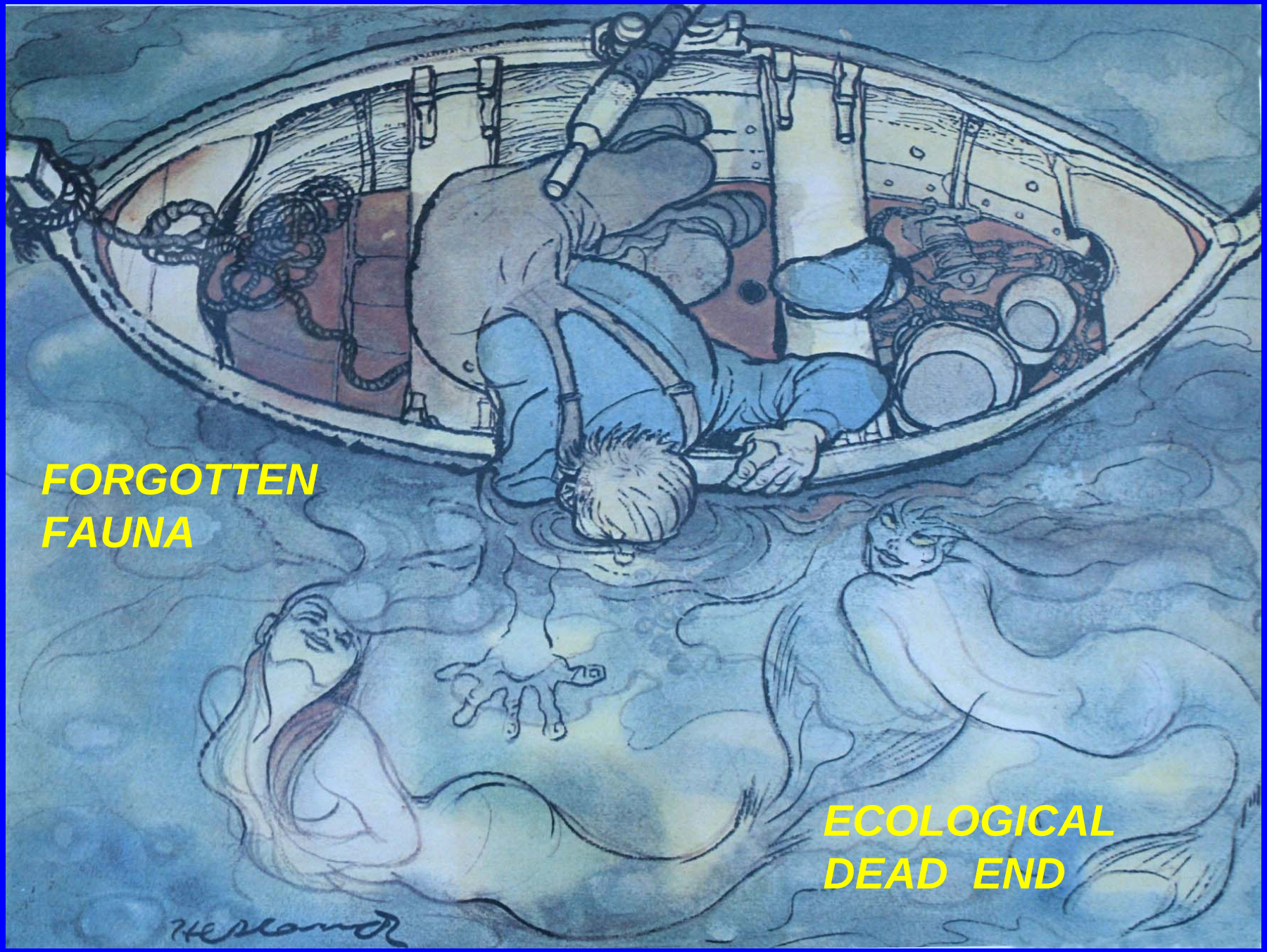
FORGOTTEN
FAUNA
ECOLOGICAL
DEAD END

PREDATORY HABITS OF THE PHYSONECT SIPHONOPHORE

NANOMIA CARA

NATIONAL SCIENCE FOUNDATION (Biological Oceanography)

HARBOR BRANCH OCEANOGRAPHIC INSTITUTION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NURP, OE)

SLOAN FOUNDATION (MarEco)

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Per Flood, Bathypelagia A/S, Bergen, Norway

Gaby Gorsky, Station Zoologique, Villefranche-sur-mer, France

Chuck Jacoby, University of Florida, Gainesville, Florida USA

Francesc Pagès, Institut de Ciències del Mar, Barcelona, Spain

Franz Uiblein, University of Salzberg, Salzberg, Austria

Why study Nanomia cara ???

- *Persistent and often abundant in boreal coastal waters of North America*
- *Nuisance species, i.e., clogs nets of commercial fisheries, Gulf of Maine*

Is this physonect siphonophore an important predator?

PERSISTENT MASS OCCURRENCE OF GELATINOUS ZOOPLANKTON

HYPOTHESES

COMPETITION FOR FOOD (Greve & Parsons 1977)

PREDATION ON FISH EGGS AND LARVAE (Purcell 1997)

CLIMATE CHANGES (Brodeur et al. 1999)

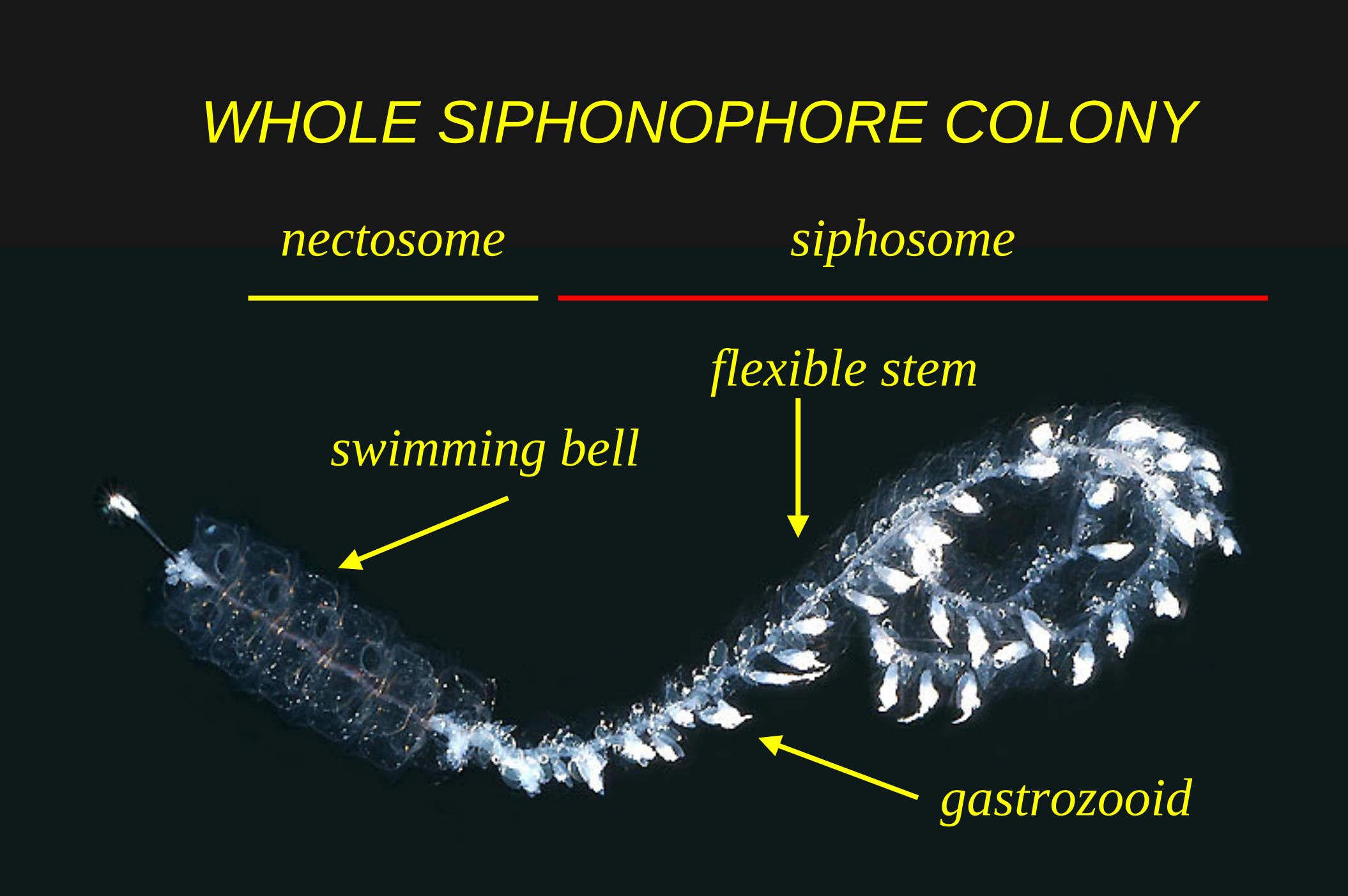
ENVIRONMENTAL DEGREDATION (Arai 2001)

