DGoMB

Deep Gulf of Mexico Benthos

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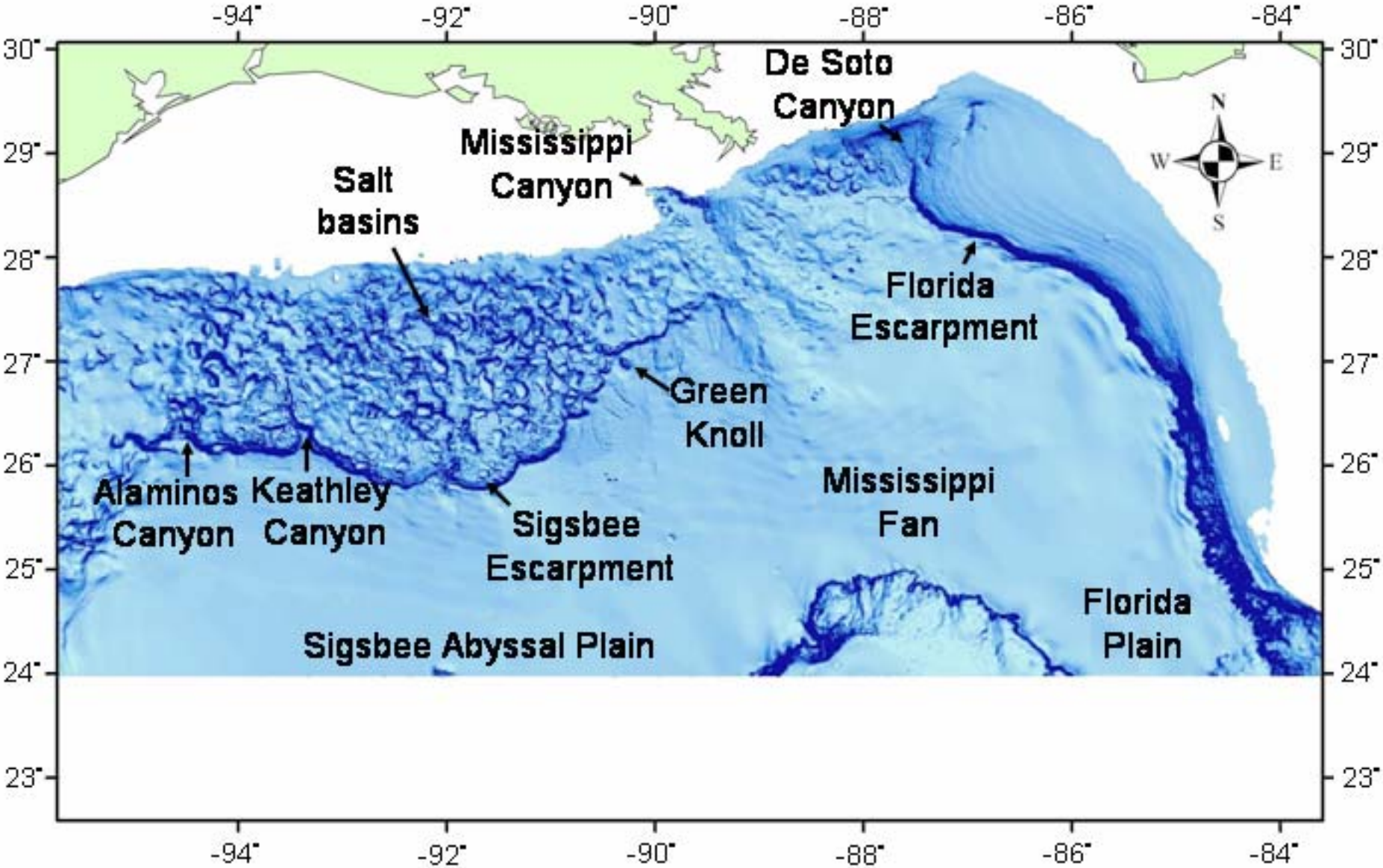
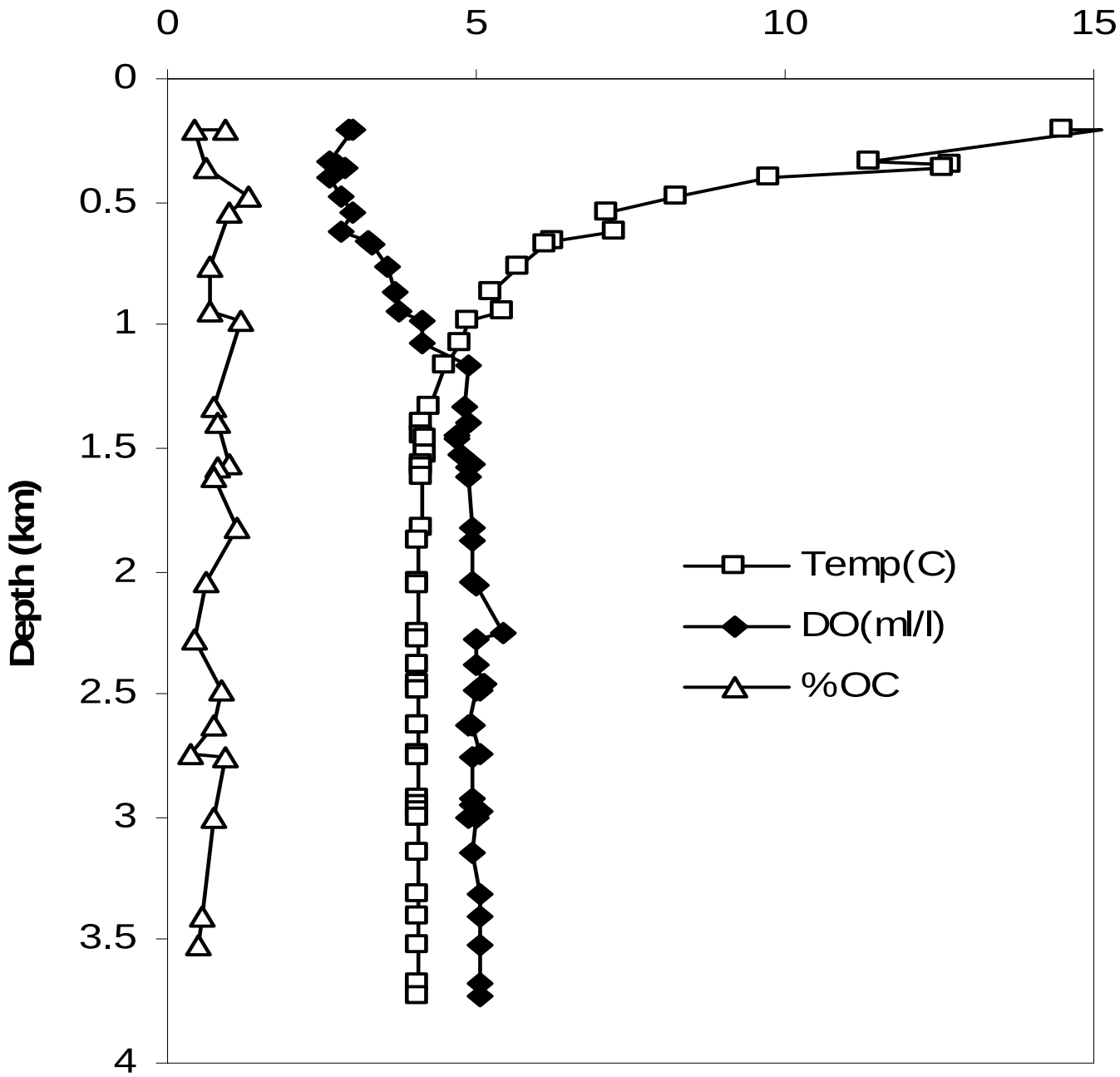
Texas A&M University


-94°
-92°
-90°
-88°
-86°
-84°
30°
29°
28°
27°
26°
25°
24°
23°
De Soto Canyon
Mississippi Canyon
Salt basins
Florida Escarpment
Green Knoll
Alaminos Canyon
Keathley Canyon
Sigsbee Escarpment
Mississippi Fan
Florida Plain
Sigsbee Abyssal Plain
N
W
E
S

