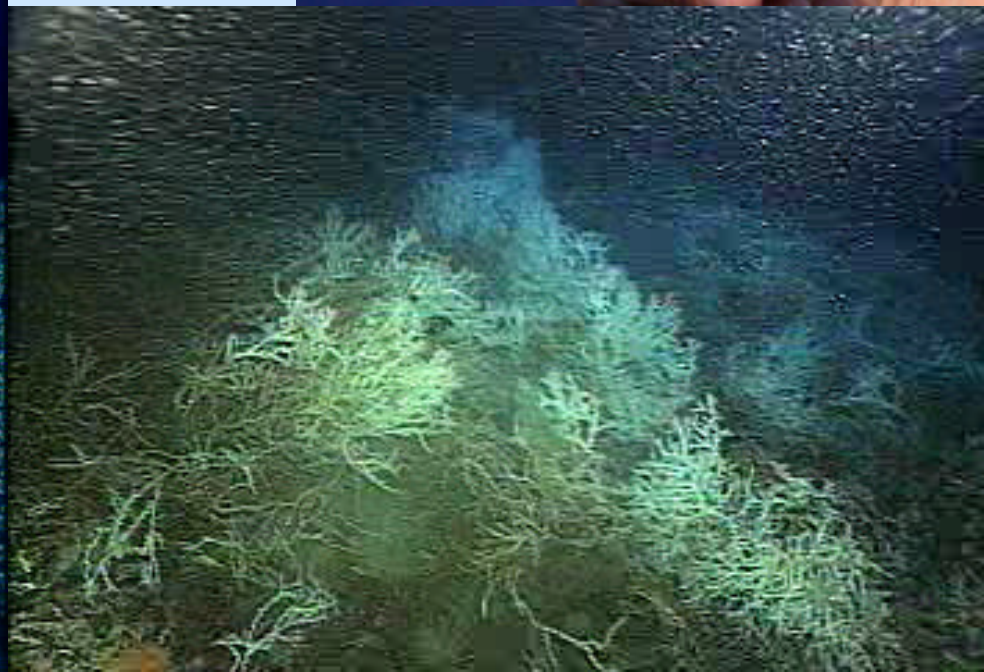
- Characterize coral bank fish communities (basic biology, habitat associations, relative abundance, community structure)
- Discover, characterize & map coral banks
- Trophodynamics of coral bank fishes
- Aging of corals
- Classify habitat affinity for deep coral fishes
- Describe coral bank invertebrate communities
- Continue full water column sampling approach (mesopelagics, Sargassum, open water)


Northern Lophelia
Sample Stations
2000 Submersible
2001 Submersible
2002 Submersible
2001 Bottom Tows
2002 Bottom Tows
0.5 0 0.5 Kilometers
75°48'
34°20'
34°18'
34°18'
75°50'
75°48'
325 m
350 m
375 m
400 m
425 m
450 m
475 m
500 m

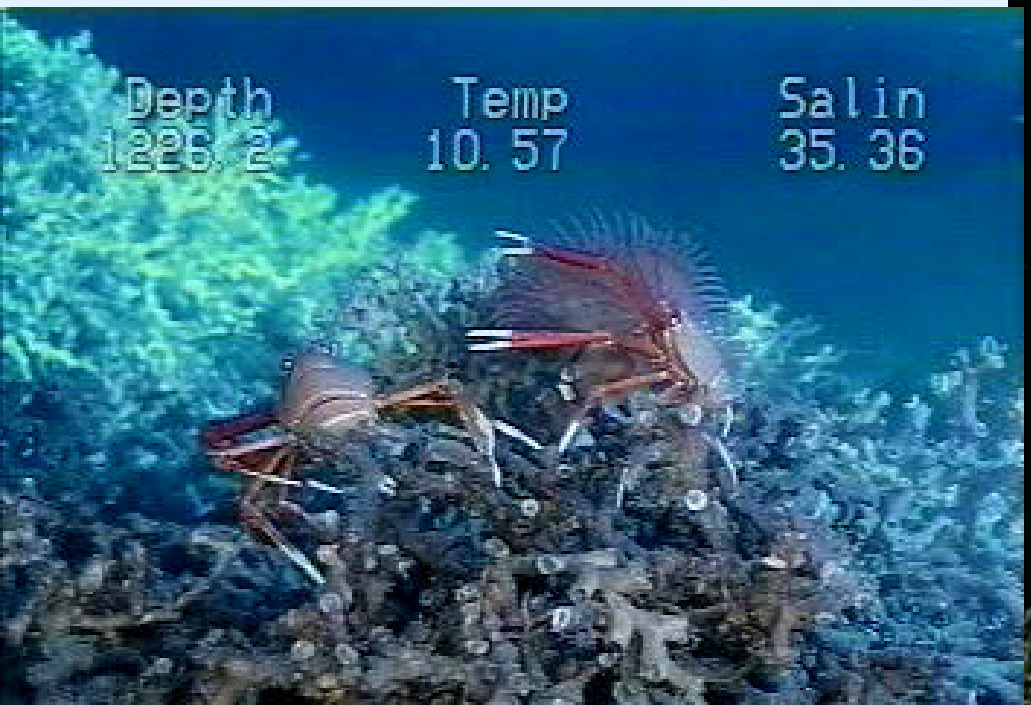
- Banks vary in size, profiles, and coral density.
- Most of the living corals and most of the invertebrates occur along the tops of the ridges, the sides and surrounding areas being covered in coral rubble.
- Coral banks tend to accelerate currents, facilitating invertebrate feeding.