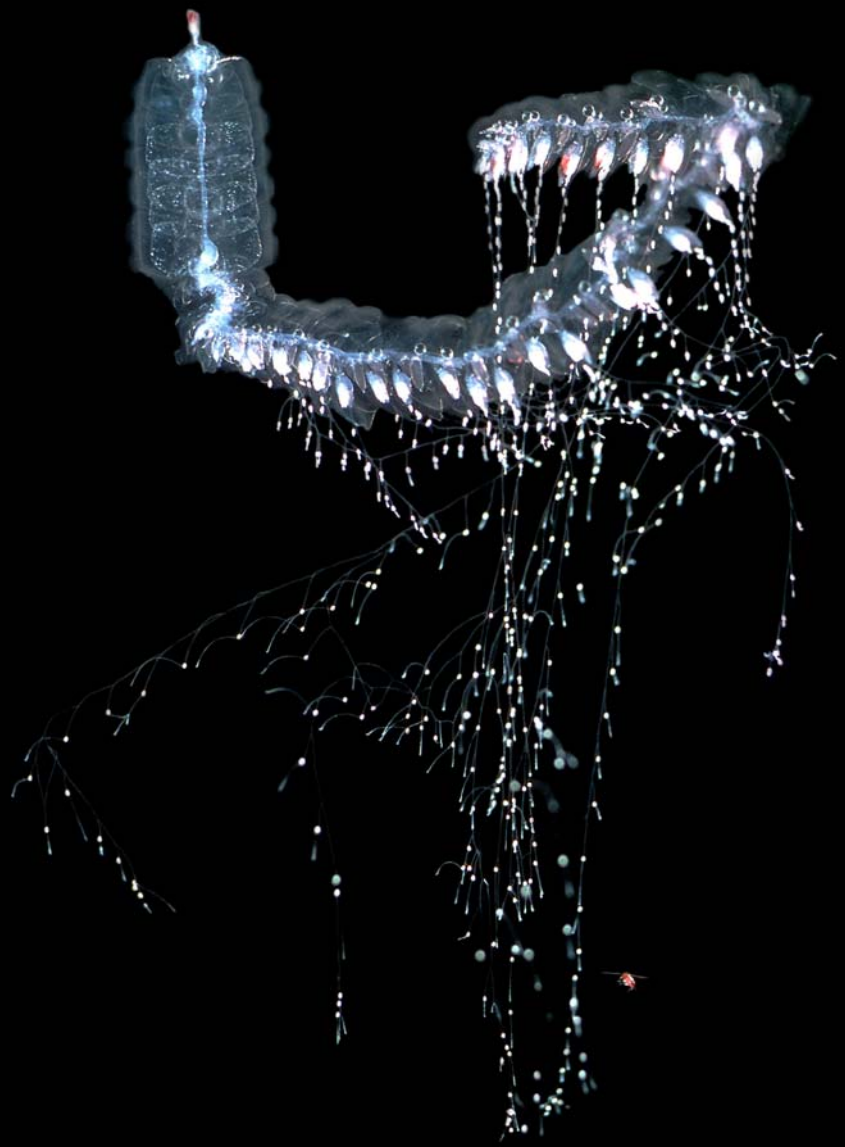
WATER COLUMN VISIBILITY (Eiane et al. 1999)

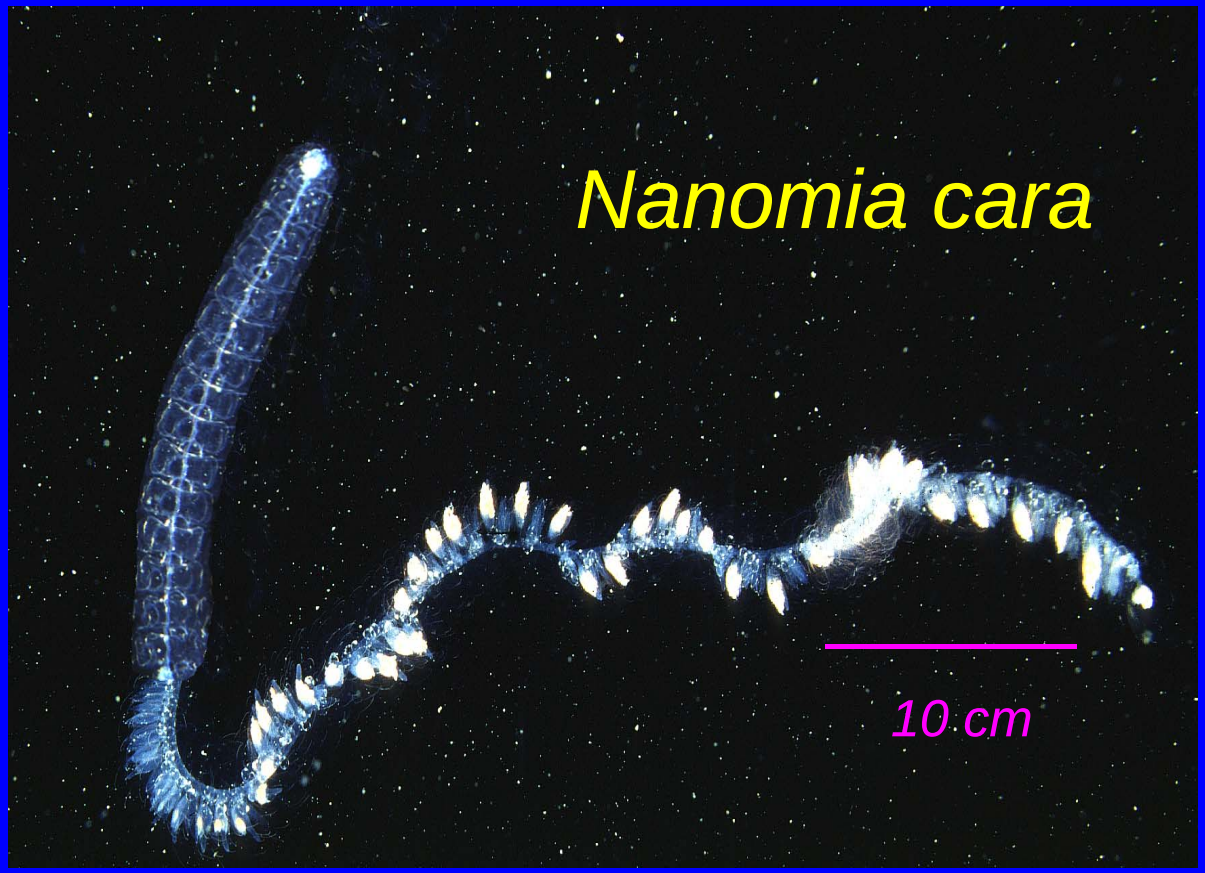
INTRODUCTION OF EXOTIC SPECIES (Kideys 2002)

OVERFISHING (Daskolov 2002)

WHOLE SIPHONOPHORE COLONY







PHYSONECT SIPHONOPHORE

FRAGILE ANIMAL

GEOGRAPHICAL DISTRIBUTION

COASTAL NORTH ATLANTIC

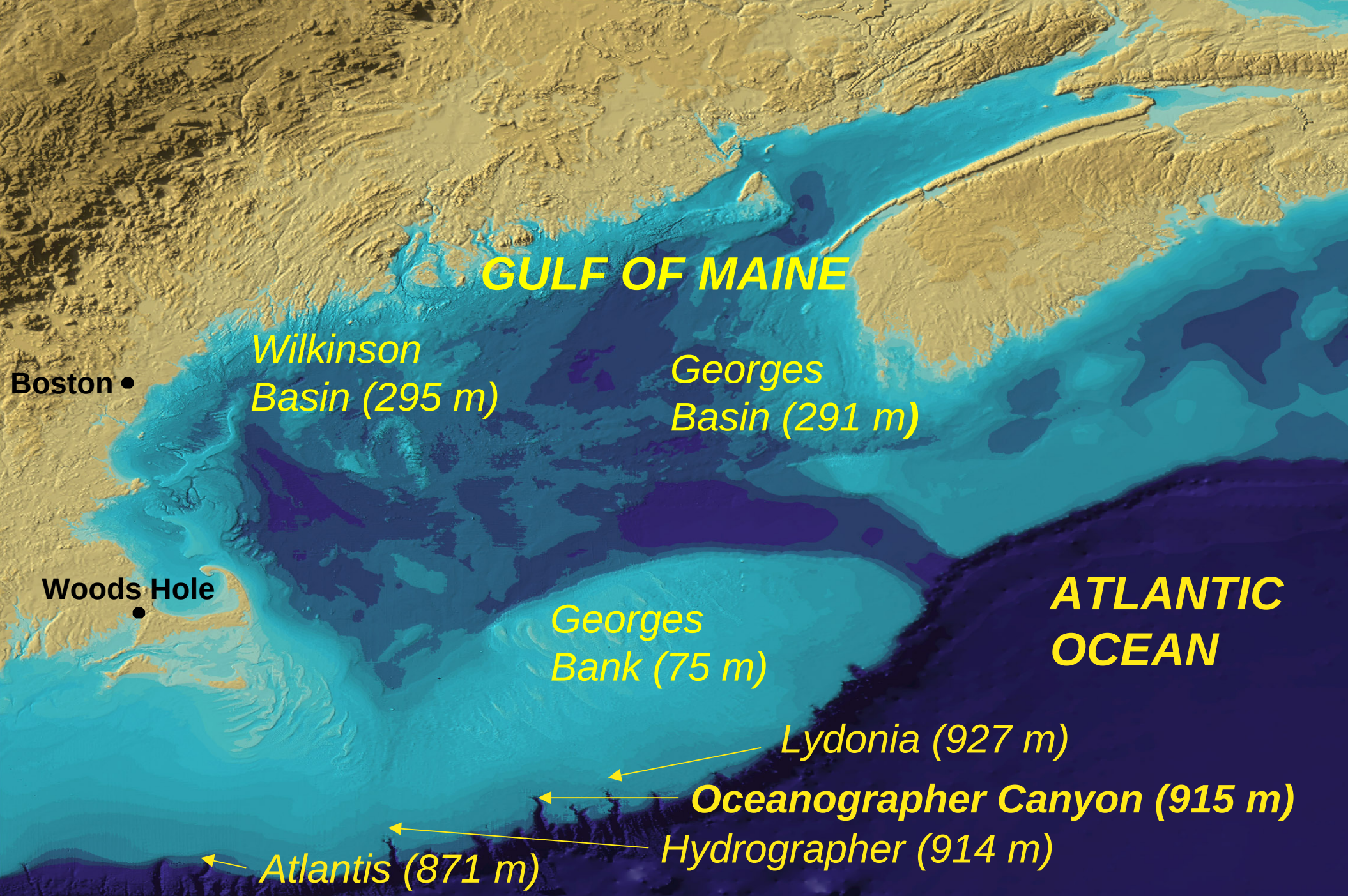
COASTAL NORTH PACIFIC

VERTICAL DISTRIBUTION: KNOWN TO 900 M (NEVER QUANTIFIED)