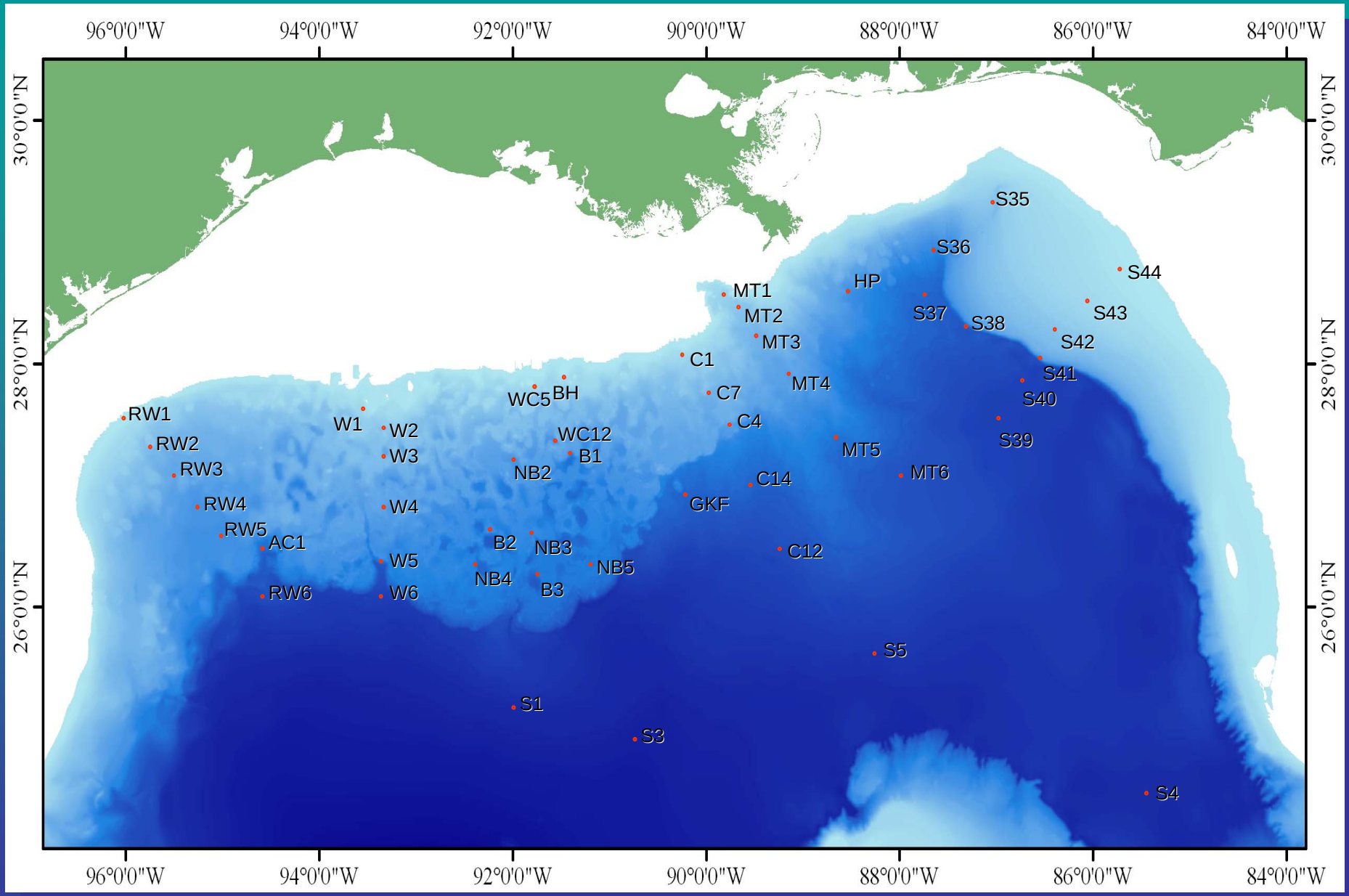

0
5
10
15
0
0.5
1
1.5
2
2.5
3
3.5
4
Depth (km)
Temp(C)
DO(ml/l)
%OC

DGoMB

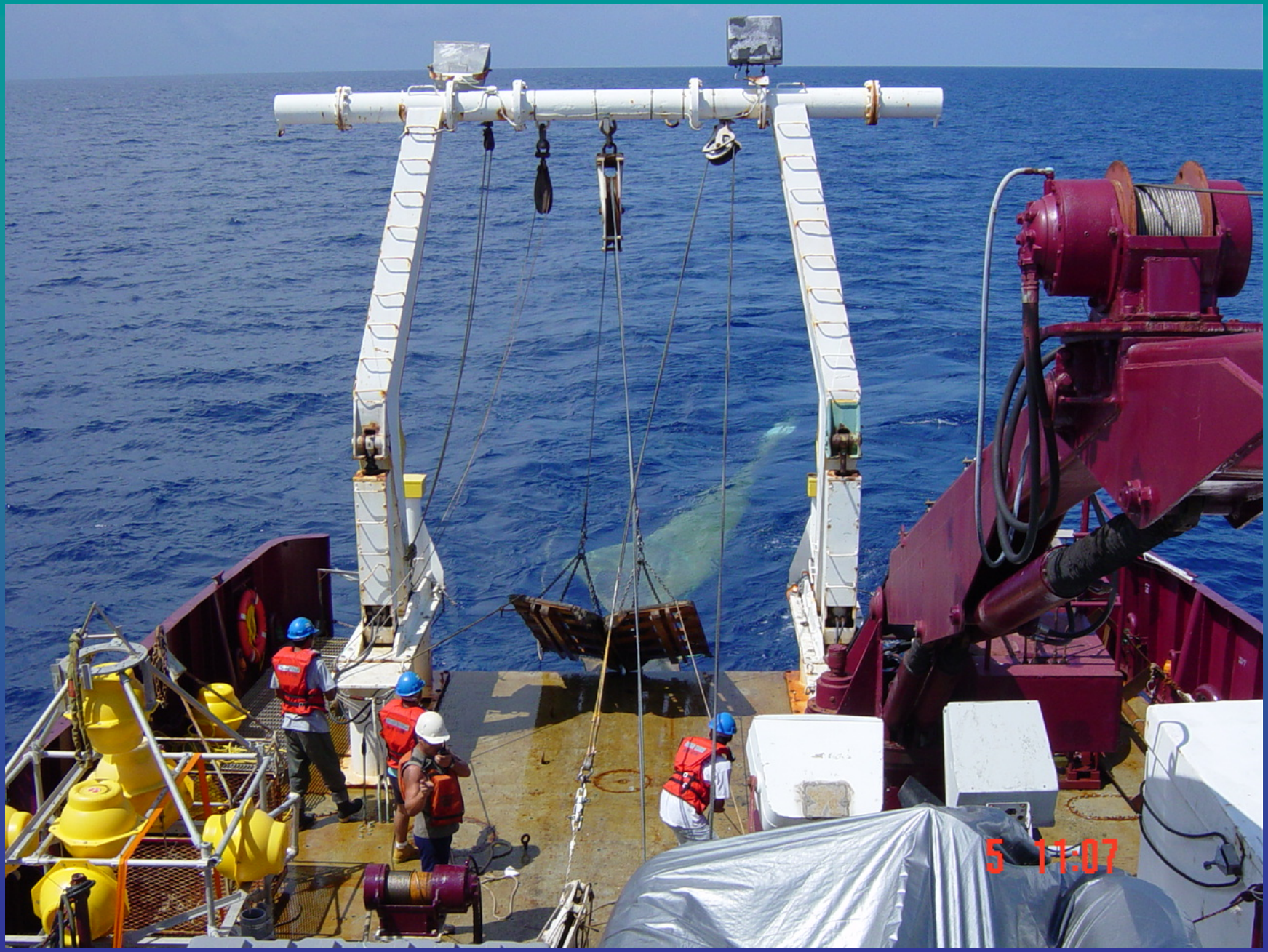
- Structure and function of benthic ecosystems in the deep Gulf of Mexico
- Model (conceptual) based
- Hypothesis (8) driven
- Structure: diversity, taxonomic composition, biomass and abundance, and mean size (bacteria, meio-, macro-, megafauna, and fishes)
- Function: Sediment community oxygen consumption
- Assumptions:
  - The DGoMB communities are food limited
  - Community structure and community dynamics (function) are interdependent

- **Megafauna – Large fish, crustaceans, echinoderms, etc.; taken by trawl or dredge; visible by camera (McEachran, Haedrich, Wicksten, Ammons, Ziegler, Hillman, Gaytan, Escobar)**
- **Macrofauna – Infauna and epifauna of sea floor; taken by boxcorer; larger than 300µ; polychaetes, crustaceans, etc. (Wilson, Hubbard, Wicksten, Rowe, Wei, Wang, Soliman, Foster, Scheltema)**
- **Meiofauna –Taken from subcores in boxcorer; between 300 and 63µ; nematodes, harpacticoid copepods (Montagna, Baguley, W. Lee, Diaz, Escobar)**

- **Microfauna – Subcores in boxcorer; foraminifera (Bernhard)**
- **Bacteria – Subcores (Deming and Carpenter)**
- **Subcores to sample for wide variety of geological and chemical variables (Morse, Wade, Cifuentes, Santschi, Kennicutt, Yaeger, Beazley, Bryant)**
- **Baited traps – Escobar**



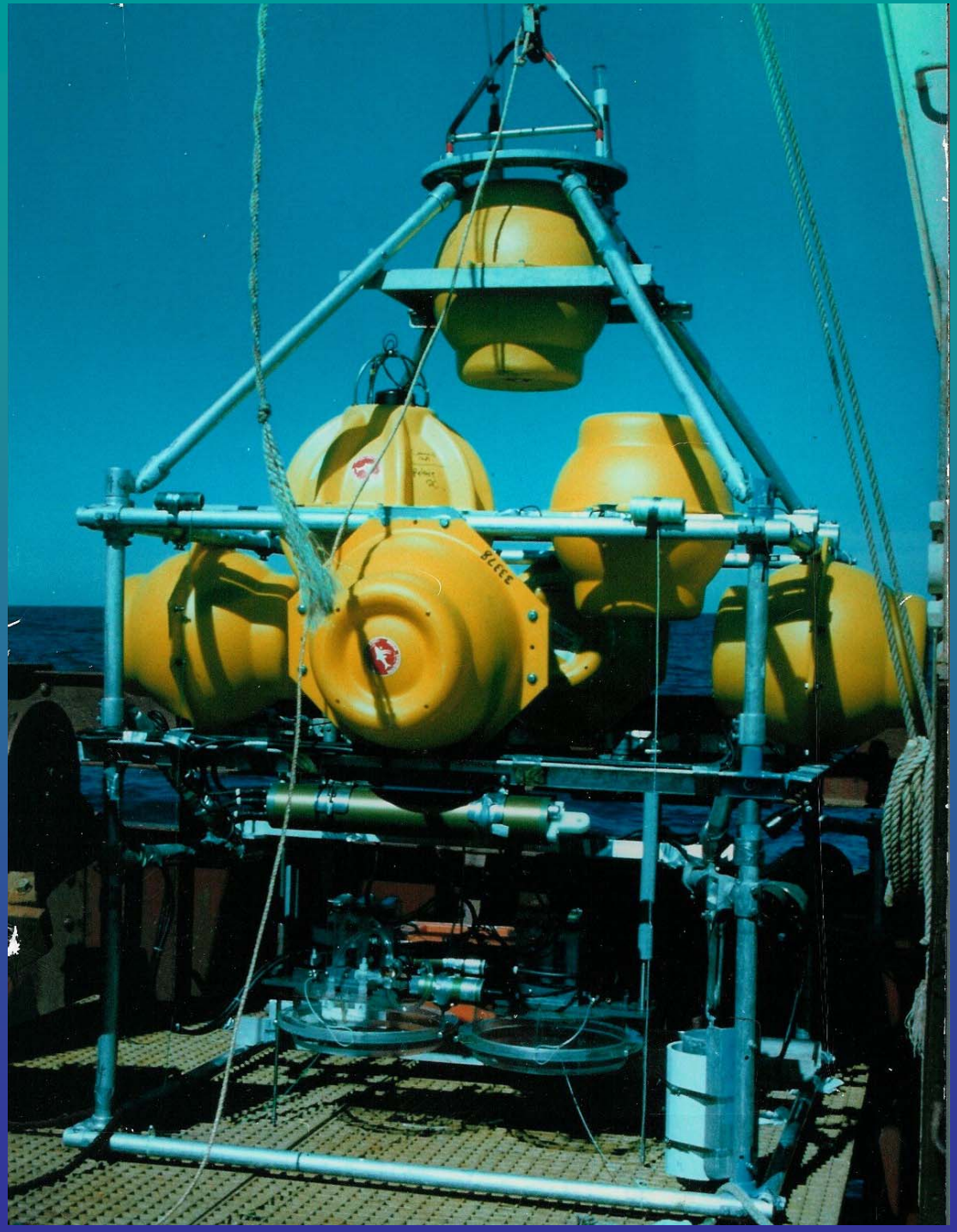
DGoMB station locations Cruises 1–3 (2000–2002).

