

Mesopelagic fishes of the north-central Gulf of Mexico and preliminary trophodynamics descriptions

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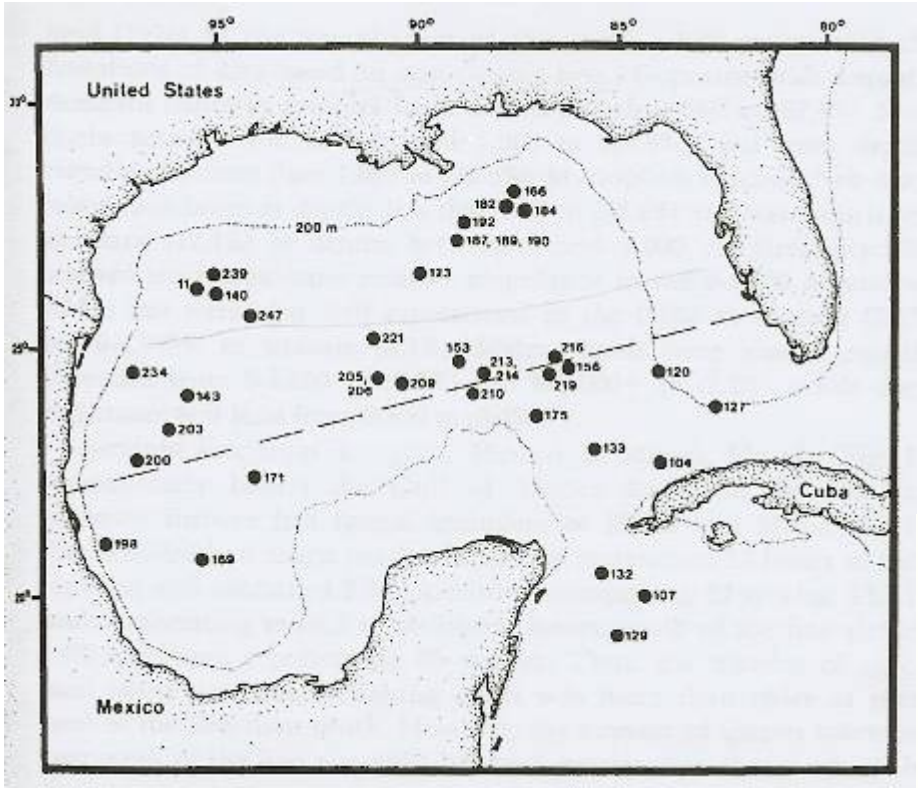
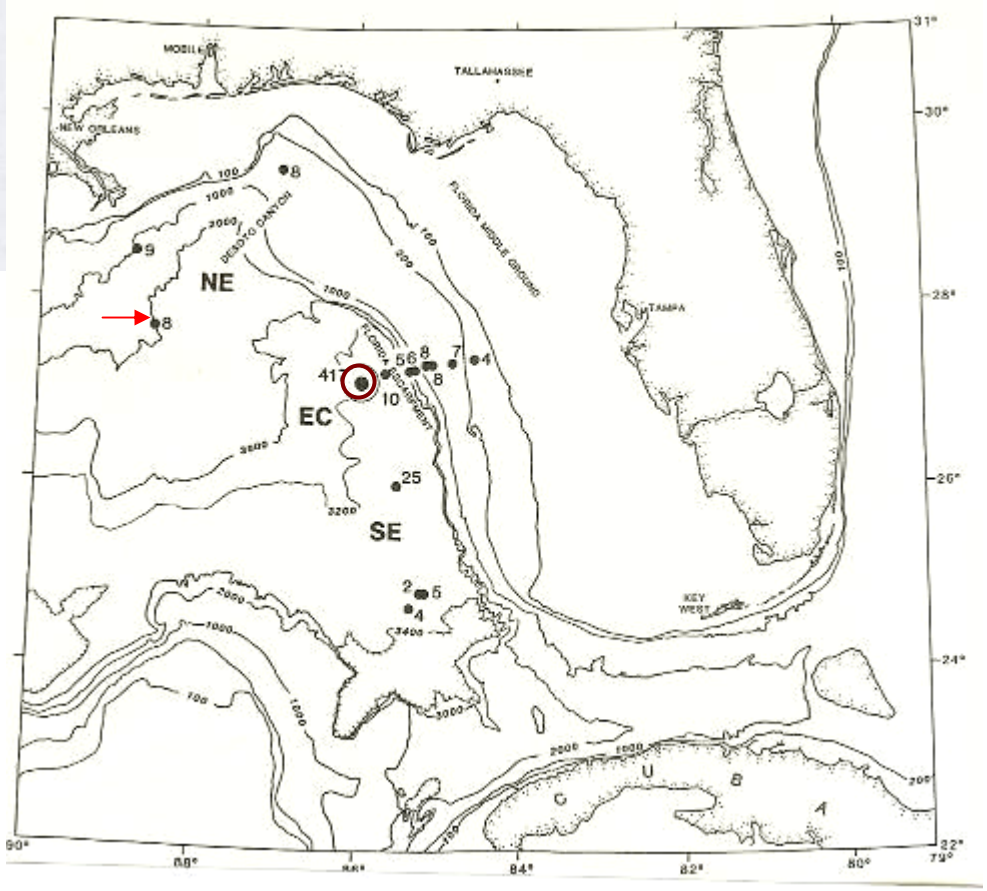
BACKGROUND