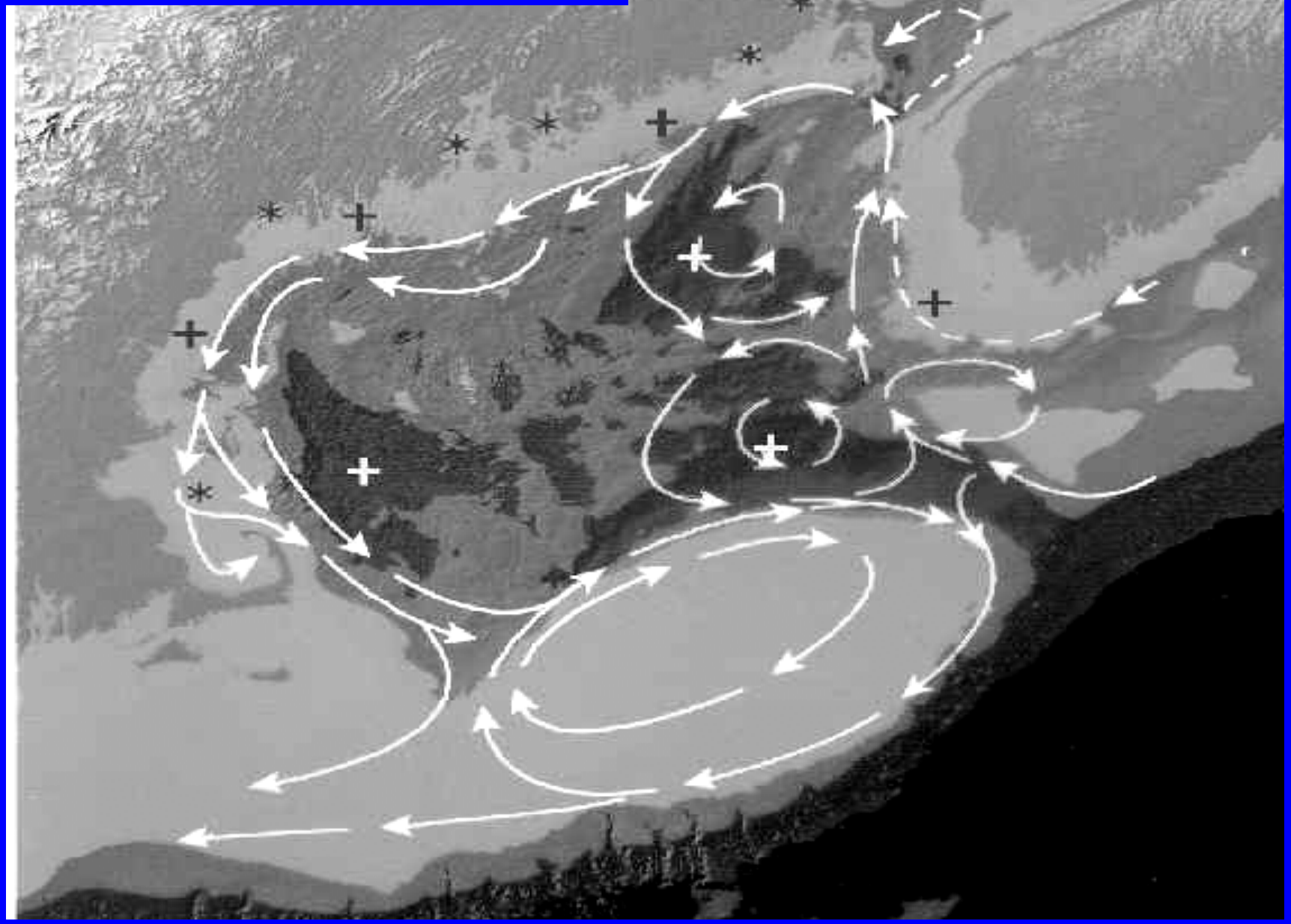
ABUNDANCE: NUISANCE TO FISHERIES (NEVER QUANTIFIED)

SIZE OF COLONY: BIOMASS, GASTROZOOIDS (NEVER QUANTIFIED)

FEEDING HABITS: COPEPODS, KRILL, FISH LARVAE (NEVER QUANTIFIED)


GULF OF MAINE
Wilkinson
Basin (295 m)
Georges
Basin (291 m)
Boston
Woods Hole
Georges
Bank (75 m)
ATLANTIC
OCEAN
Lydonia (927 m)
Oceanographer Canyon (915 m)
Hydrographer (914 m)
Atlantis (871 m)

SIMPLIFIED CIRCULATION



EXPERIMENTAL APPROACHES IN SITU AND ONBOARD SHIP

OBSERVED BEHAVIOR IN SITU
QUANTIFIED ABUNDANCE AND DISTRIBUTION
COLLECTED / PRESERVED IN SITU TO QUANTIFY PREY CAPTURED

Day and Night Dives with JSL submersible

MAINTAINED ALIVE TO QUANTIFY PREY DIGESTION RATE

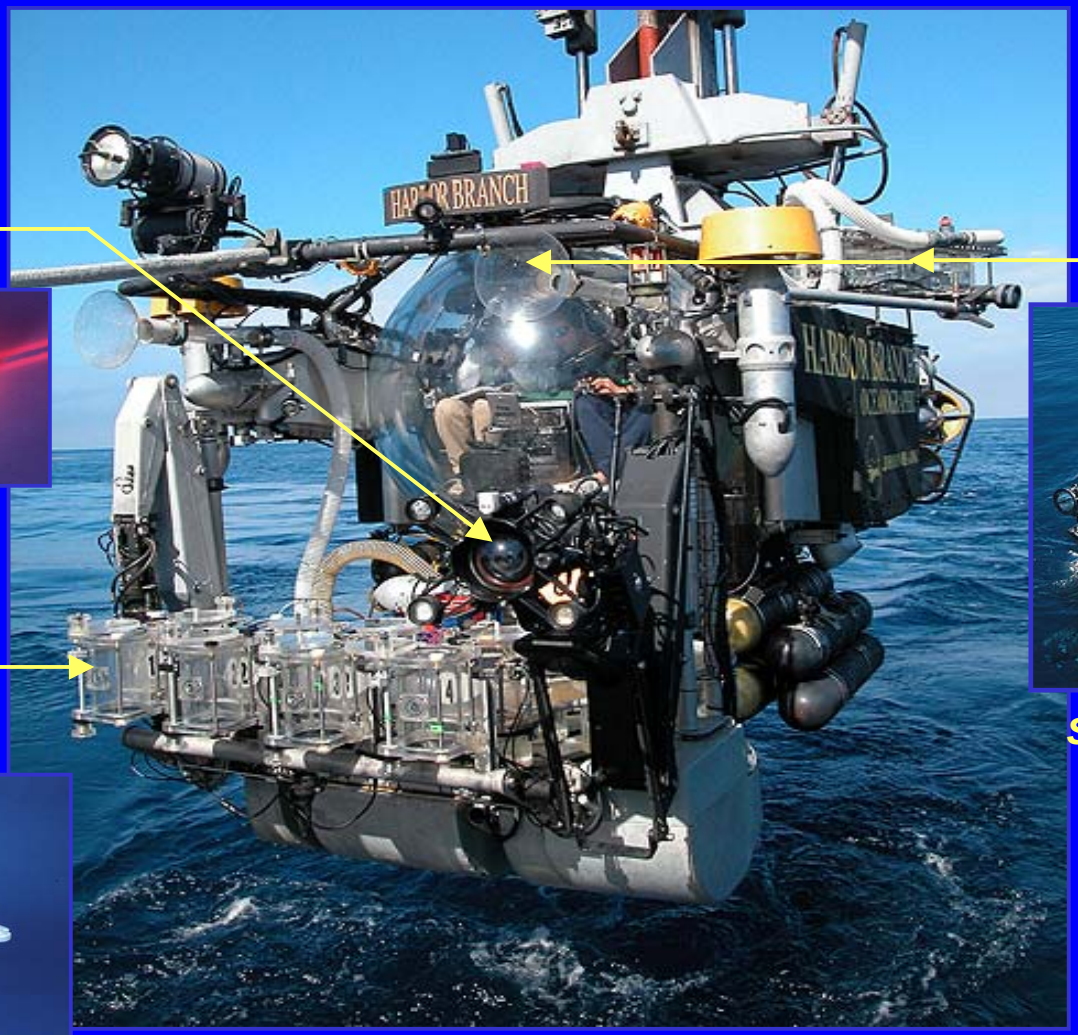
- Placed collection chambers in temperature-controlled laboratory
- Kept in darkness
- Fed stained and naturally pigmented prey
- Observed digestion rate under red light