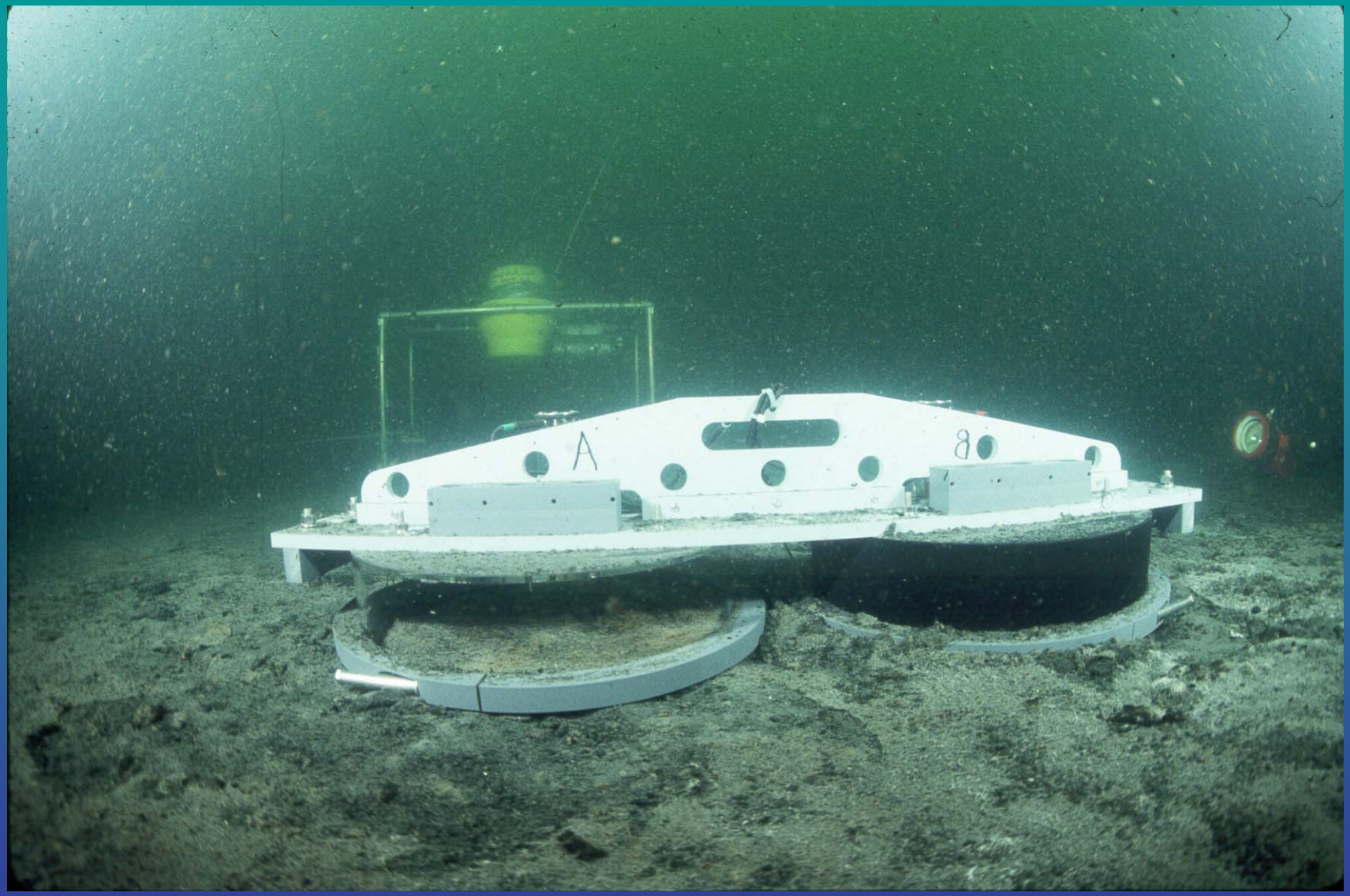

5 11:07

Neolithodes agassizi

Dr. Lee, Dr. Rowe and Chris unloading the boxcorer

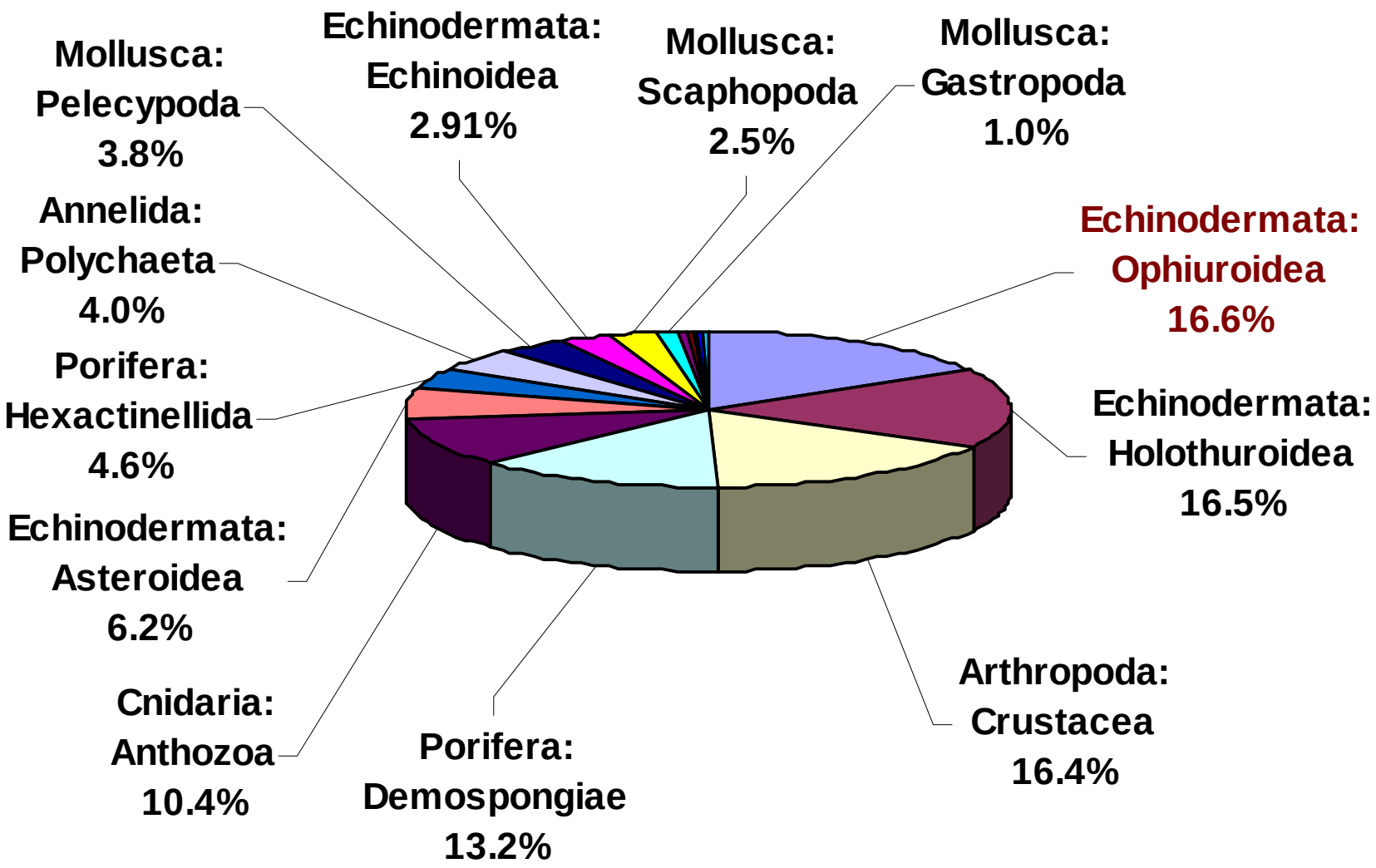
Benthic lander on deck



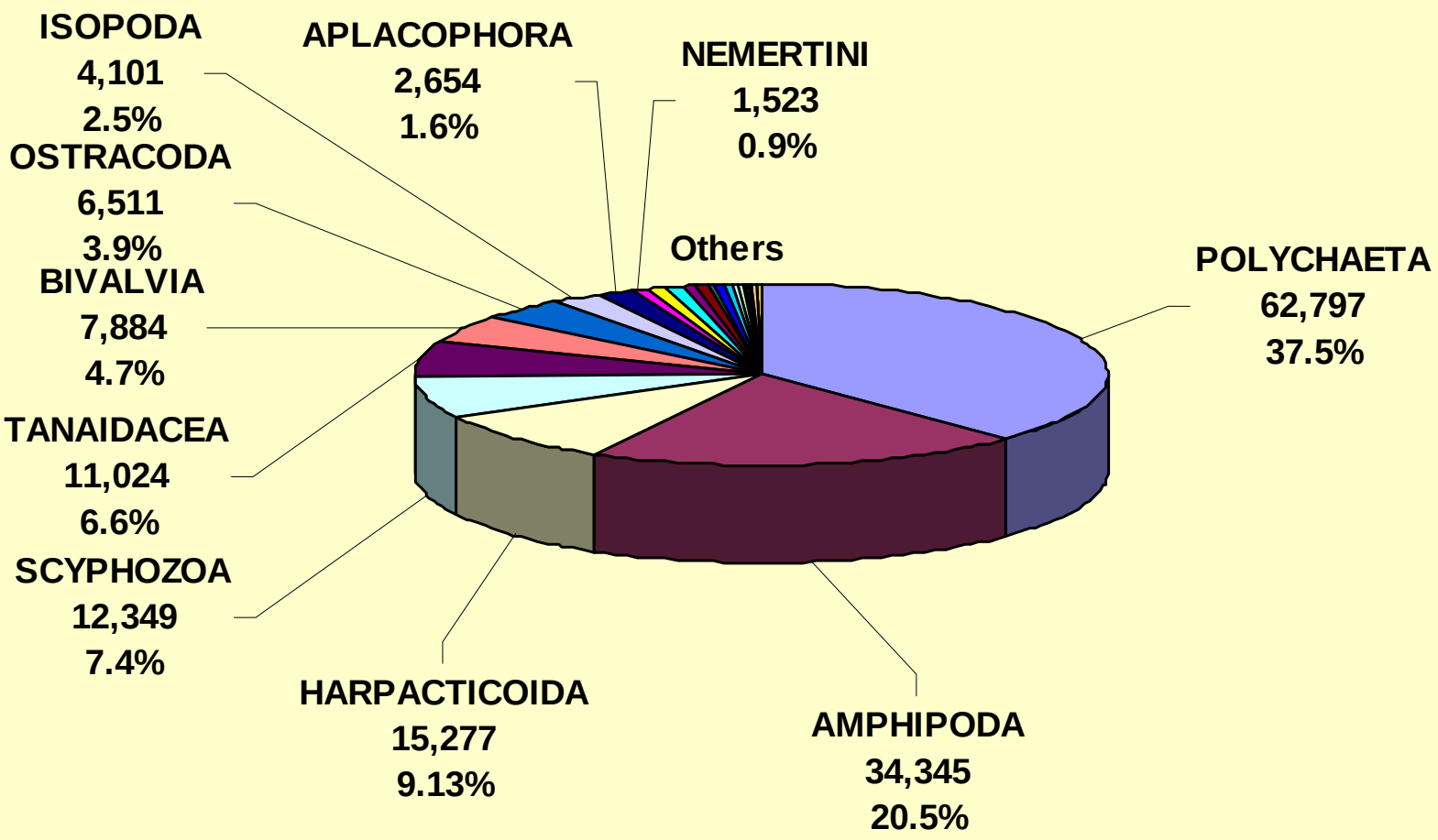


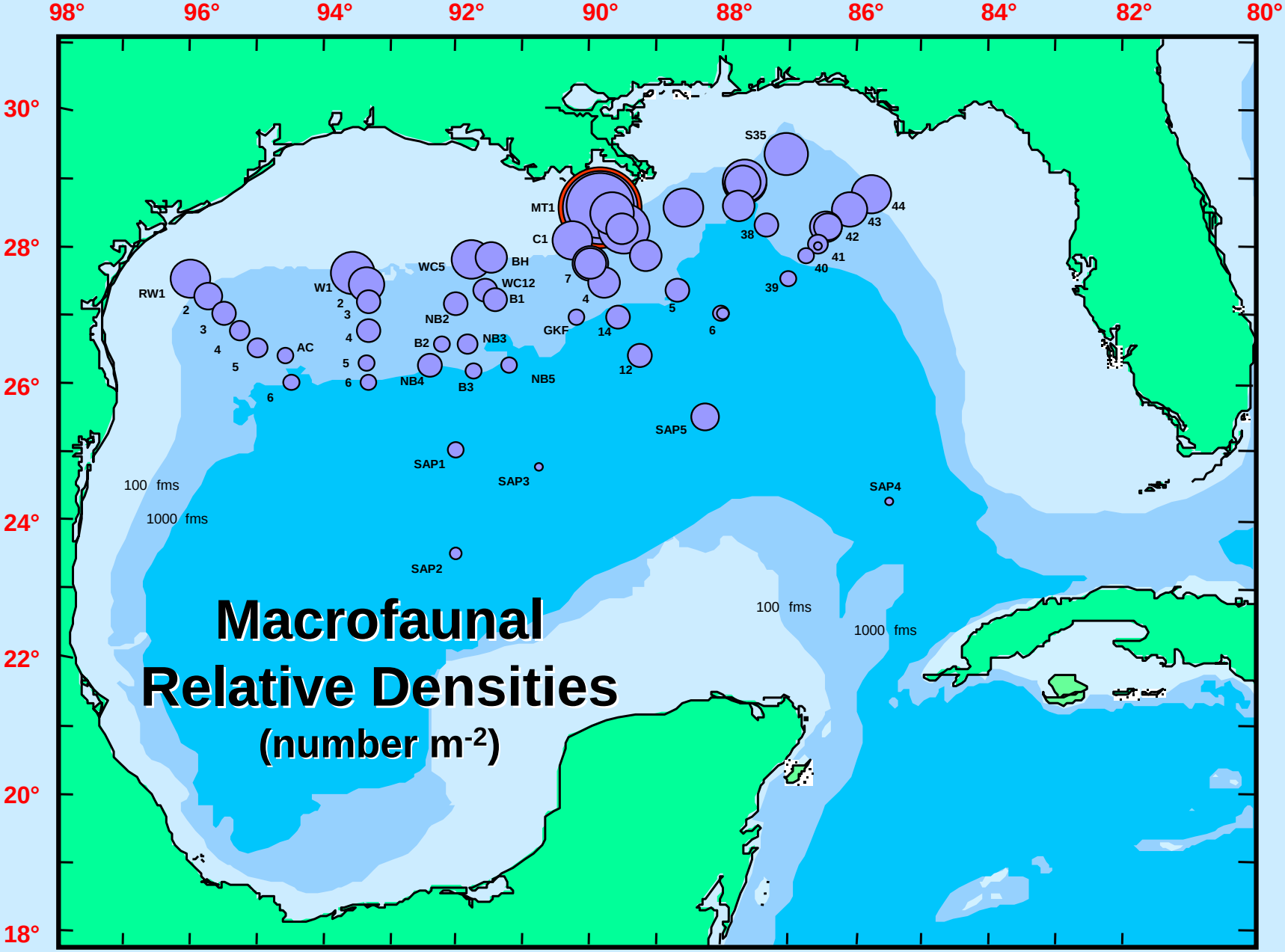
Benthic chambers in position on the bottom