- Sampling for midwater fauna has been widespread in the GOM, usually < 1,000m, but rarely at discrete depths.
- Most detailed data and most depth discrete data were from the eastern GOM.
- Although midwater fauna is species rich, the GOM is dominated by few families and species.
- Micronekton (15–200 mm), most migrators, dominate samples.
- GOM is transitional region between Atlantic tropical (Caribbean) & subtropical (Sargasso) mesopelagic faunas, but probably tends toward tropical.



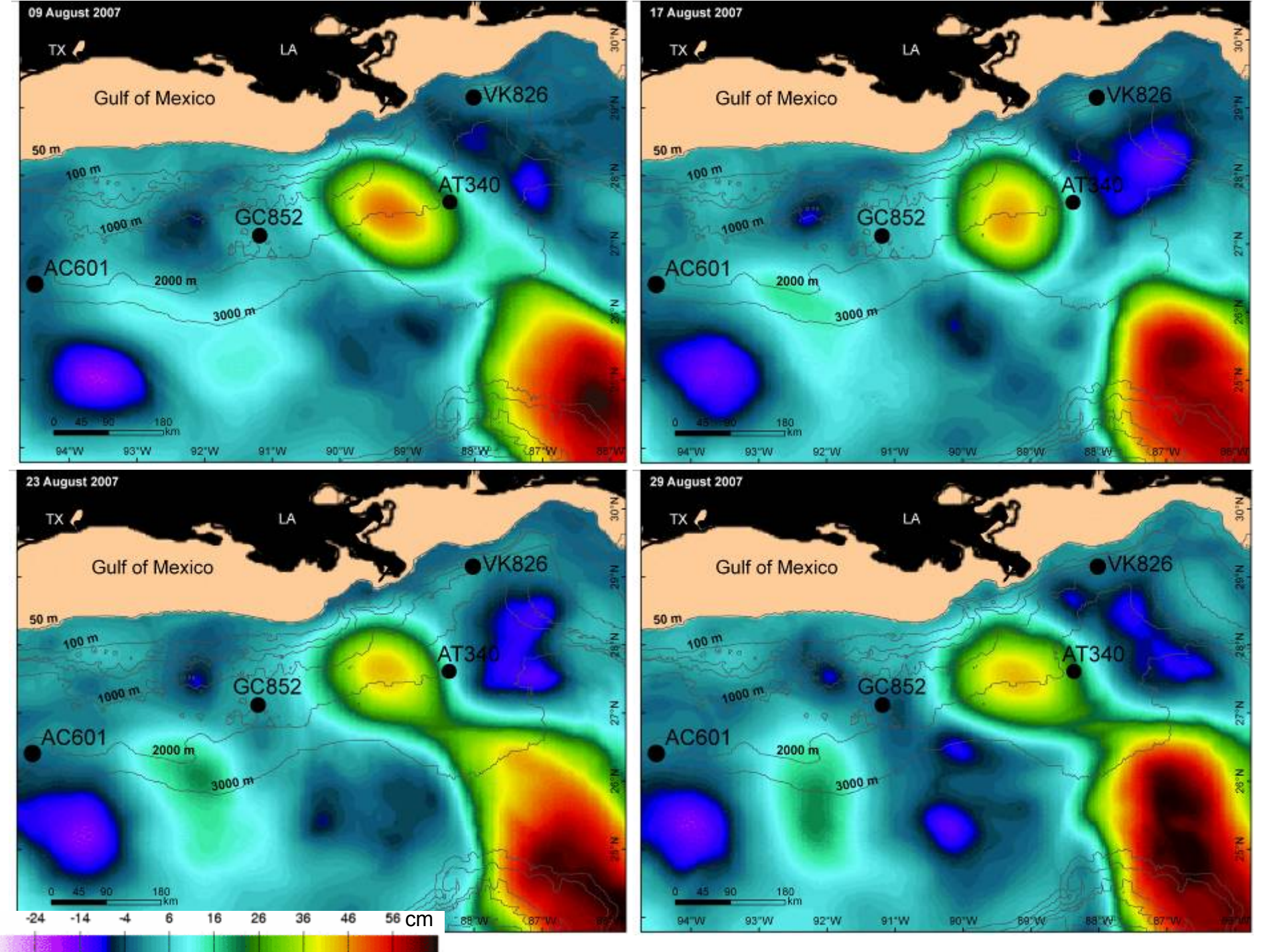
R/V Alaminos midwater stations, 1965–1973 (Murdy et al. 1983)