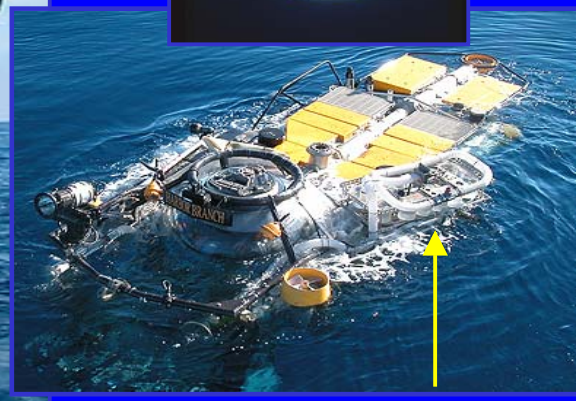
MAINTAINED ALIVE TO MEASURE OXYGEN CONSUMPTION RATES

- Micro-optode and Winkler techniques

Johnson Sea Link Submersible

VIDEO CAMERA
AND PAIRED LASER





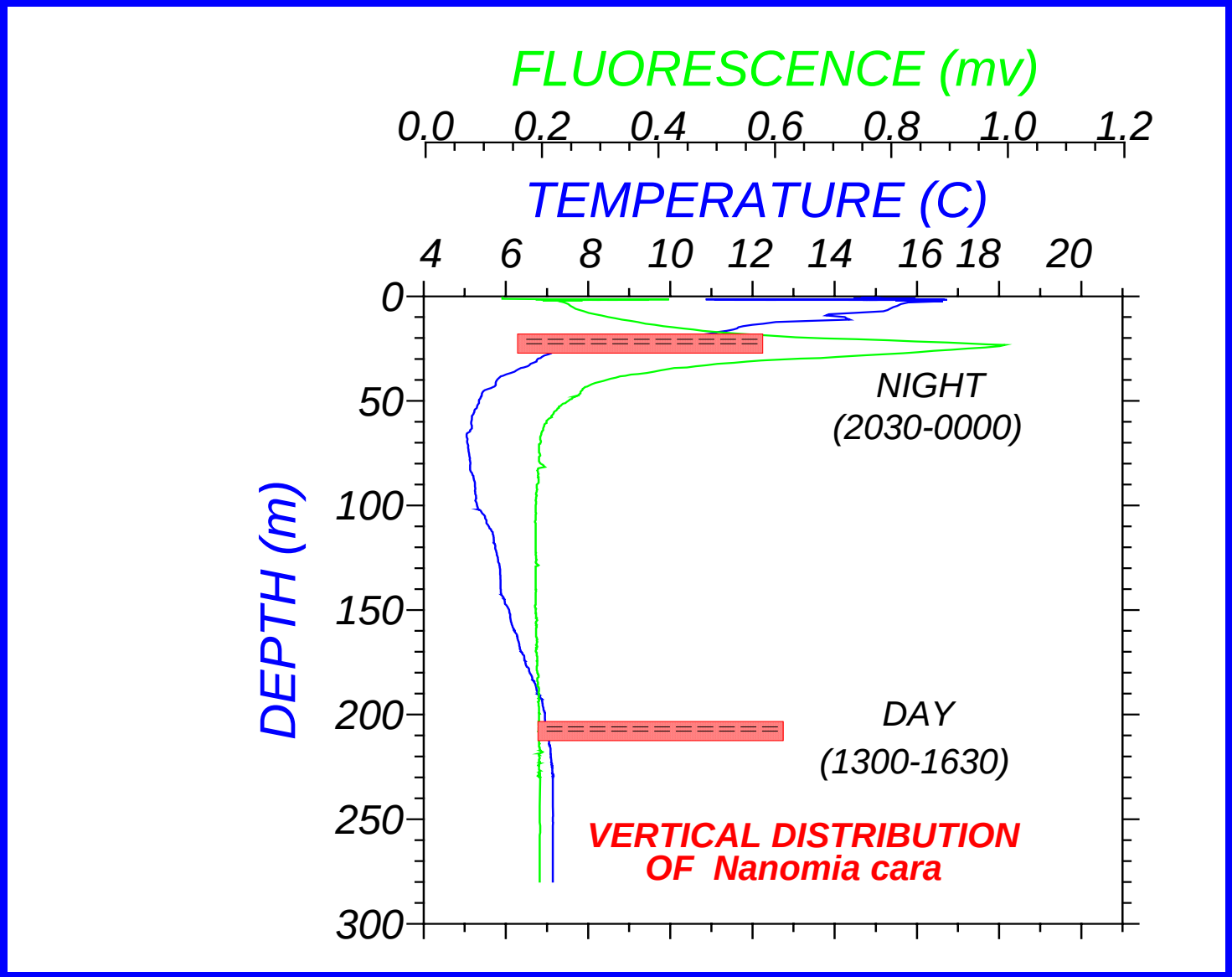
SUCTION SAMPLERS (24)

SAMPLER FOR GELATINOUS
ZOOPLANKTON (8)