Trawl Taxa Distribution by Abundance

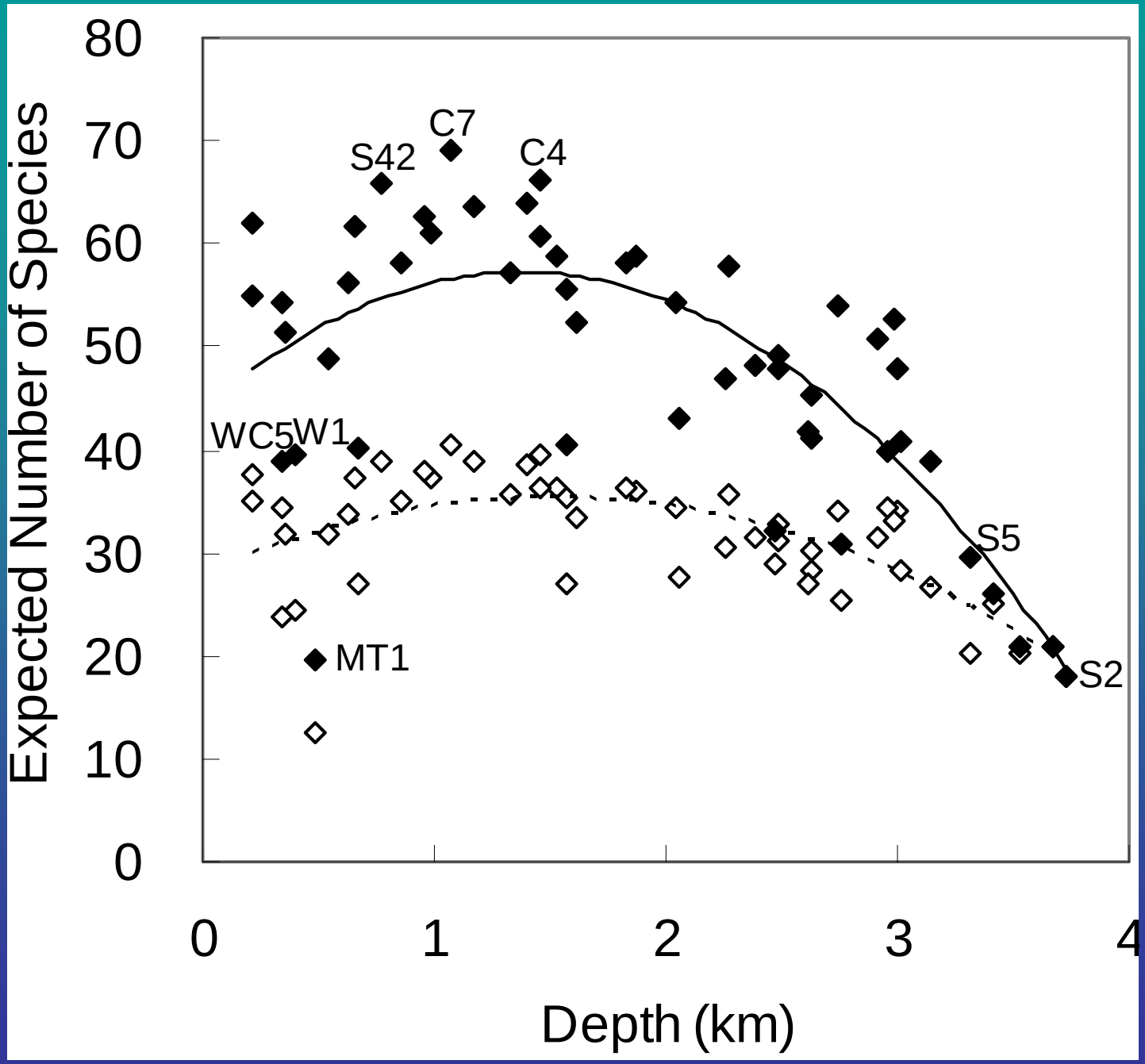


MACROFAUNA
(infauna and epifauna)

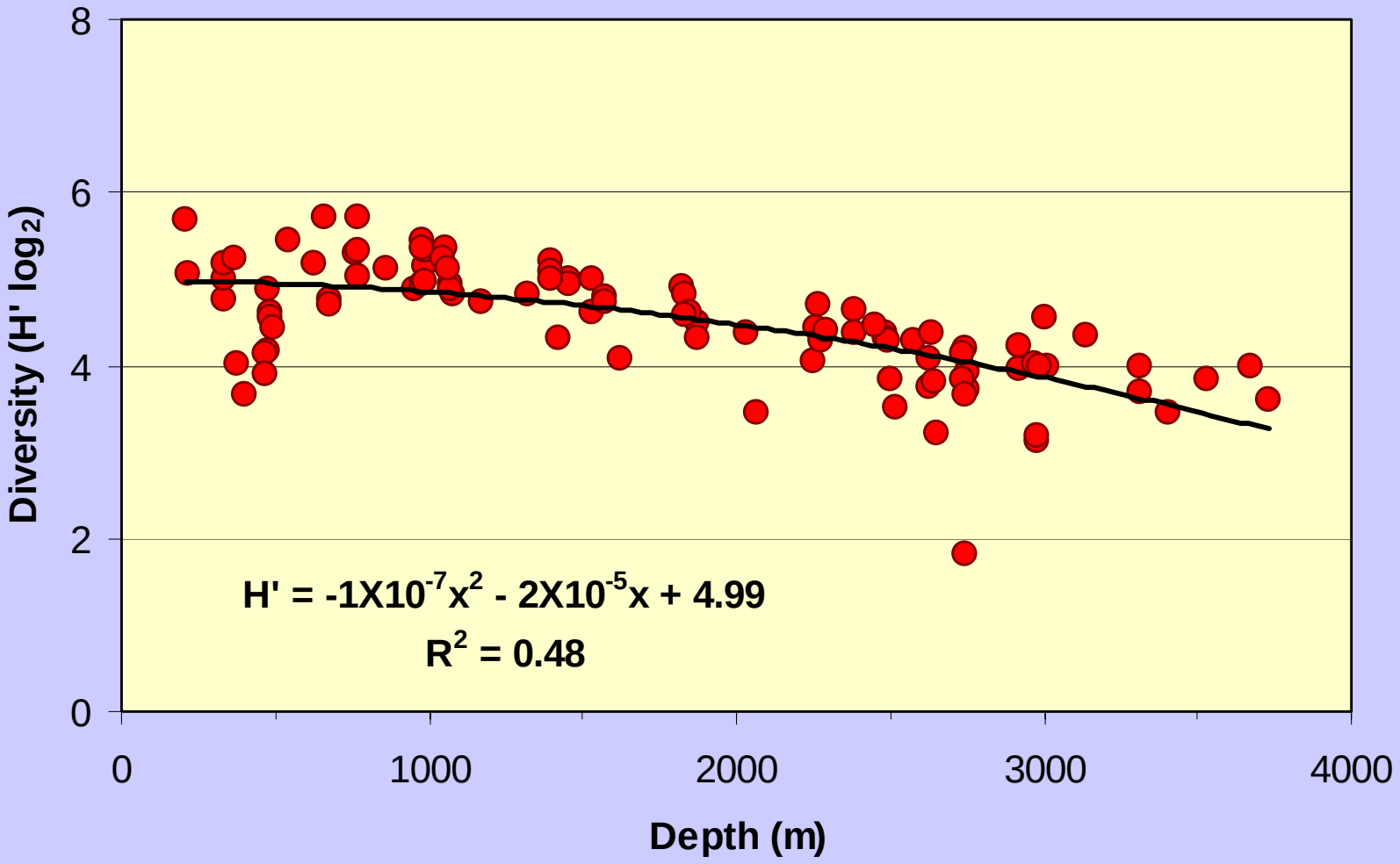


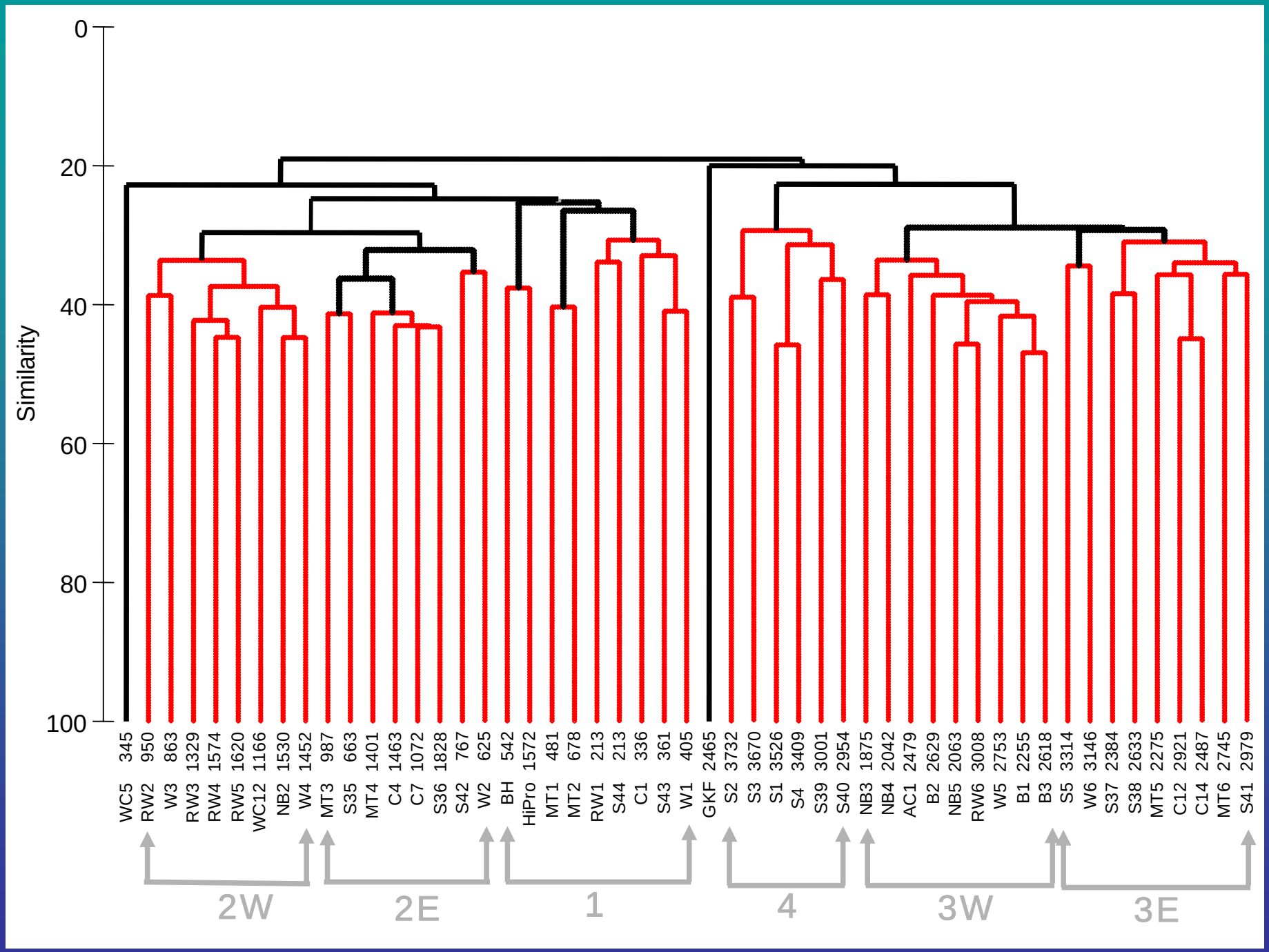

98°
96°
94°
92°
90°
88°
86°
84°
82°
80°
30°
28°
26°
24°
22°
20°
18°
Macrofaunal
Relative Densities
(number m-2)
RW1
2
3
4
5
6
AC
W1
2
3
4
5
6
WC5
BH
WC12
B1
NB2
B2
NB3
NB4
B3
NB5
MT1
C1
7
4
GKF
14
12
5
6
S35
38
39
40
41
42
43
44
SAP1
SAP2
SAP3
SAP4
SAP5
100 fms
1000 fms
100 fms
1000 fms