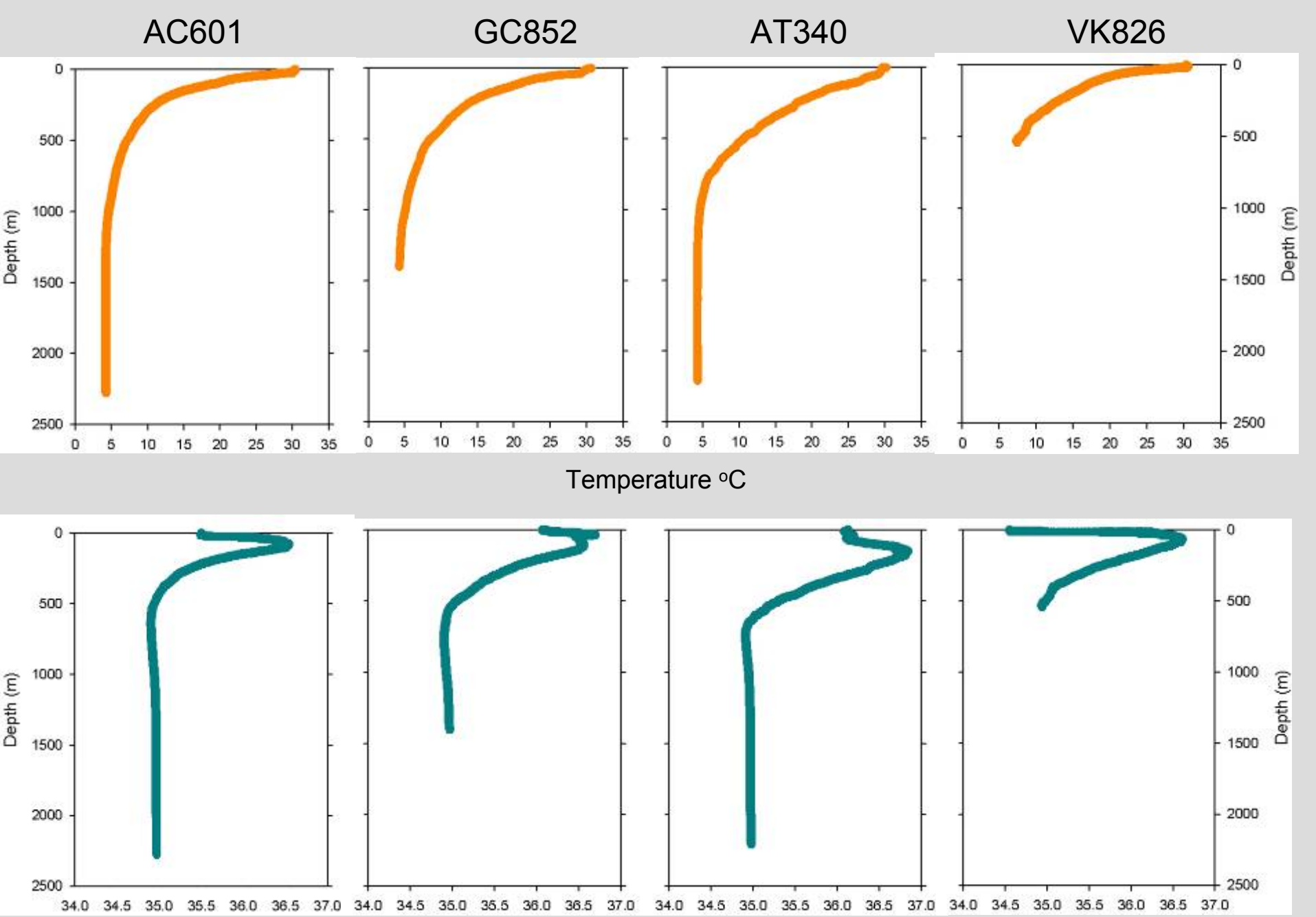


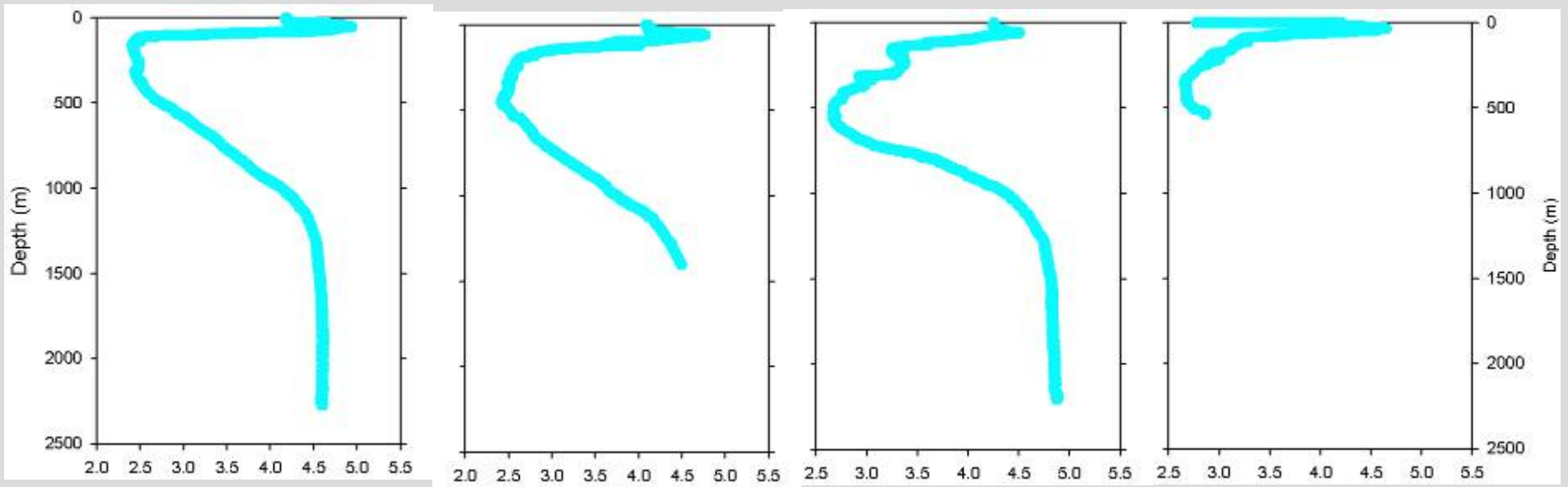
Tucker trawl stations, 1970–1977 (Gartner et al. 1987)