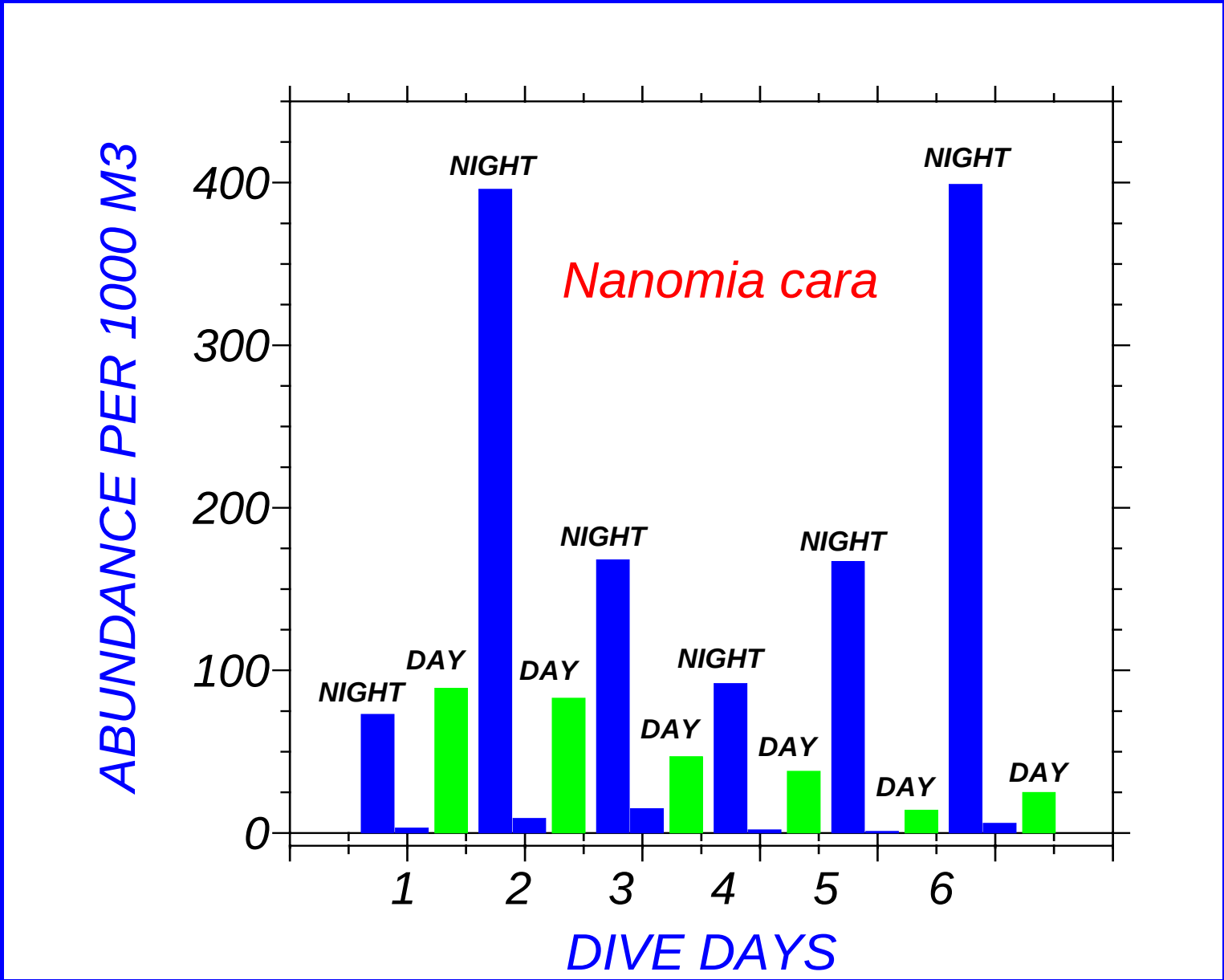
Depth range - 1000m
32 samplers

CTD-SENSORS
TRANSMISSOMETER
FLUOROMETER

WILKINSON BASIN



WILKINSON BASIN

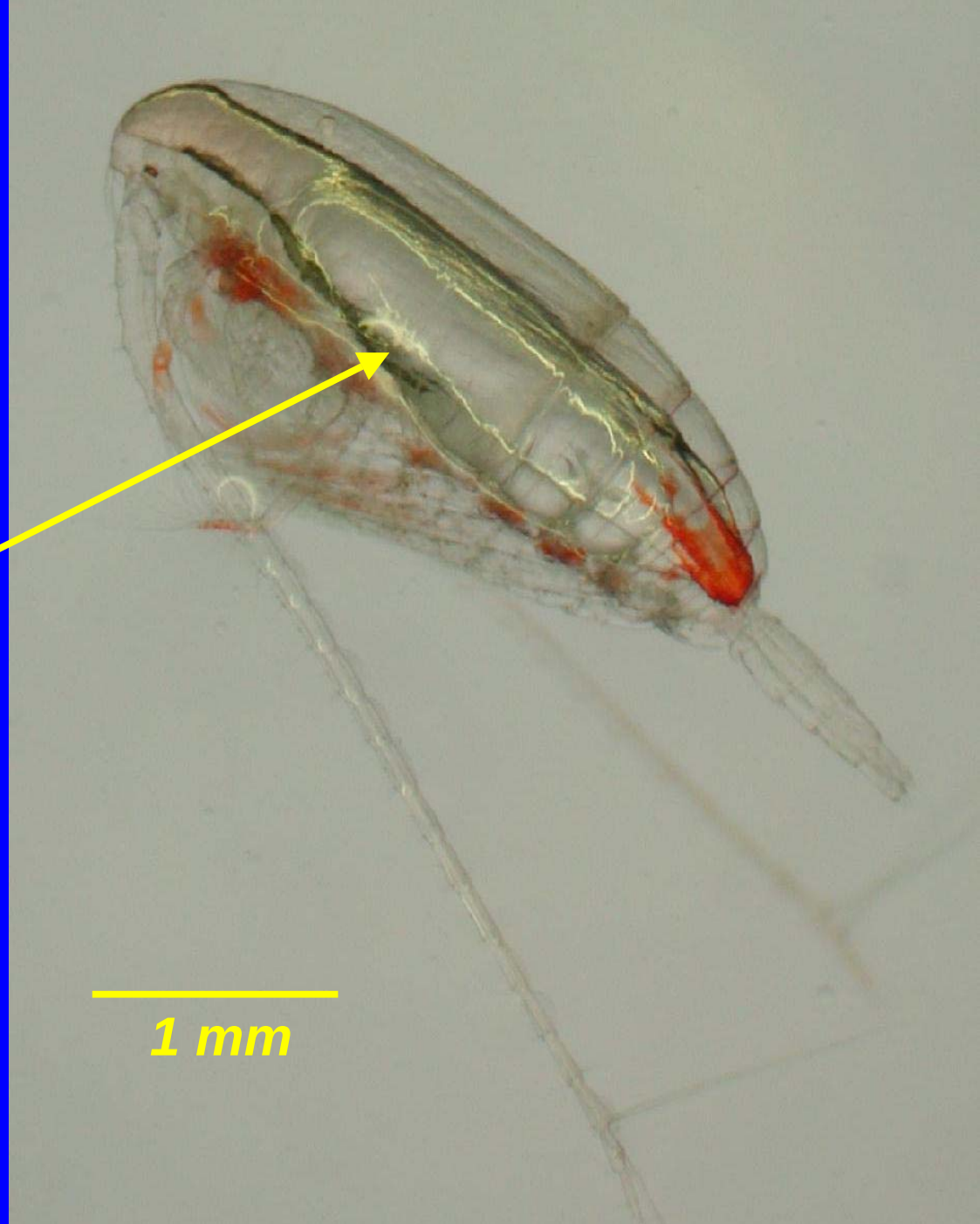


DIAPAUSE (=resting) STAGE

calanoid copepod

lipid sac

Calanus finmarchicus CV



SUMMARY OF RESULTS - WILKINSON BASIN (depth = 300 m)

20, 3-h Dives (60 h), Day and Night (10 dives in each time period)

Distribution *(Vertical Transects)*

Occurred in 2-5 m thick layers
Bimodal Vertical Distribution (20 and 215 m)
Strong Diel Migration (200 m)

Patchy Abundance *(Horizontal Transects)*

Size of Colonies: 0.5-1 m
Number of Colonies: 0.01-0.4/m3

Number of Gastrozooids: 15-83 per colony

Prey Consumed

Fed Exclusively on Stage IV-V copepods of one species, ***Calanus finmarchicus***

Nocturnal Feeding *(at 20 m)*

Digestion Rate *(3-4 h per copepod)*

CONSUMPTION OF PREY

Feed only on resting stage of calanoid copepod

25 PREY PER COLONY PER DAY

PREY INGESTED PER COLONY PER DAY

PI = H/D x T,

H = NUMBER OF PREY PER COLONY (1-37, MEAN 20)

D = DIGESTION TIME IN HOURS (3-5 H, MEAN 4)

T = FEEDING INTERVAL IN HOURS (ASSUMED 18 H)

20 PREY PER COLONY PER DAY

METABOLIC DEMAND AND PREY REQUIREMENTS

4% OF BODY CARBON PER DAY

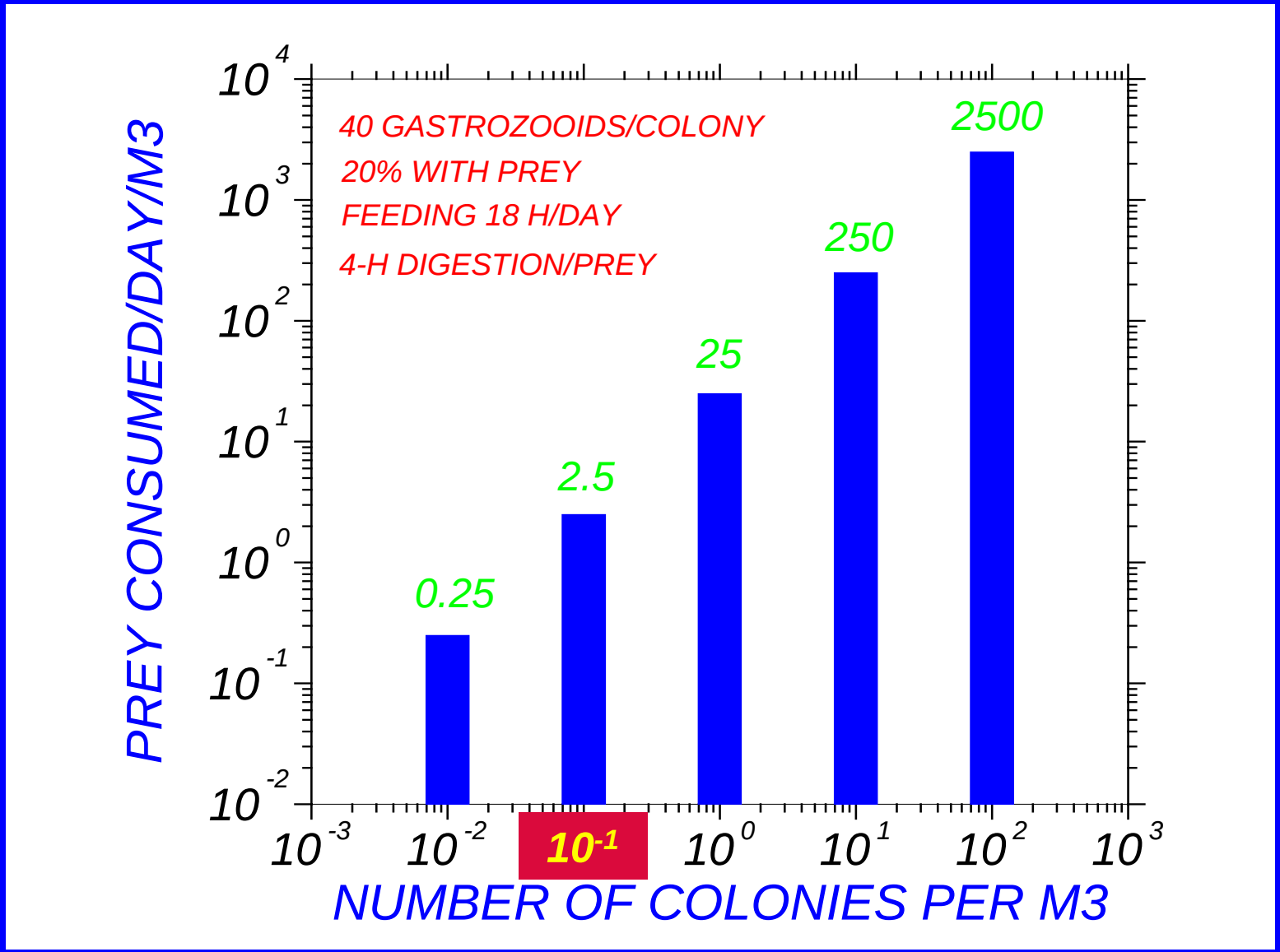
MEAN COLONY CARBON (49 mg C)