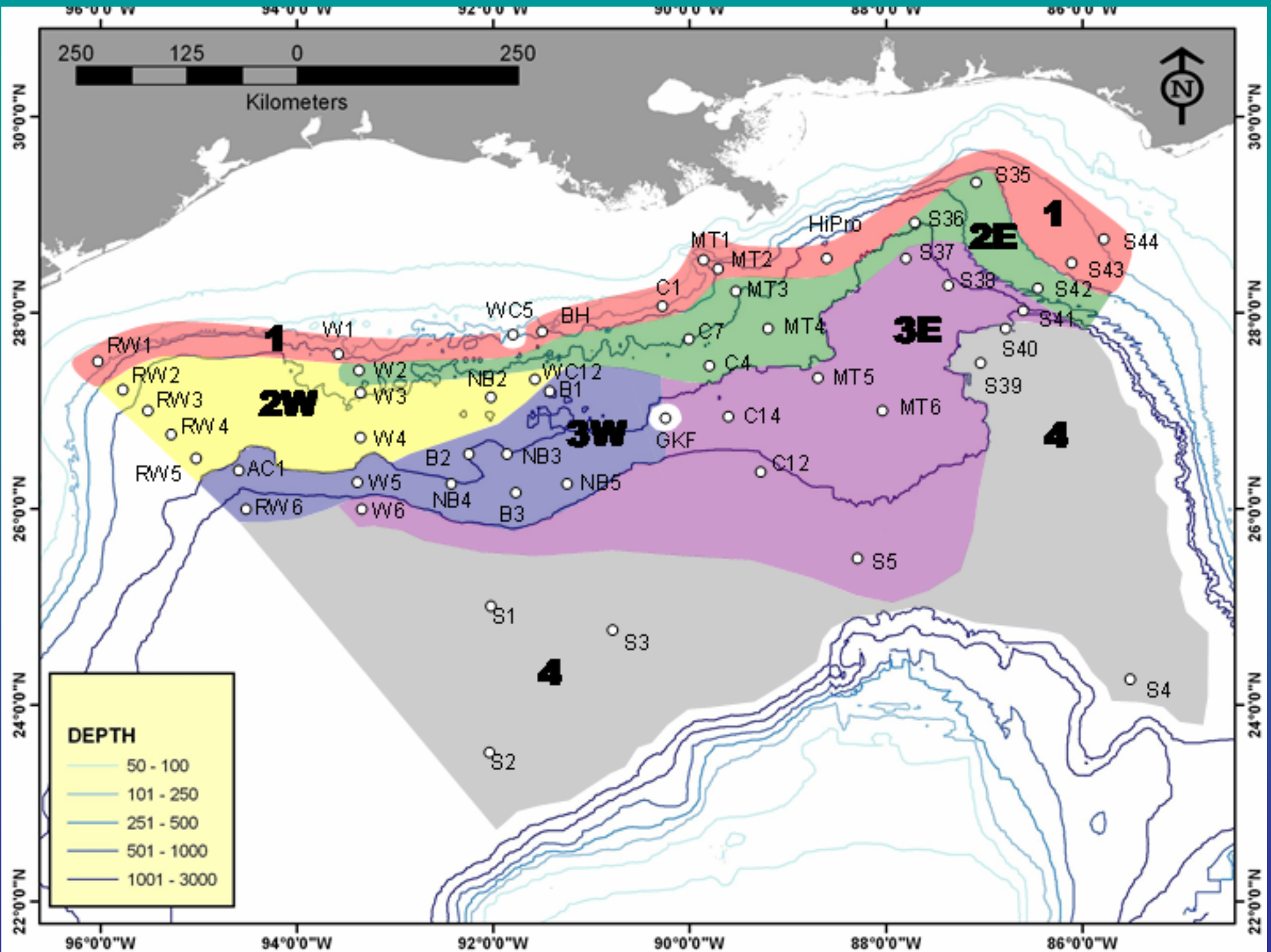
DGoMB station MT1, showing amphipod tubes on the surface with mounds, depressions, and lebensspuren


Expected Number of Species
80
70
60
50
40
30
20
10
0
0
1
2
3
4
Depth (km)
C7
S42
C4
WC5
W1
S5
MT1
S2

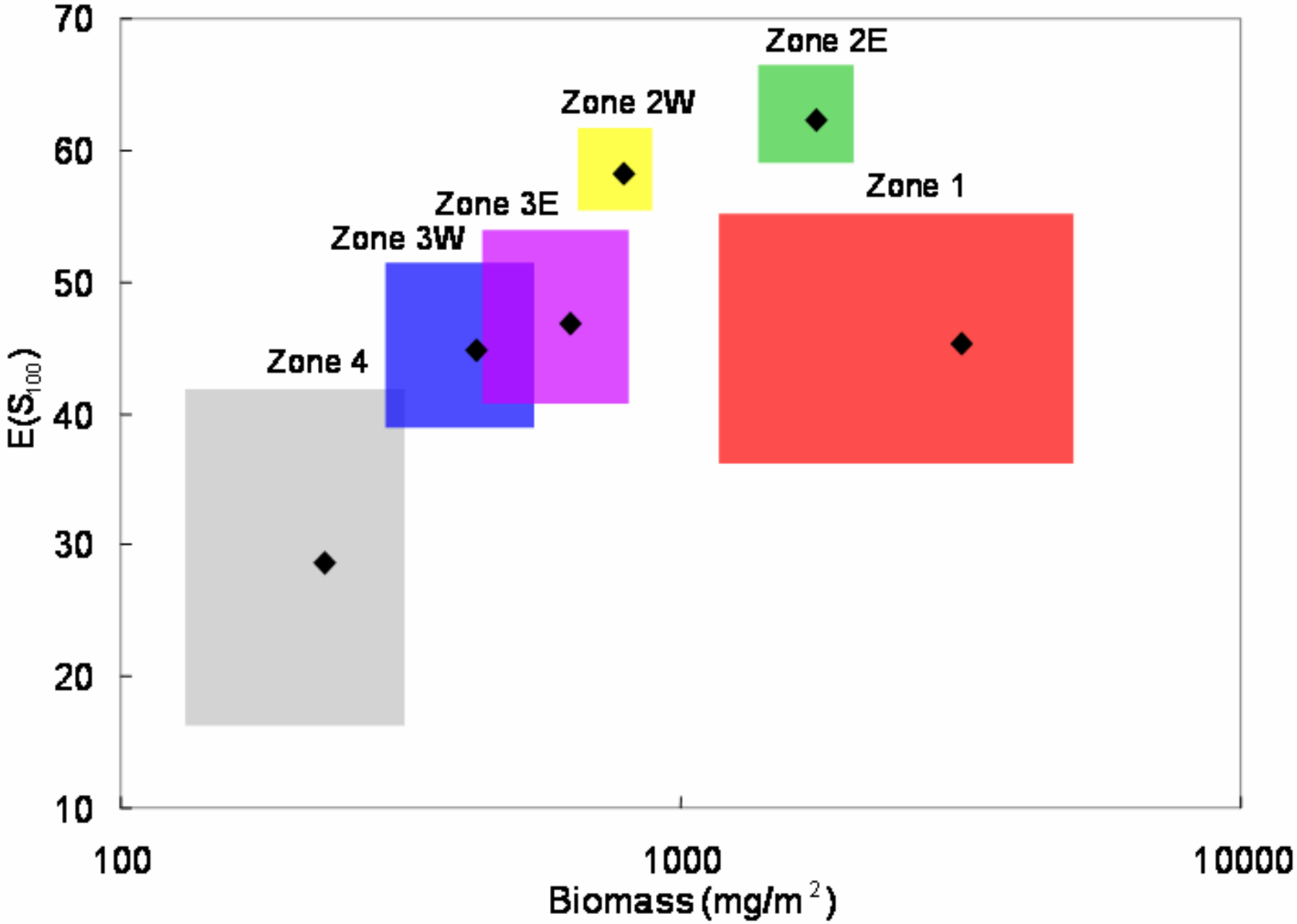
Polychaete Diversity by Depth



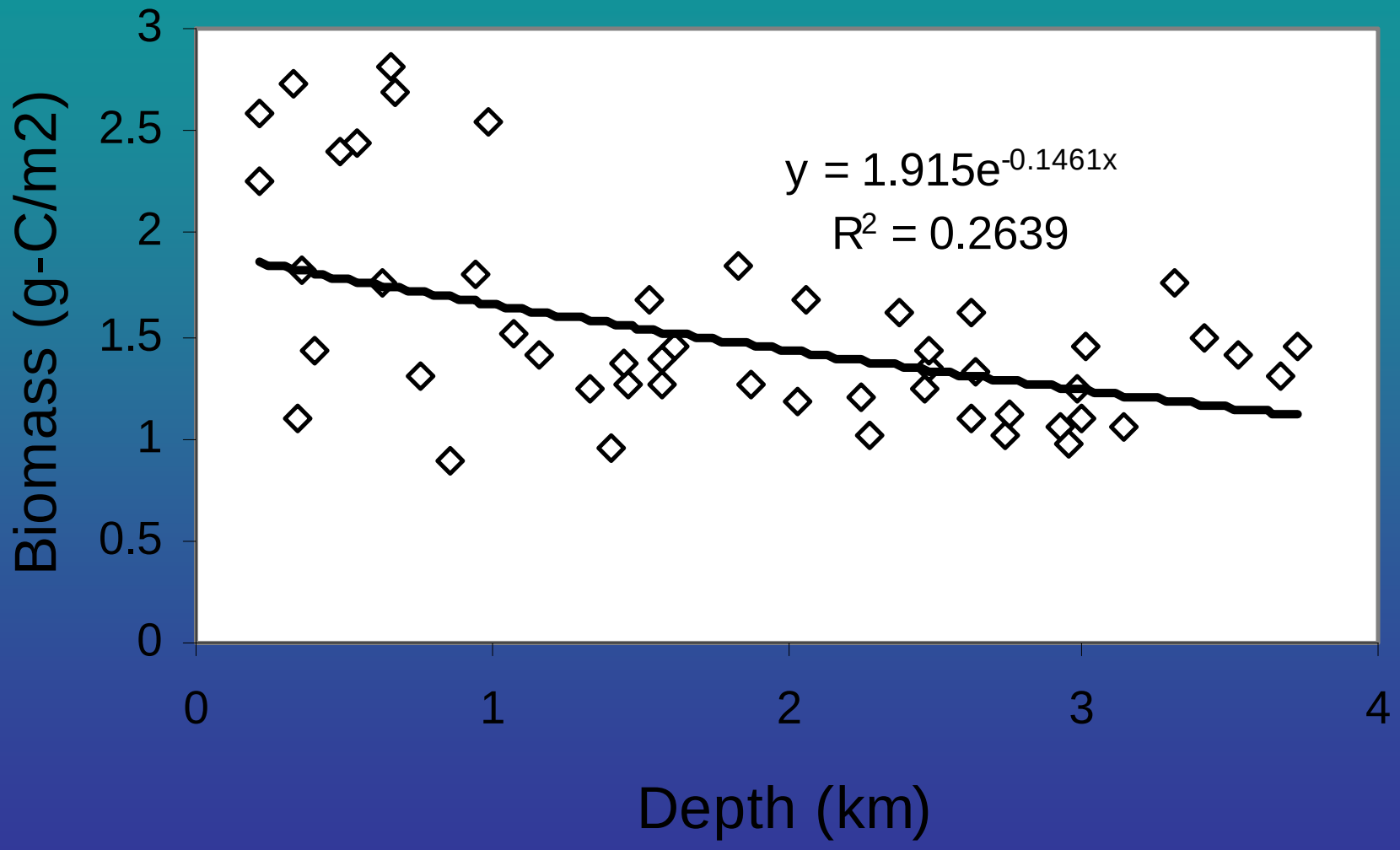

Similarity
0
20
40
60
80
100
WC5 345
RW2 950
W3 863
RW3 1329
RW4 1574
RW5 1620
WC12 1166
NB2 1530
W4 1452
MT3 987
S35 663
MT4 1401
C4 1463
C7 1072
S36 1828
S42 767
W2 625
BH 542
HiPro 1572
MT1 481
MT2 678
RW1 213
S44 213
C1 336
S43 361
W1 405
GKF 2465
S2 3732
S3 3670
S1 3526
S4 3409
S39 3001
S40 2954
NB3 1875
NB4 2042
AC1 2479
B2 2629
NB5 2063
RW6 3008
W5 2753
B1 2255
B3 2618
S5 3314
W6 3146
S37 2384
S38 2633
MT5 2275
C12 2921
C14 2487
MT6 2745
S41 2979
2W
2E
1
4
3W
3E