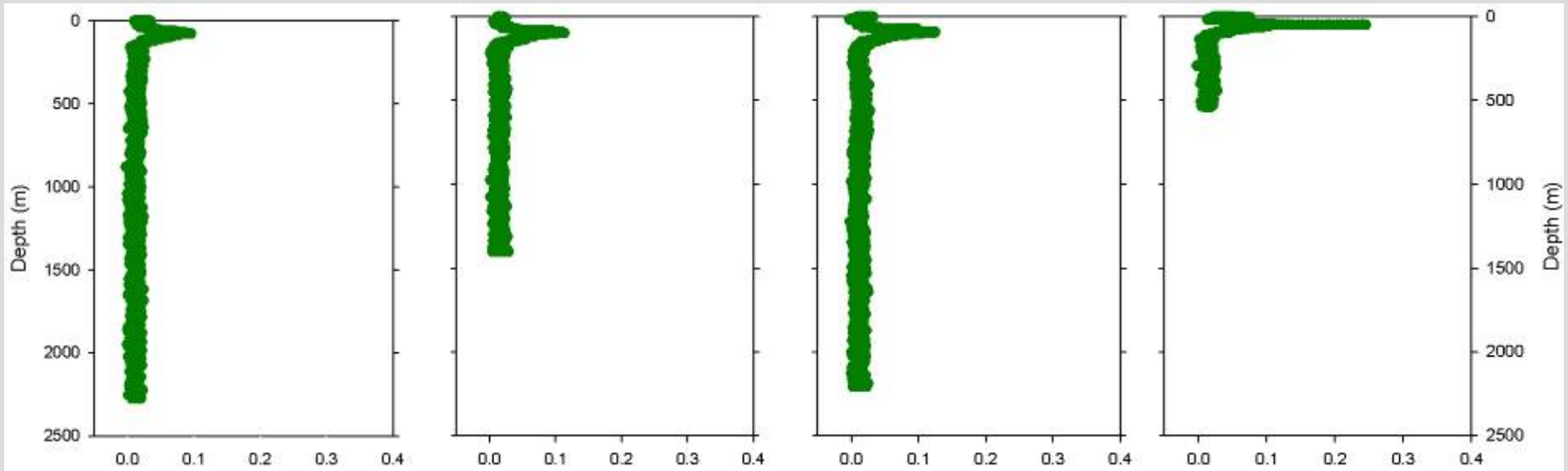
OBJECTIVES

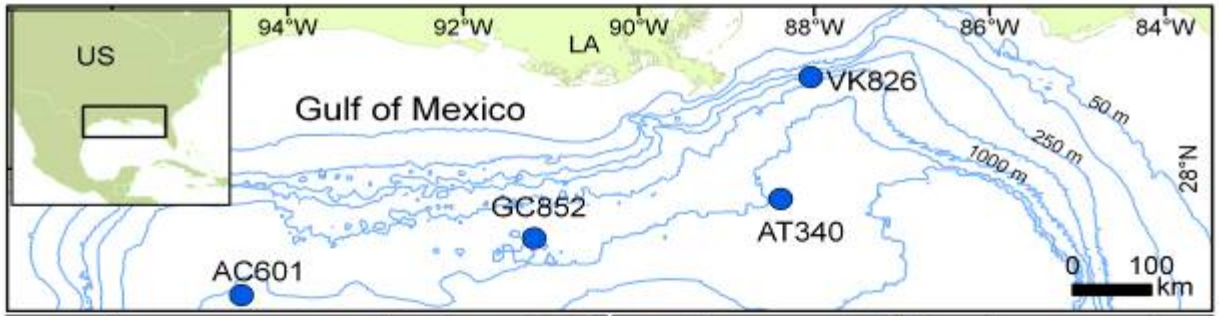
- Overall goal: sample relatively few sites intensively
- Characterize vertical distributions of mesopelagic fishes & describe diel migration patterns (if any)
- Describe size composition of midwater fishes
- Compare ichthyofaunal composition and behavior among the three offshore, deeper sites and the inshore study site
- Describe diet of dominant fishes and general feeding of whole community (preliminary)