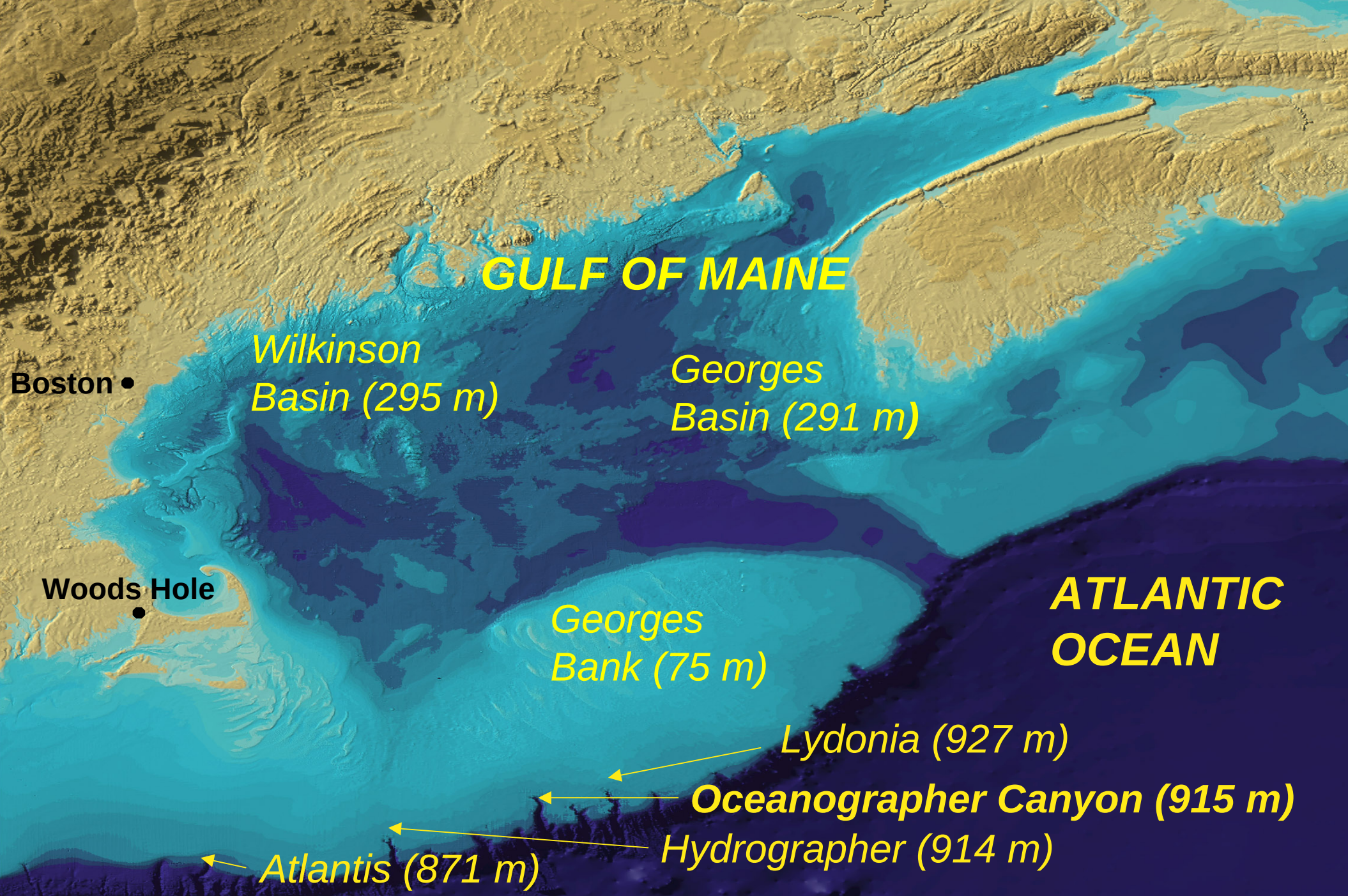
ASSUMED MEAN RESPIRATION RATE (4.2 µL/mg C/H) - IN SITU

ASSUMED ASSIMILATION EFFICIENCY OF 90% FOR CARBON

ASSUMED MEAN BIOMASS *CALANUS FINMARCHICUS* (0.12 mg C)

POTENTIAL IMPACT AS PREDATOR ON COPEPODS

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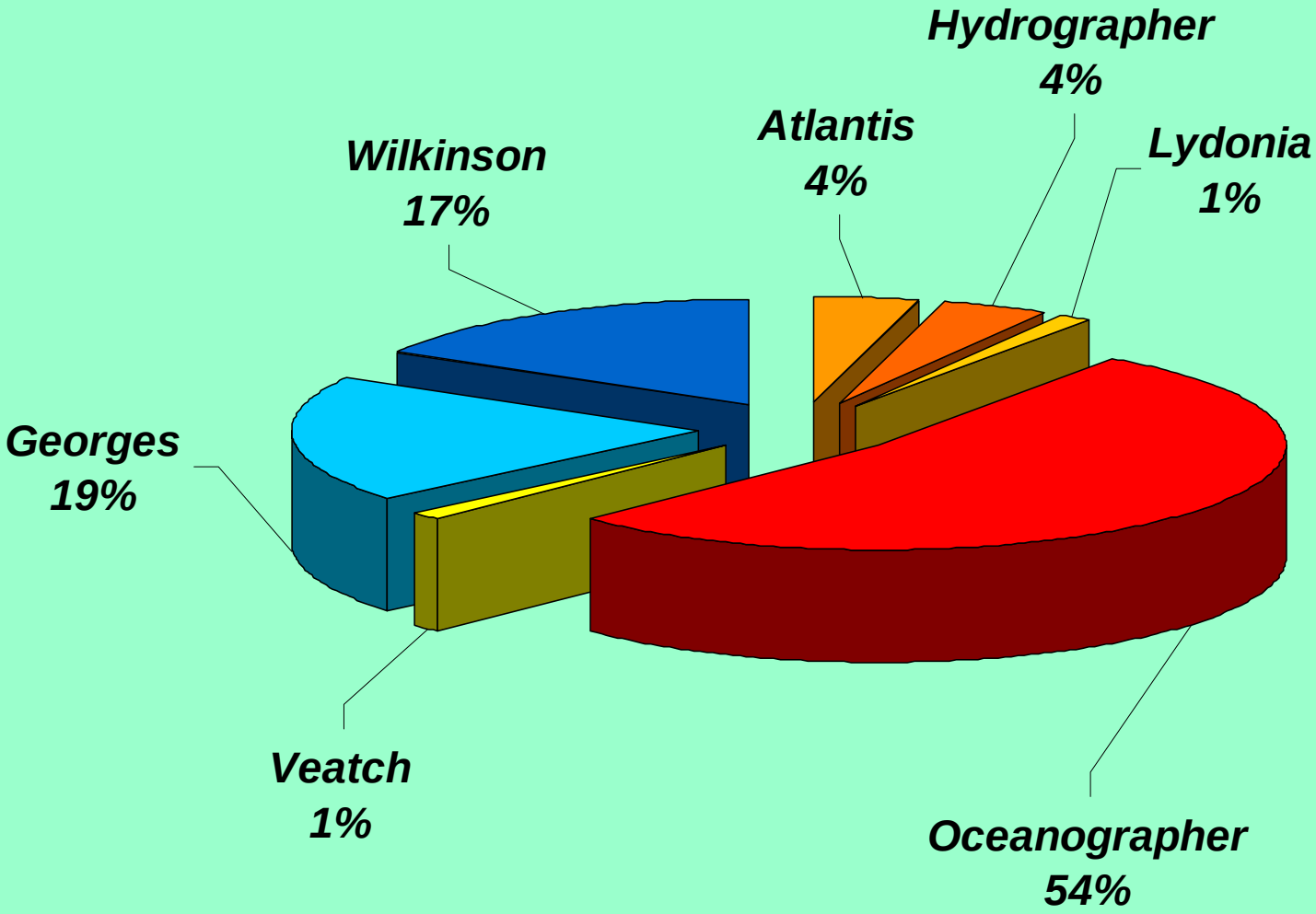
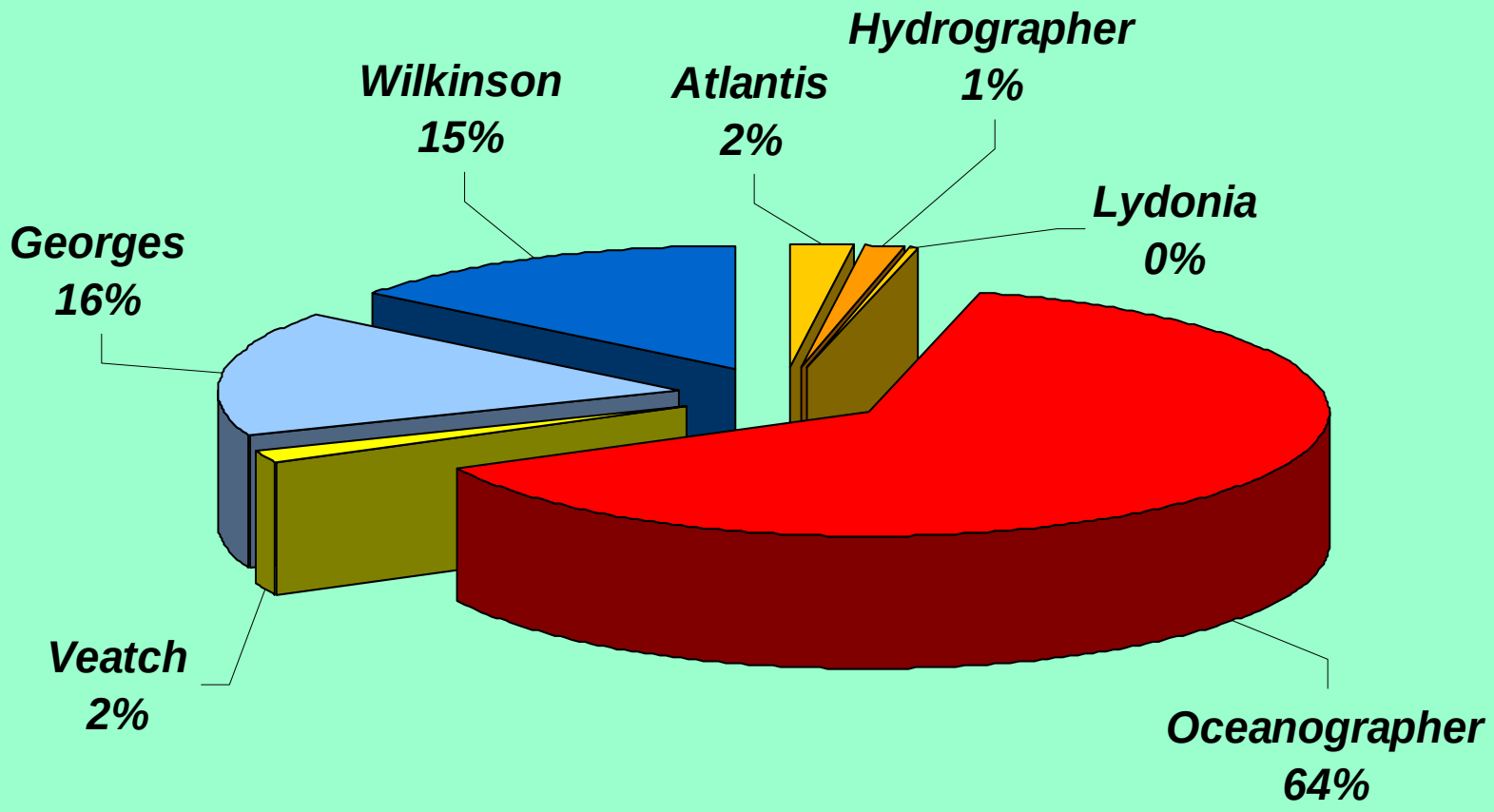
LOCATIONS OF DIVES (N = 83)