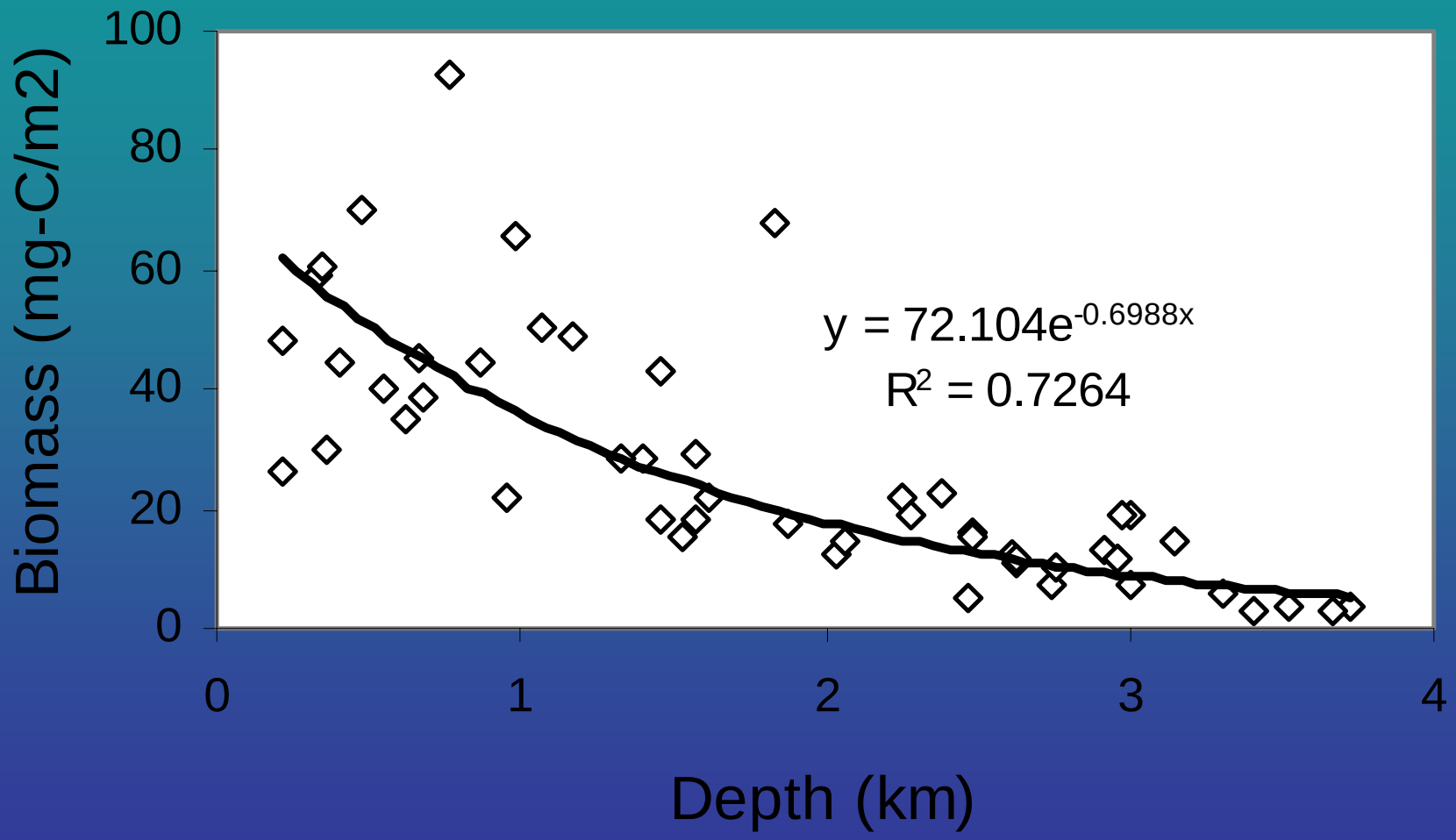
250 125 0 250
Kilometers
N
96°0'0"W
94°0'0"W
92°0'0"W
90°0'0"W
88°0'0"W
86°0'0"W
30°0'0"N
28°0'0"N
26°0'0"N
24°0'0"N
22°0'0"N
1
2W
2E
3W
3E
4
RW1
RW2
RW3
RW4
RW5
RW6
W1
W2
W3
W4
W5
W6
AC1
WC5
BH
NB2
WC12
B1
B2
NB3
NB4
B3
NB5
GKF
C1
C7
C4
C14
C12
MT1
MT2
MT3
MT4
MT5
MT6
HiPro
S35
S36
S37
S38
S39
S40
S41
S42
S43
S44
S5
S1
S2
S3
S4
DEPTH
50 - 100
101 - 250
251 - 500
501 - 1000
1001 - 3000


Zone 2E
Zone 2W
Zone 1
Zone 3E
Zone 3W
Zone 4
70
60
50
40
30
20
10
E(S100)
100
1000
10000
Biomass (mg/m2)

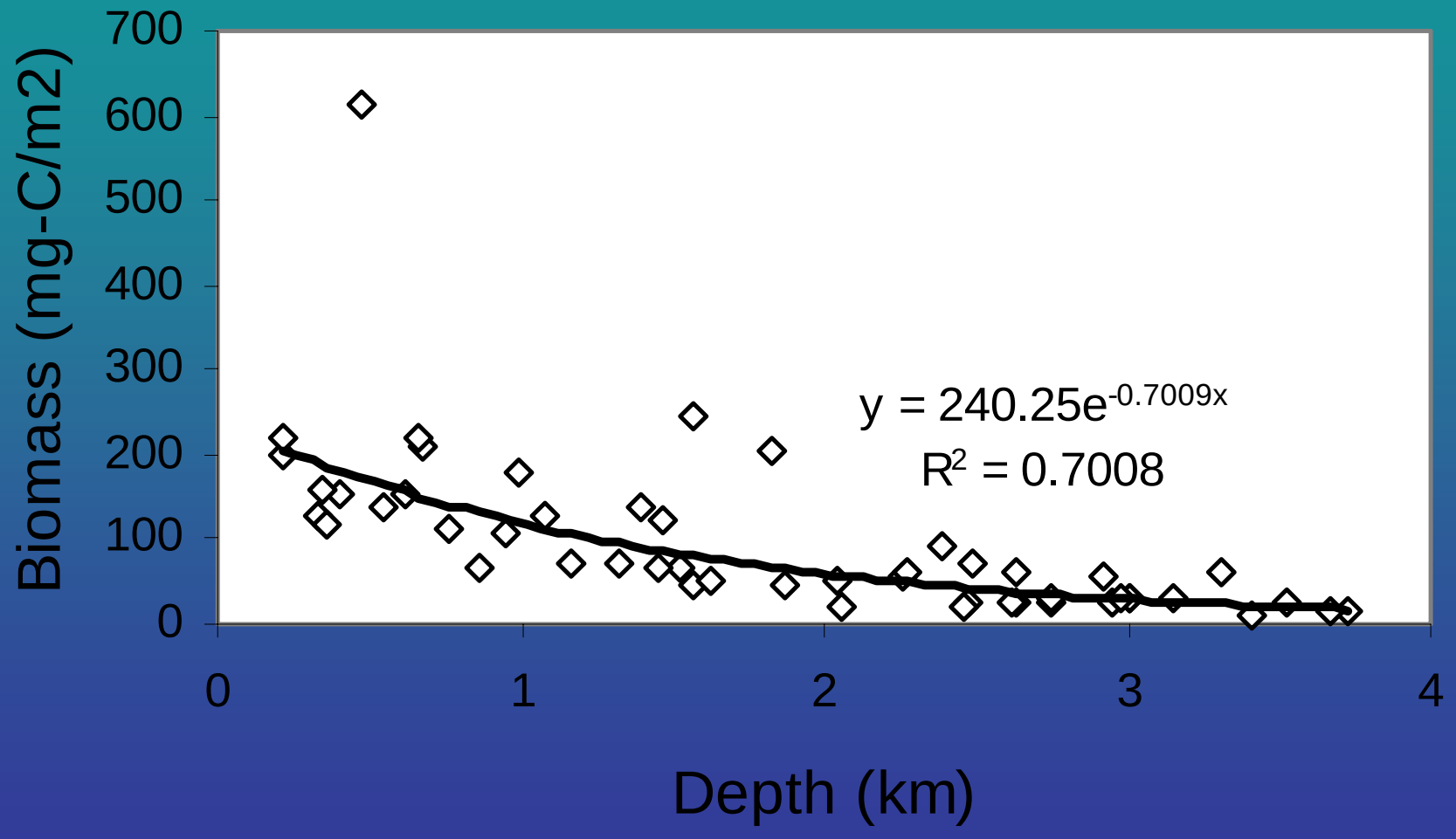
Bacteria


y = 1.915e-0.1461x
R2 = 0.2639
Biomass (g-C/m2)
Depth (km)
0
0.5
1
1.5
2
2.5
3
0
1
2
3
4

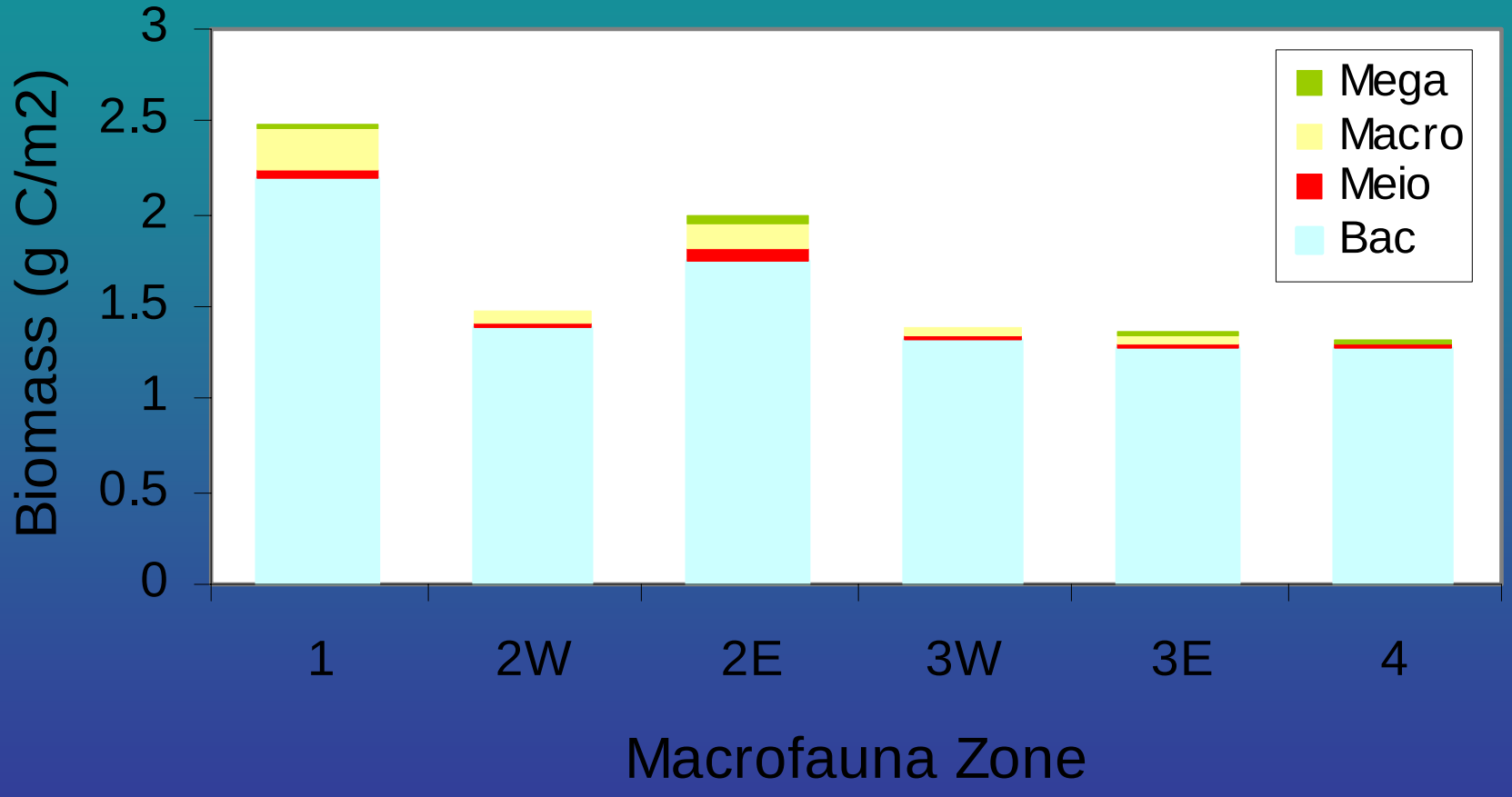
Meiofauna


Biomass (mg-C/m2)
100
80
60
40
20
0
0
1
2
3
4
Depth (km)
y = 72.104e-0.6988x
R2 = 0.7264