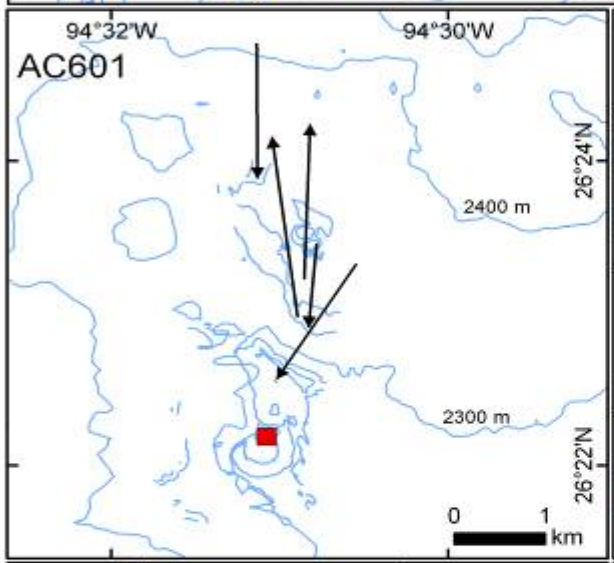

09 August 2007
17 August 2007
23 August 2007
29 August 2007
TX
LA
Gulf of Mexico
VK826
AT340
GC852
AC601
50 m
100 m
1000 m
2000 m
3000 m
0 45 90 180 km
94°W
93°W
92°W
91°W
90°W
89°W
88°W
87°W
30°N
29°N
28°N
27°N
26°N
25°N
-24 -14 -4 6 16 26 36 46 56 cm

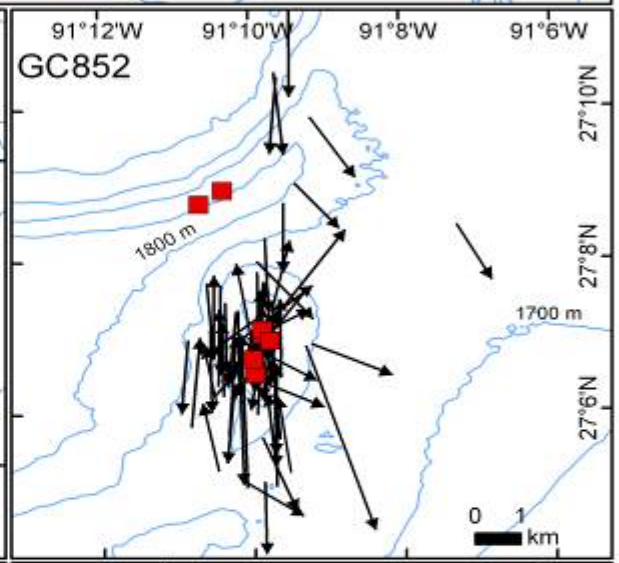

AC601
GC852
AT340
VK826
Depth (m)
0
500
1000
1500
2000
2500
0 5 10 15 20 25 30 35
Temperature °C
34.0 34.5 35.0 35.5 36.0 36.5 37.0
Salinity PSU

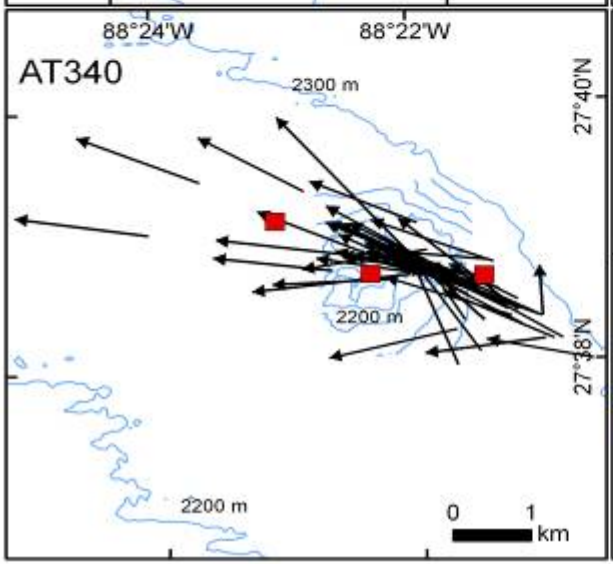

AC601
GC852
AT340
VK826
Depth (m)
0
500
1000
1500
2000
2500
2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5
Dissolved Oxygen ml/L