LOCATIONS OF SIPHONOPORE CAPTURES
(N = 501 COLONIES, 19,299 gastrozooids)



OCEANOGRAPHER CANYON (depth = 915 m)

Larger colonies (2 m long)

Less numerous (0.02-0.04 m3)

Deeper distribution, less vertical migration (100 m)

430-460 m night

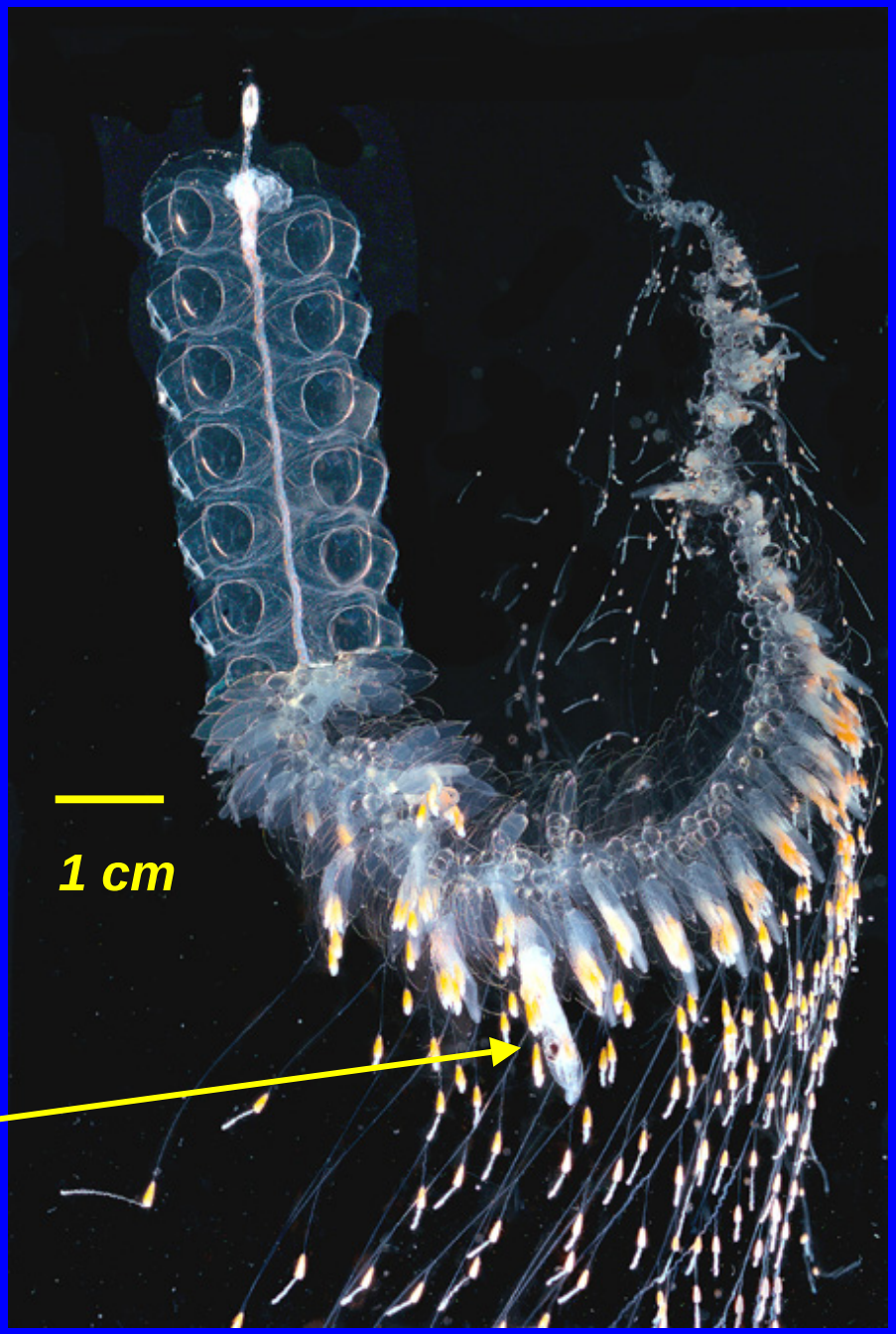
520-550 m day

Prey on several zooplankton

copepods (3 mm)

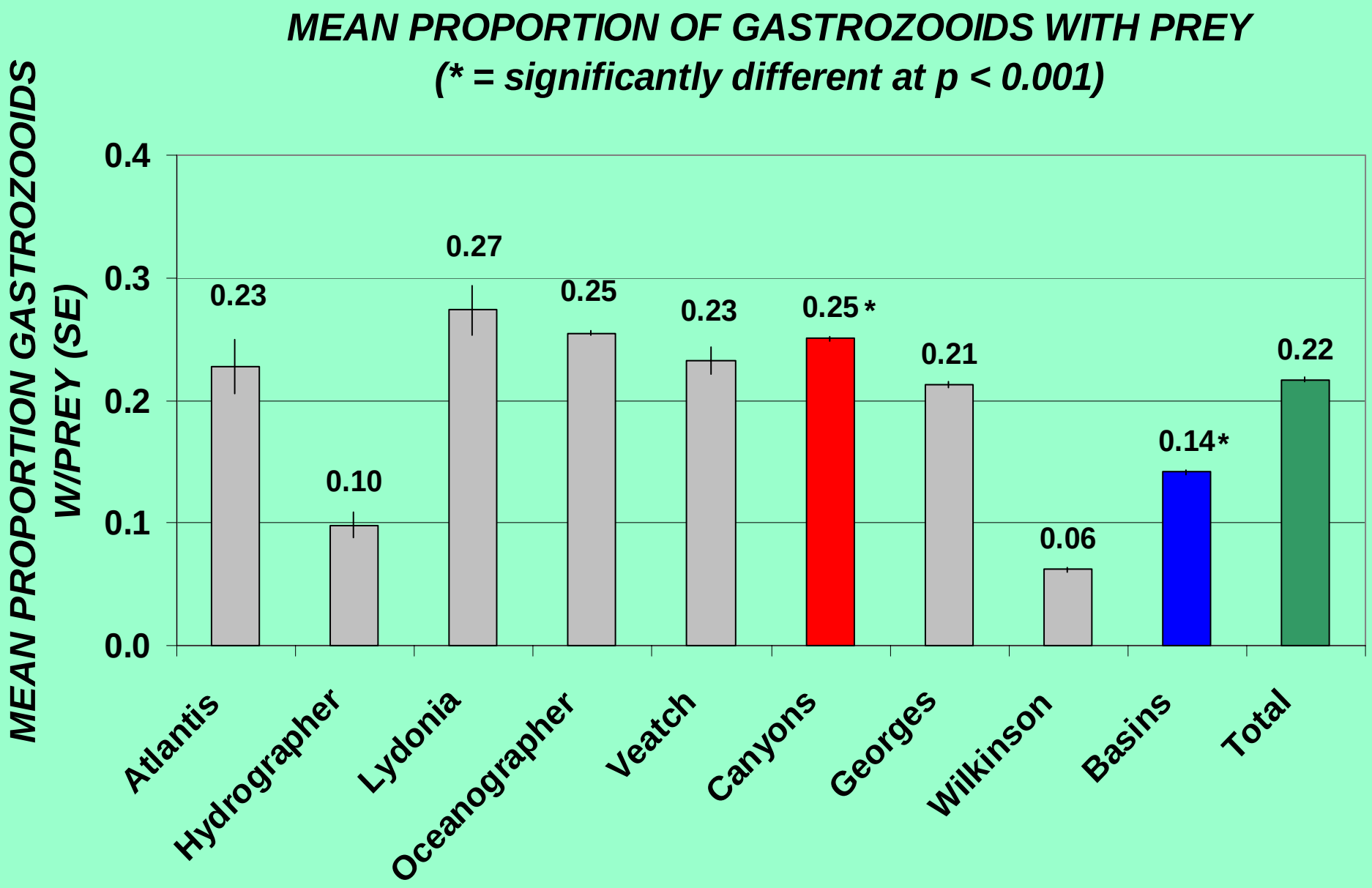
euphausiids (3 cm)

midwater fishes (4 cm)