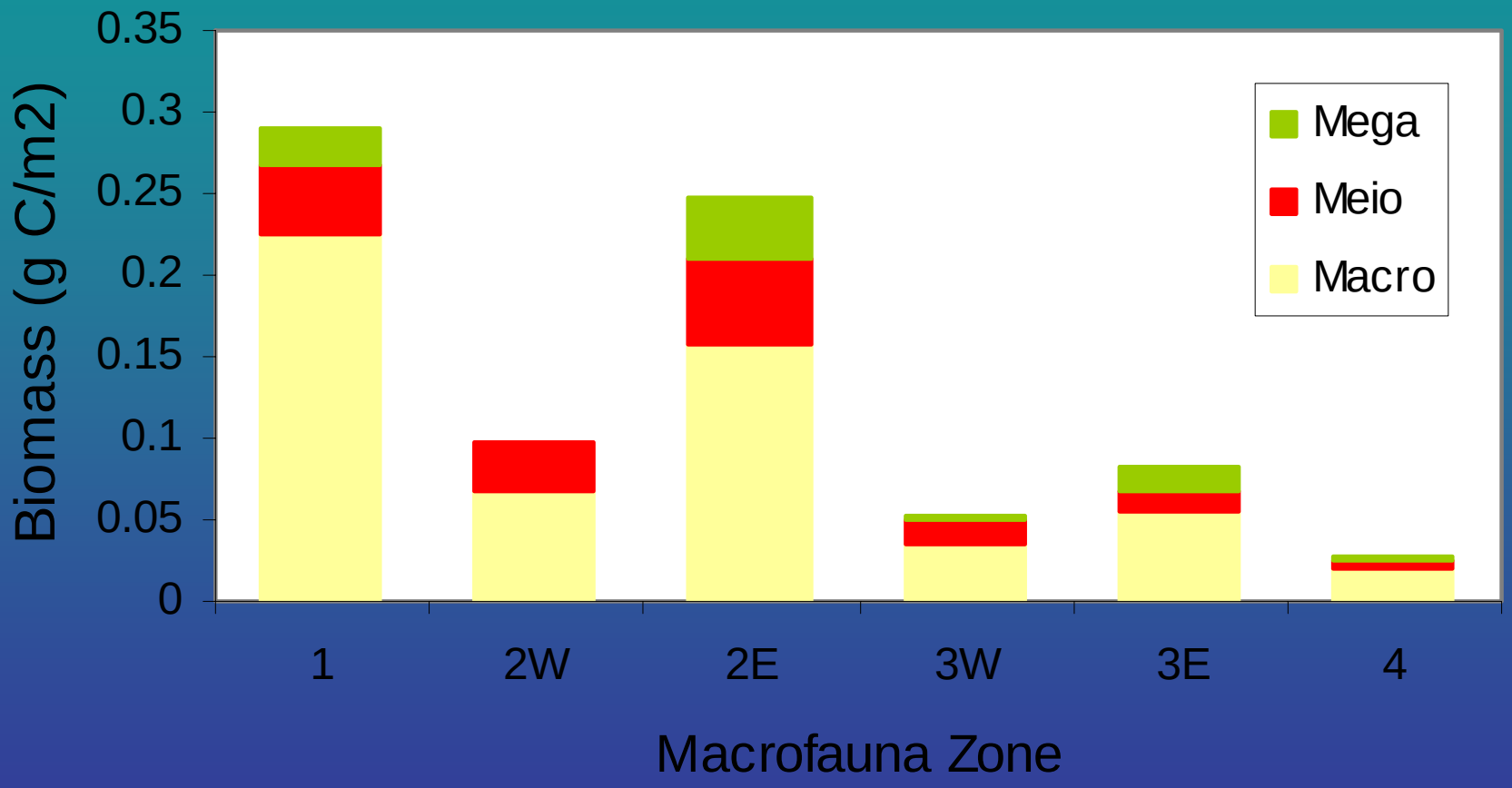
Macrofauna

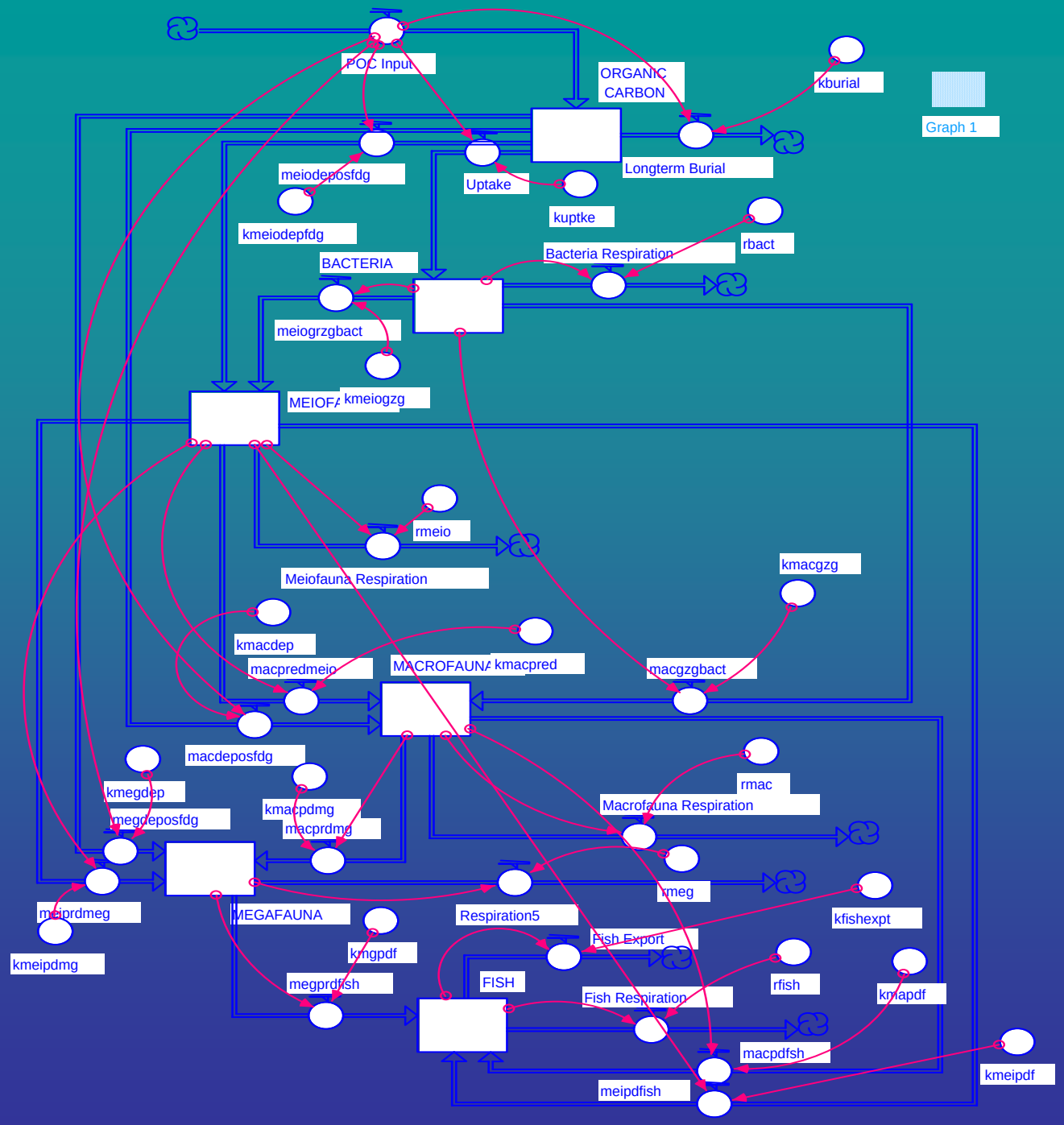

Biomass (mg-C/m2)
700
600
500
400
300
200
100
0
0
1
2
3
4
Depth (km)
y = 240.25e-0.7009x
R2 = 0.7008

Total Biomass



Total Biomass




POC Input
ORGANIC CARBON
kburial
Graph 1
meiodeposfdg
Uptake
Longterm Burial
kmeiodepfdg
kuptke
rbact
BACTERIA
Bacteria Respiration
meiogrzgbact
kmeiogzg
MEIOFA
rmeio
Meiofauna Respiration
kmacgzg
kmacdep
macpredmeio
MACROFAUNA
kmacpred
macgzgbact
macdeposfdg
kmegdep
megdeposfdg
kmacpdmg
macprdmg
rmac
Macrofauna Respiration
rmeg
meiprdmeg
MEGAFAUNA
Respiration5
kfishexpt
kmeipdmg
kmgpdf
Fish Export
megprdfish
FISH
rfish
kmapdf
Fish Respiration
macpdfsh
kmeipdf
meipdfish

d(fishes)/dt = feeding on carcasses, megafauna and macrofauna– respiration – feces – reproduction – loss to predation by other fishes – loss to fisheries

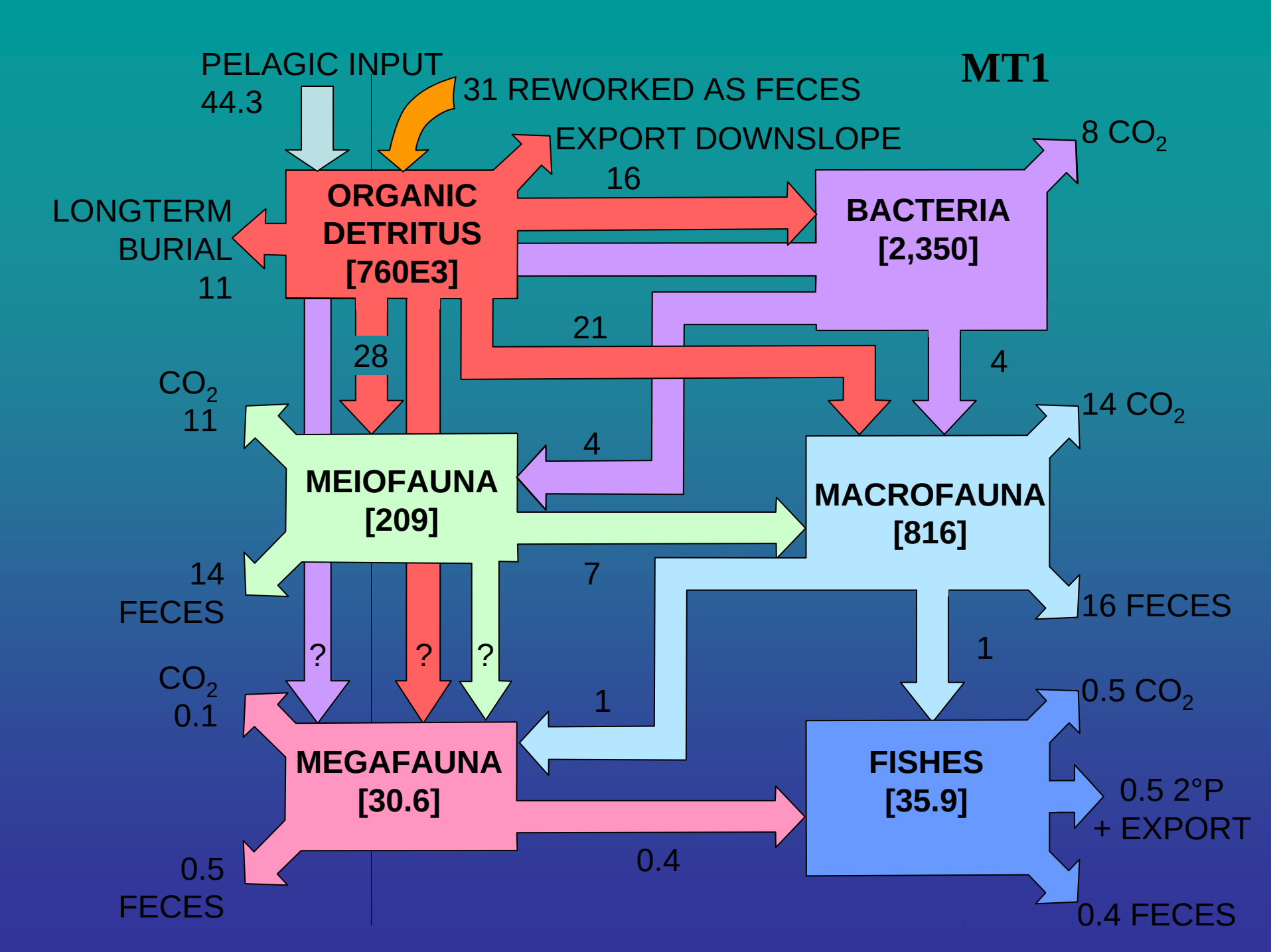
d(megafauna)/dt = feeding on carcasses, macrofauna and meiofauna– respiration – feces – reproduction – loss to predation by fishes – loss to fisheries

d(macrofauna)/dt = feeding on meiofauna, sediment OM and bacteria – respiration – feces – reproduction – loss to predation by megafauna and fishes