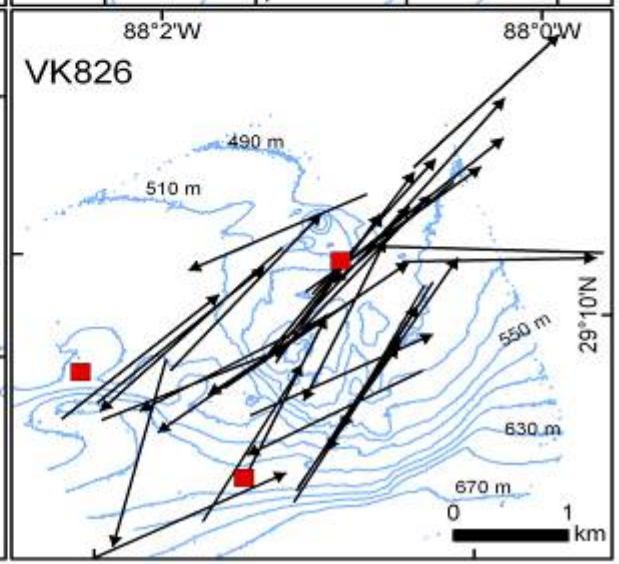

Depth (m)
0
500
1000
1500
2000
2500
0.0 0.1 0.2 0.3 0.4
Fluorescence ug/L









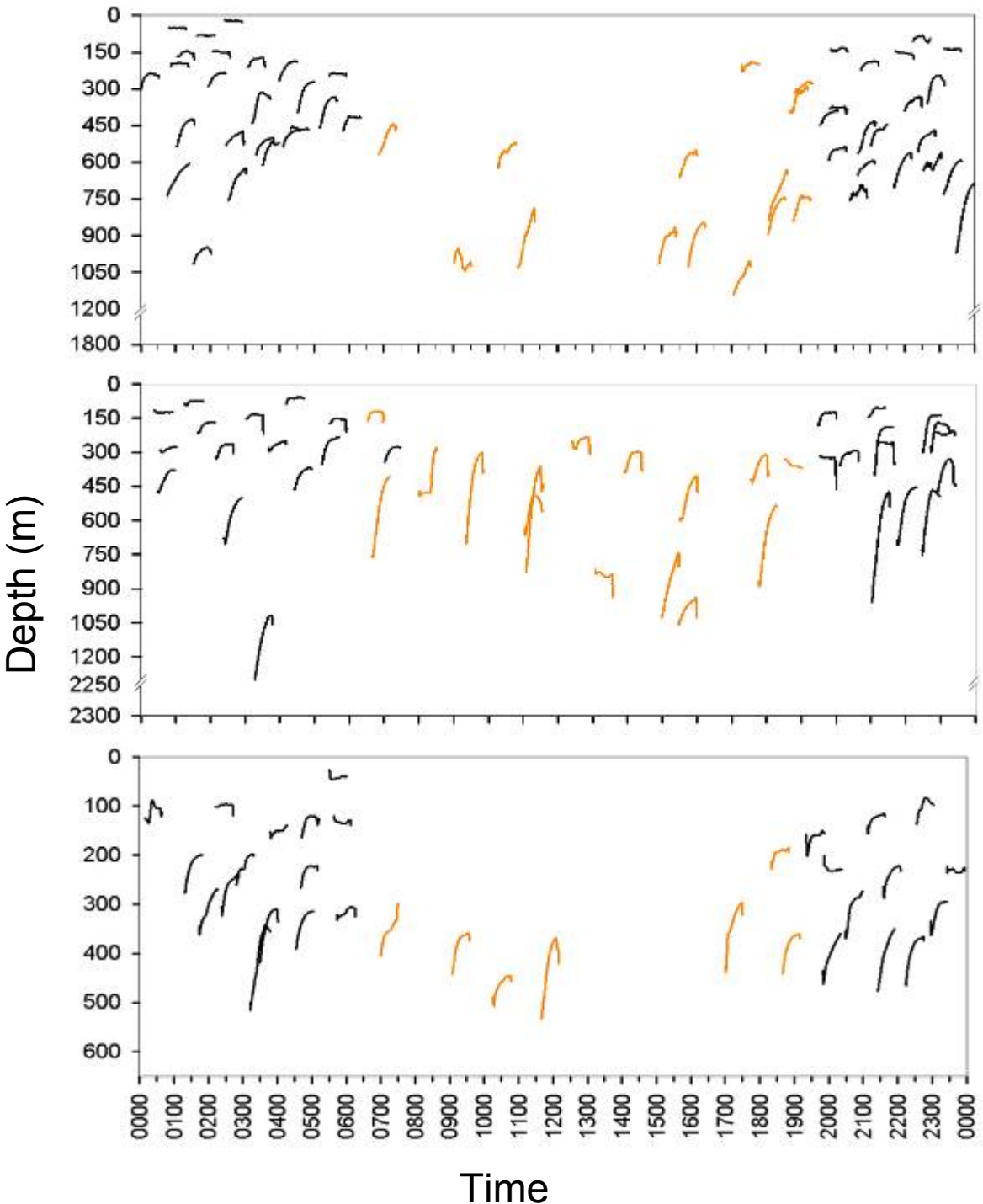


Depth discrete Tucker trawl stations = ⟶

TT = 30 min @ 2 kn

CTD stations = ■

Depth–Time Profiles



GC852
9–17 Aug 07

New moon
12 Aug

AT340
20–25 Aug

VK852
26–29 Aug

Full moon
28 Aug

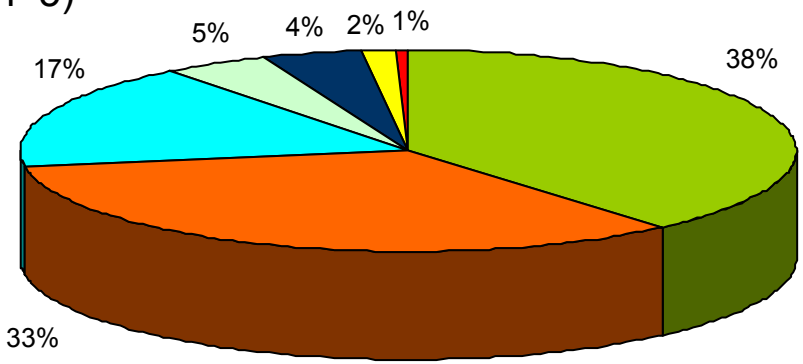
Overall Catch Summary