- Invertebrate community quite diverse.
- Galatheid crabs seem to be dominant macro invertebrate
- Coral matrix filled with brittle stars + other spp.
- Sessile invertbrates use corals as substrate.



- Fish fauna well developed but seems less species rich than invertebrates.
- Several fish spp. thought to be rare seem to be coral associates. Many spp. new to area.
- Exploitable fishes use the habitat.

Idiastion kyphos

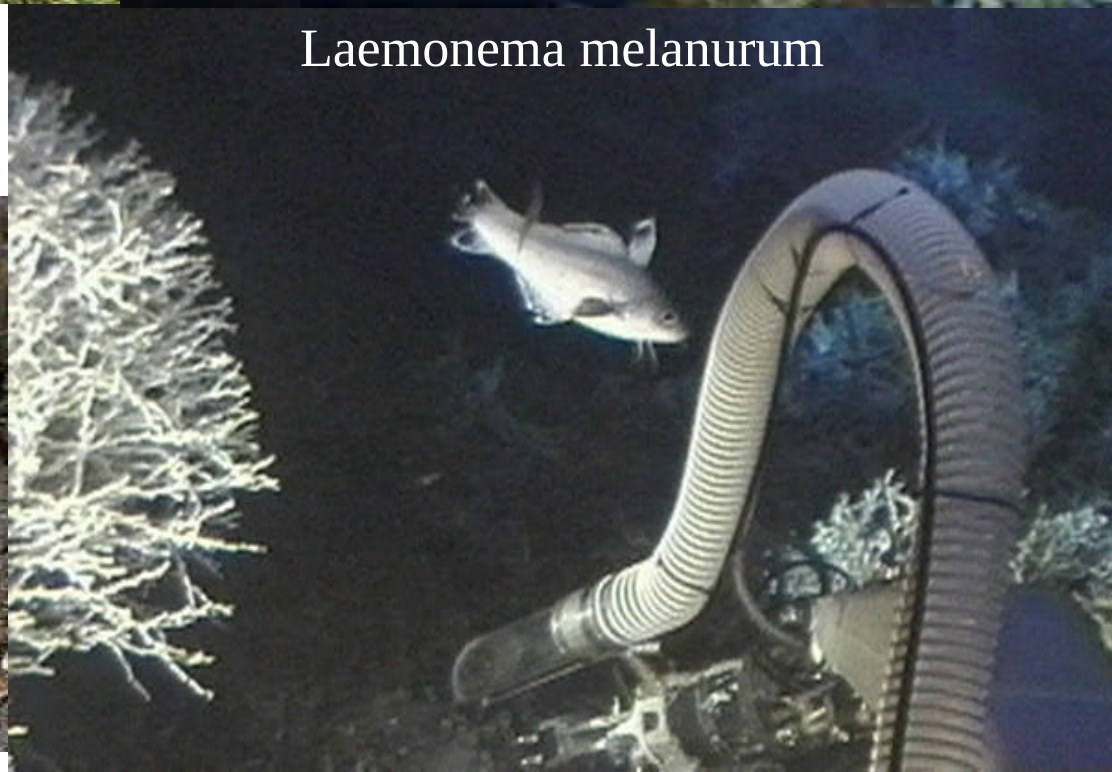
Polyprion americanus

Physiculus karrerae

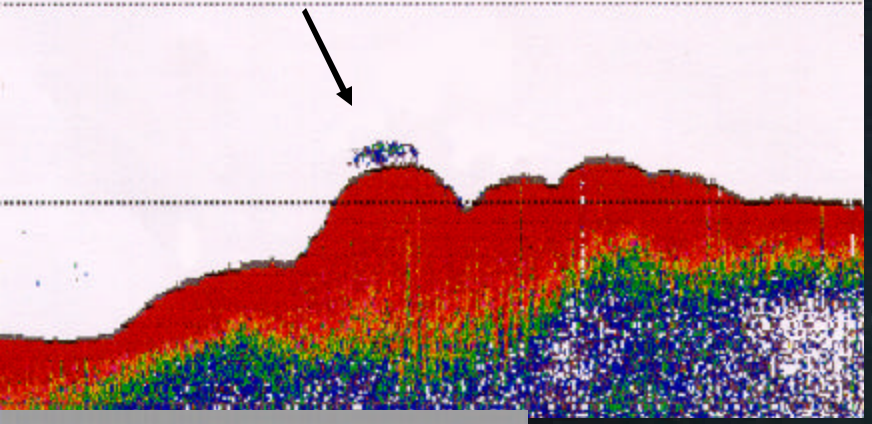
Beryx splendens

Laemonema melanurum

Lophiodes monodi



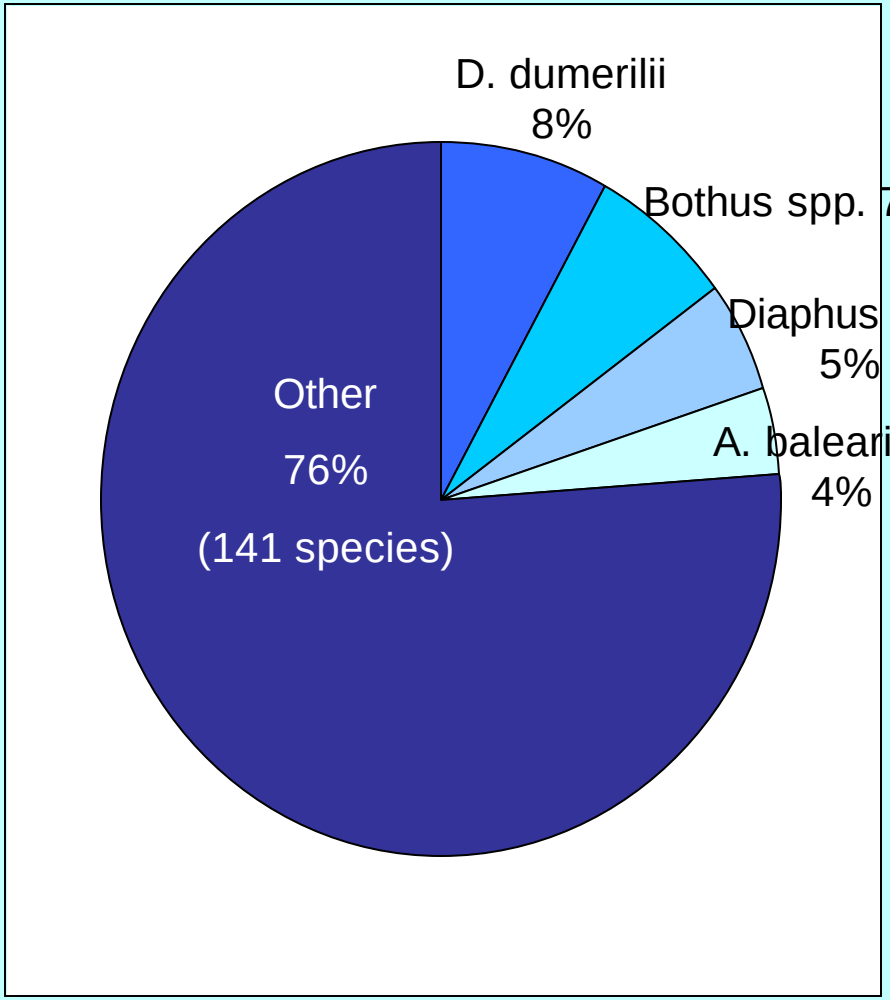
Mostly composed of *Diaphus dumerilii* and *Polyipnus asteroides*