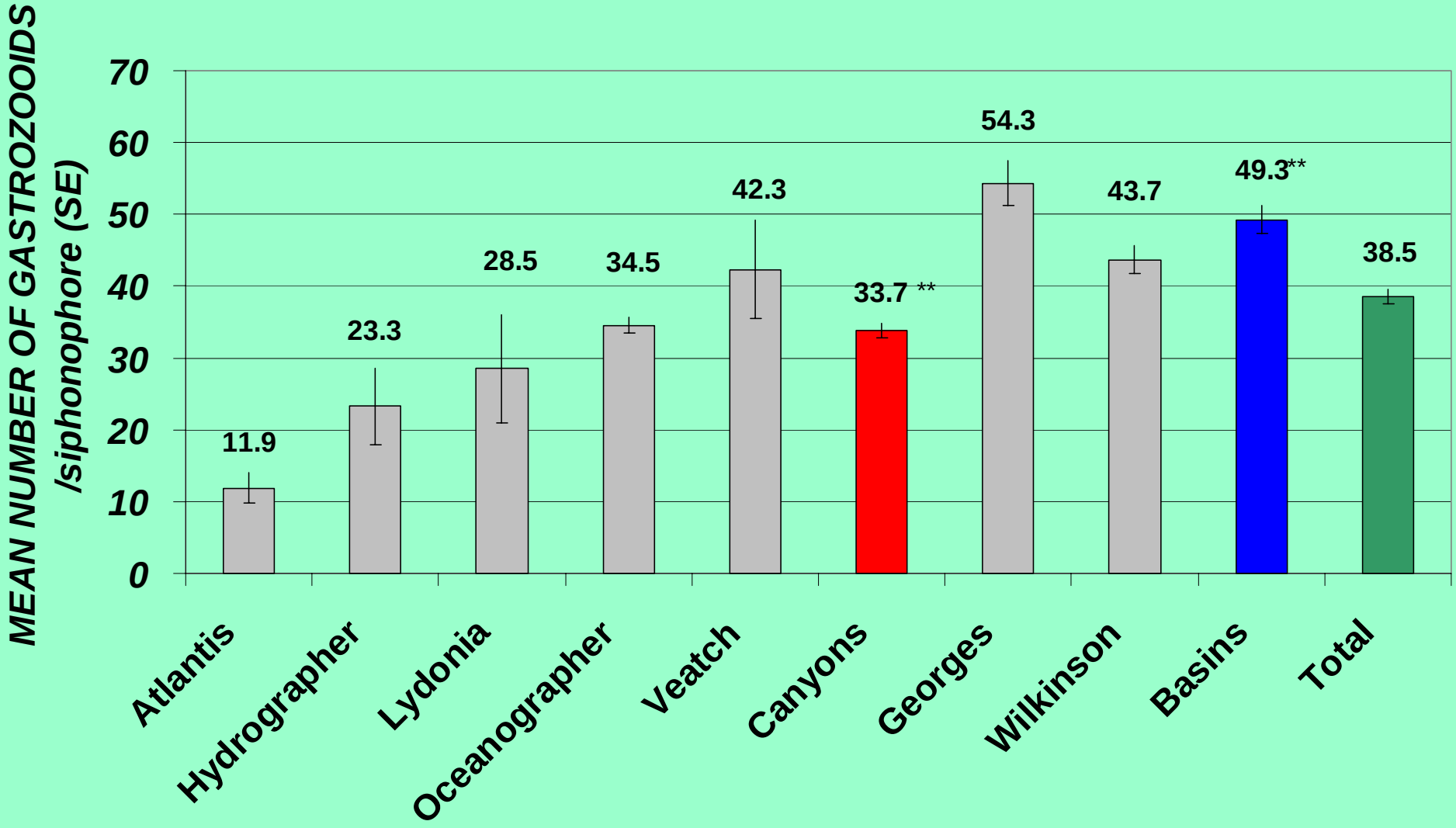


Nanomia cara: gastrozooid contents, 3 euphausiid genera

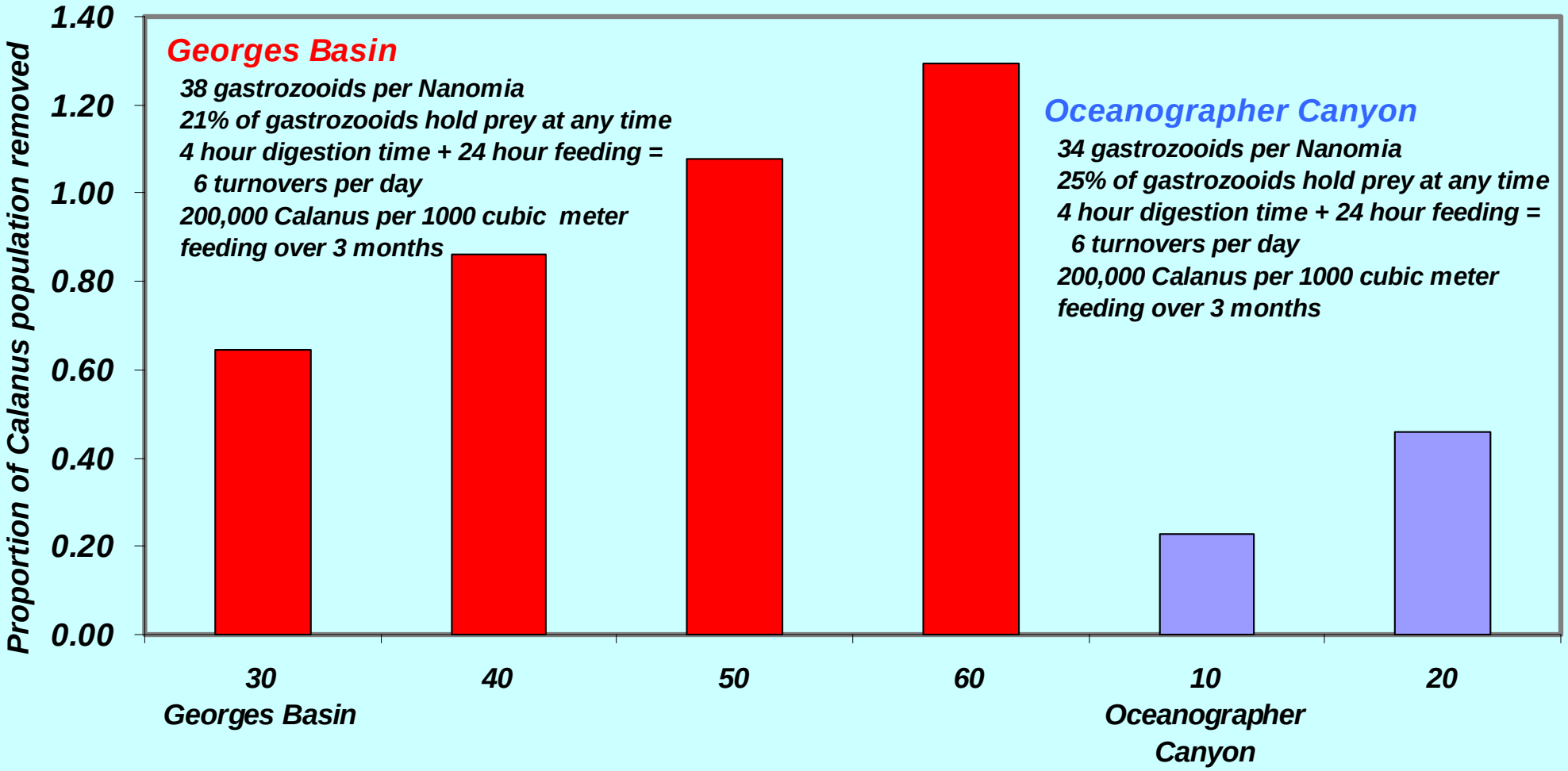
Nanomia cara: gastrozooid content , copepods and fish


MEAN PROPORTION OF GASTROZOOIDS WITH PREY
(* = significantly different at p < 0.001)
MEAN PROPORTION GASTROZOOIDS W/PREY (SE)
0.4
0.3
0.2
0.1
0.0
0.23
0.10
0.27
0.25
0.23
0.25 *
0.21
0.06
0.14*
0.22
Atlantis
Hydrographer
Lydonia
Oceanographer
Veatch
Canyons
Georges
Wilkinson
Basins
Total

MEAN NUMBER OF GASTROZOOIDS PER SIPHONOPHORE
(** = significantly different at p < 0.001)



POTENTIAL IMPACT OF PREDATION BY NANOMIA CARA



NUMBER OF NANOMIA CARA PER 1000 M3 (0.03 TO 0.06 PER M3)

CONCLUSIONS

Morphologically different populations of Nanomia cara occur in basins and canyons.

Colonies tend to aggregate in relatively narrow depth intervals.

The bulk of a given population may or may not migrate vertically each day to feed, BUT Nanomia cara colonies feed continuously.

Both populations tend to select the resting phase of the copepod Calanus finmarchicus, especially in the basins.

Nanomia cara colonies have the potential to consume a large portion of the resting stock of Calanus finmarchicus.