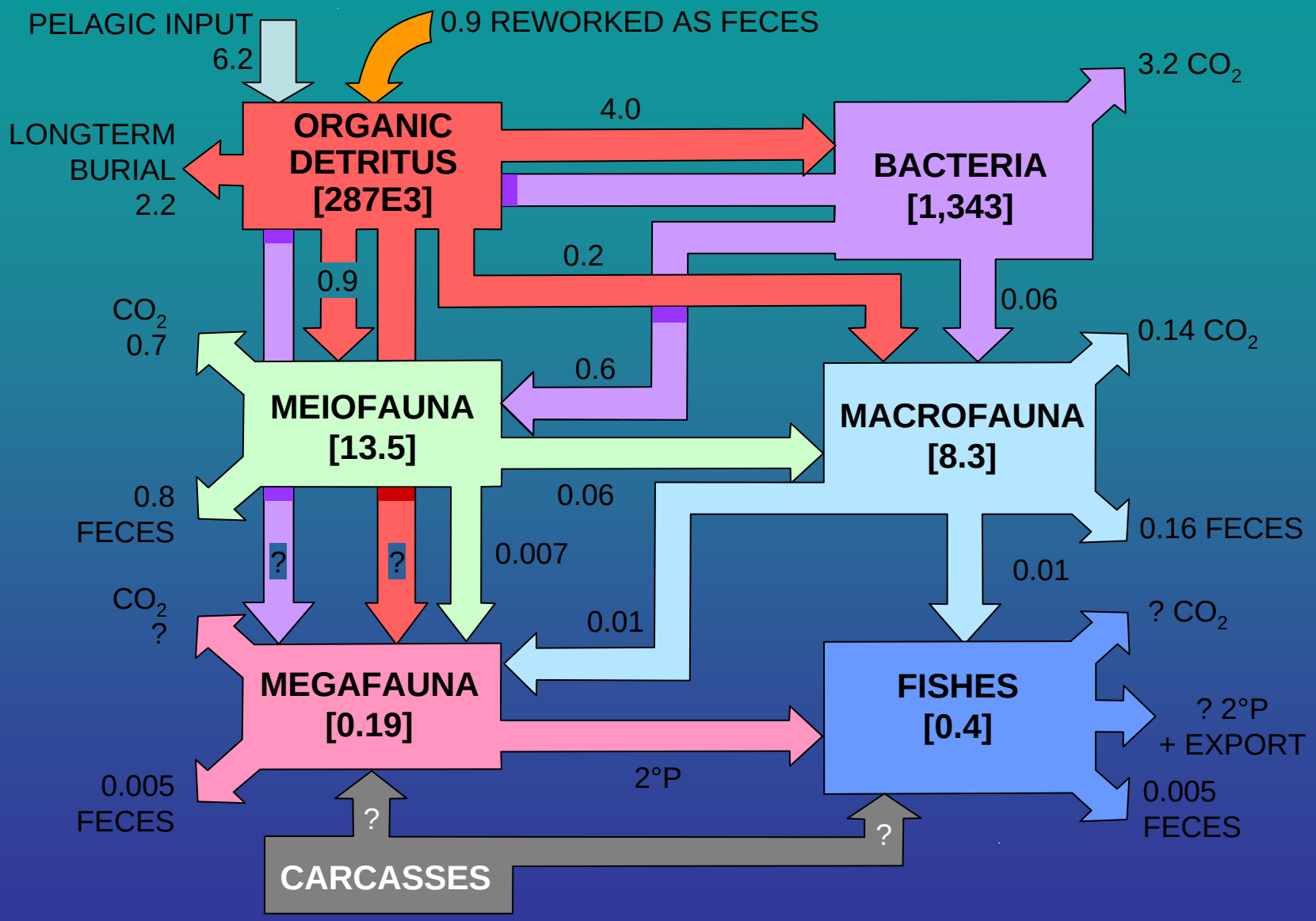
d(meiofauna)/dt = feeding on sediment OM and bacteria– respiration – feces – reproduction – loss to predation by macrofauna and megafauna

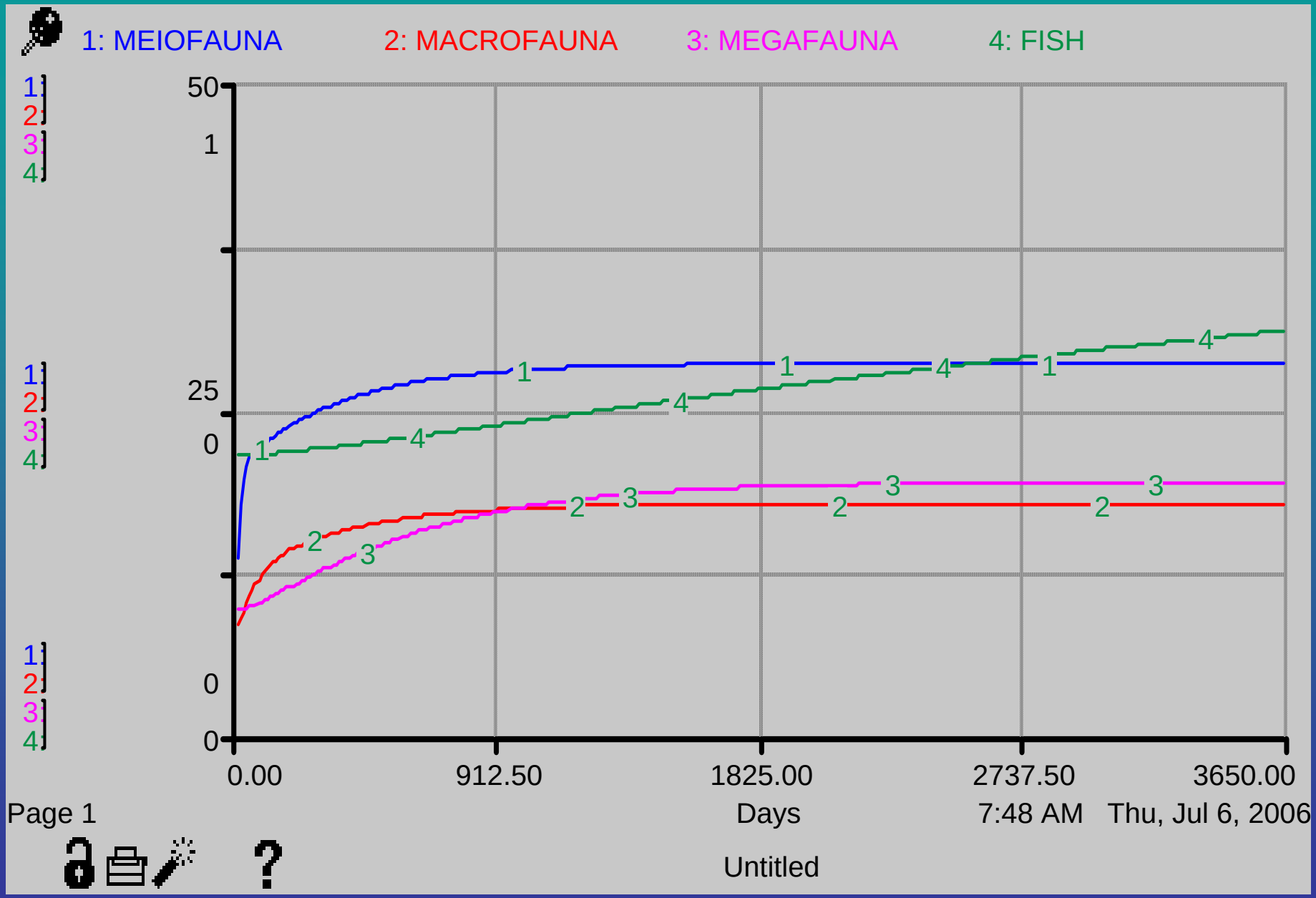
d(bacteria)/dt = feeding on OM in the sediments – respiration – reproduction – loss to predation by macrofauna and meiofauna

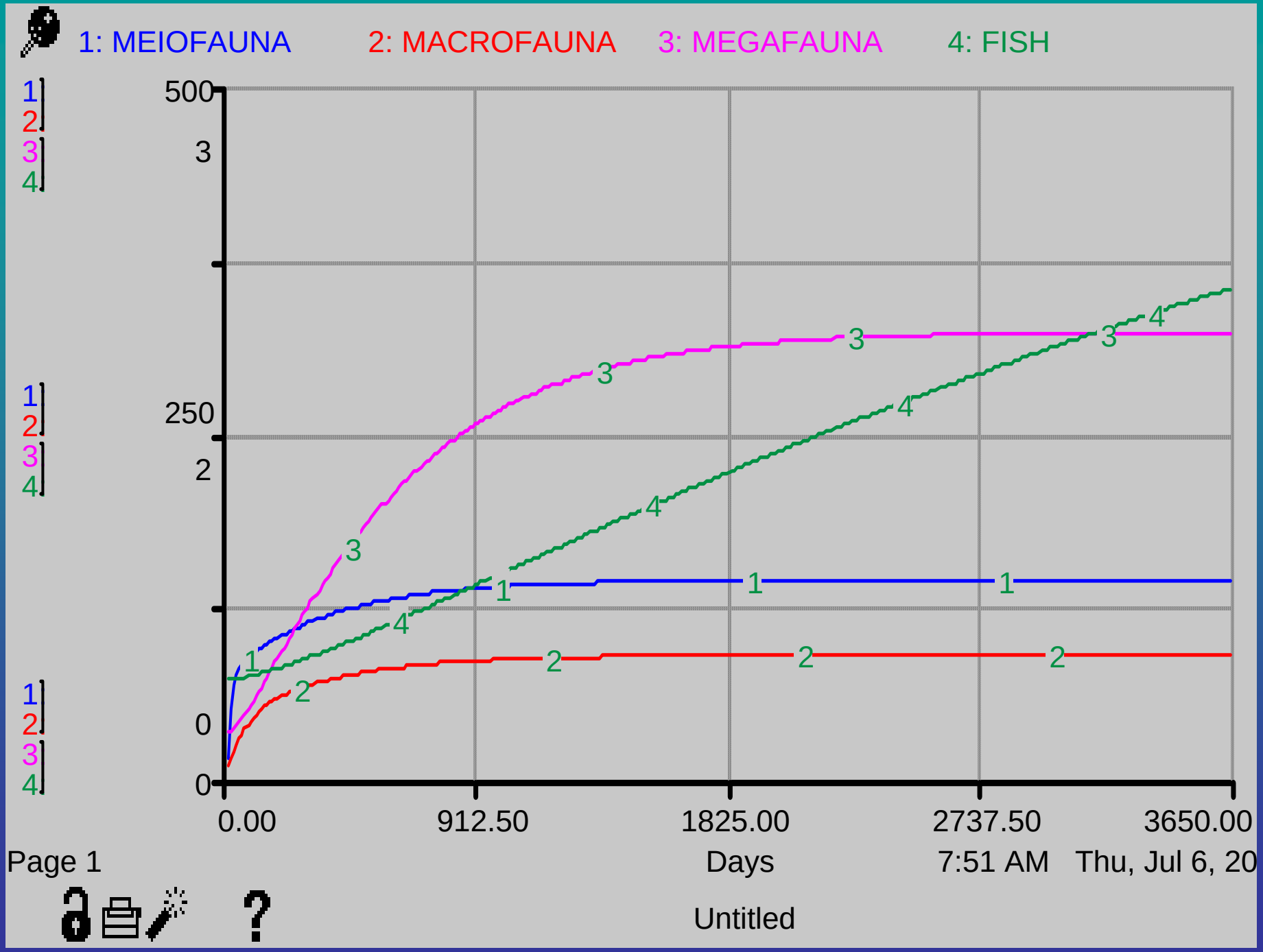
d(sediment OM)/dt = POC particle rain + carcasses + hydrocarbon seeps + feces (all metazoans) – consumption by bacteria – consumption by deposit feeding metazoans – burial – erosional processes


MT1
PELAGIC INPUT
44.3
31 REWORKED AS FECES
EXPORT DOWNSLOPE
16
8 CO_2
LONGTERM
BURIAL
11
ORGANIC
DETRITUS
[760E3]
BACTERIA
[2,350]
21
28
4
CO_2
11
14 CO_2
4
MEIOFAUNA
[209]
MACROFAUNA
[816]
14
FECES
7
16 FECES
?
?
?
1
CO_2
0.1
1
0.5 CO_2
MEGAFAUNA
[30.6]
FISHES
[35.9]
0.5 2°P
+ EXPORT
0.5
FECES
0.4
0.4 FECES

JSSD1


PELAGIC INPUT
6.2
0.9 REWORKED AS FECES
LONGTERM
BURIAL
2.2
ORGANIC
DETRITUS
[287E3]
4.0
BACTERIA
[1,343]
3.2 CO_2
0.2
0.9
0.06
CO_2
0.7
0.14 CO_2
0.6
MEIOFAUNA
[13.5]
MACROFAUNA
[8.3]
0.8
FECES
0.06
0.16 FECES
?
?
0.007
0.01
CO_2
?
0.01
? CO_2
MEGAFAUNA
[0.19]
FISHES
[0.4]
? 2°P
+ EXPORT
0.005
FECES
2°P
0.005
FECES
?
?
CARCASSES


1: MEIOFAUNA
2: MACROFAUNA
3: MEGAFAUNA
4: FISH
50
1
25
0
0
0
0.00
912.50
1825.00
2737.50
3650.00
Days
Page 1
7:48 AM
Thu, Jul 6, 2006
Untitled


1: MEIOFAUNA
2: MACROFAUNA
3: MEGAFAUNA
4: FISH
500
250
0
0.00
912.50
1825.00
2737.50
3650.00
Days
Page 1
7:51 AM
Thu, Jul 6, 20
Untitled

Conclusions

- Density and biomass decline abruptly with depth, with the exception of the bacteria;
- The GOM is depauperate, with the exception of the canyons;
- The fauna occurs in four zones parallel to the bathymetry; two are divided into sub-zones;
- Each zone and sub-zone has a characteristic biomass and diversity;
- Zones submerge in the central GOM, associated with the Mississippi Fan; and
- Zonation and diversity are a function of organic matter input.