Benthosema glaciale

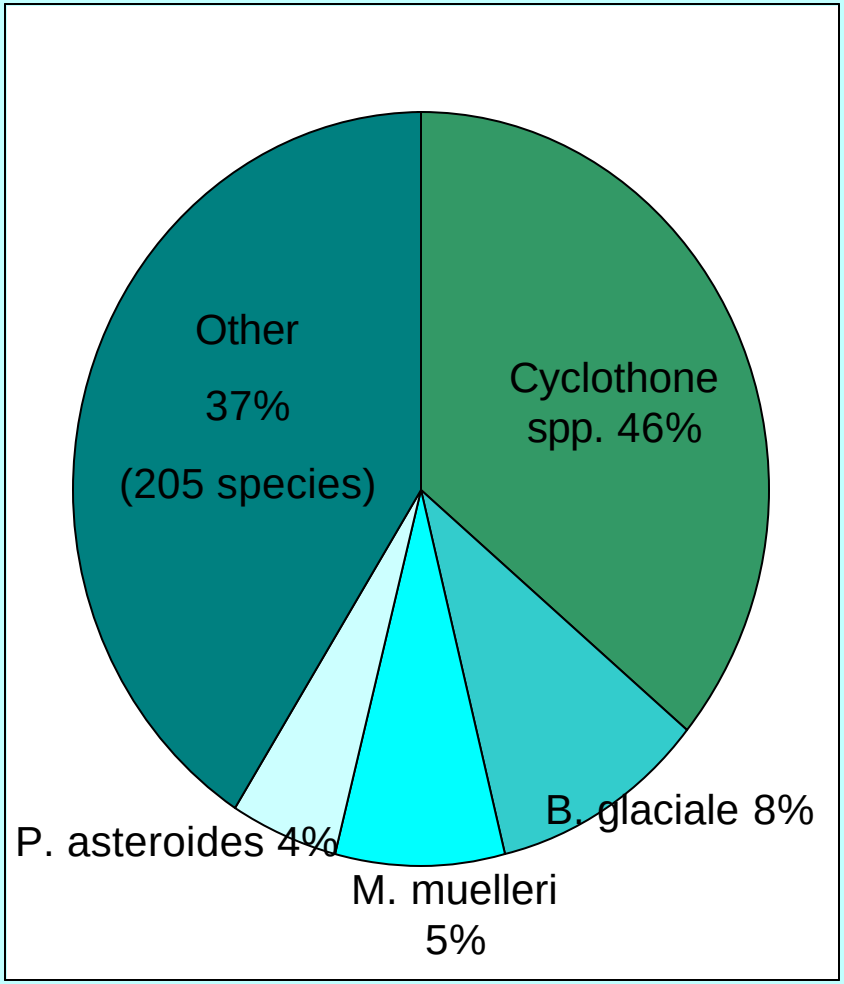
***Diaphus dumerilii* and *Polyipnus asteroides* at base of coral mound-417 m**

Midwater Species Composition



Lophelia

150 total species

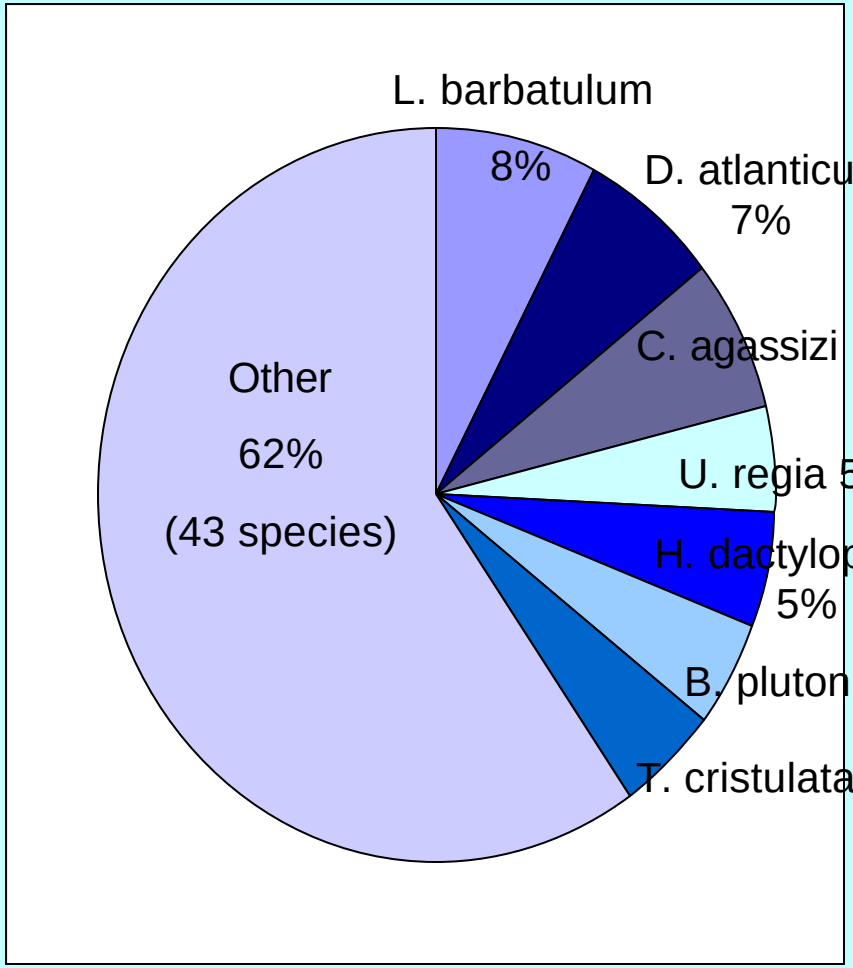


Point

214 total species

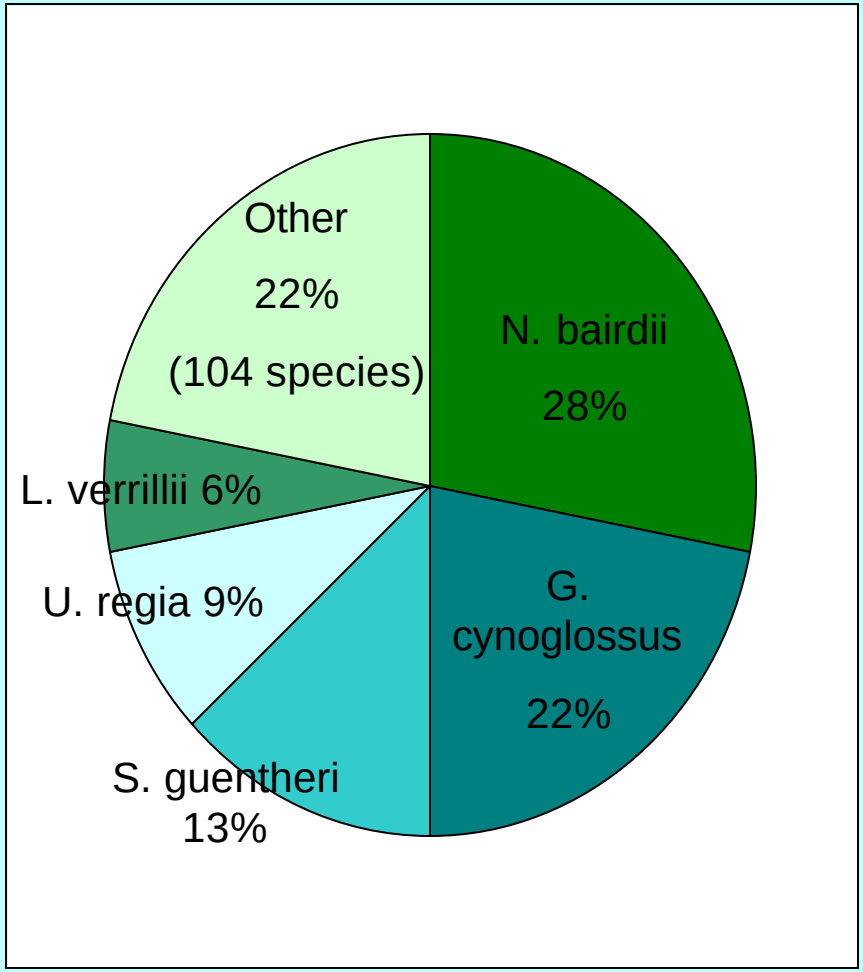
Bottom Species Composition

(incomplete)



Lophelia

50 total species



Point

109 total species

SUMMARY

- Added considerably to what we know about slope fish and invertebrate species structure, behaviors, distributions, habitat associations
- Better understanding of coral bank habitat
- Documentation of energy flow through parts of these systems
- Much of our data will quickly go into management initiatives