- 159 TT stations yielded 126 spp. mesopelagic fishes (30 families; 9,728 individuals)
- Dominant families
  - Myctophidae (38 species)
  - Stomiidae (17 species)
  - Gonostomatidae (12 species)
  - Sternoptychidae (10 species)
- Three spp. new to GOM: *Ceratias uranoscopus*, *C. holboelli*, & *Sphyraenops bairdianus*
- Maybe two new spp. of *Cyclothone*
- One endemic sp. collected: *Stemonosudis bullisi*

Families Relative Abundance (%)

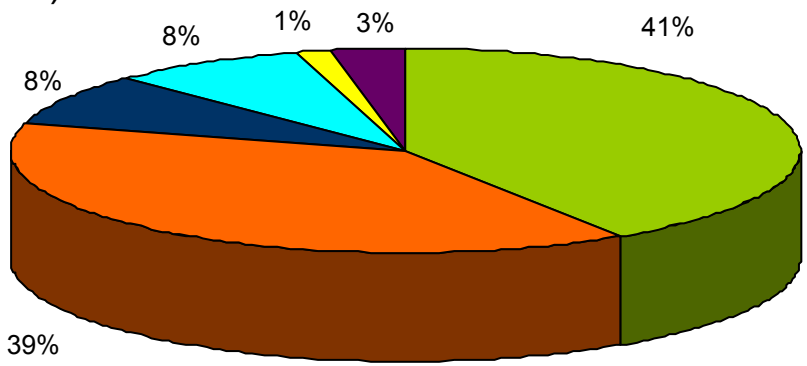
AC601
(n=5)

31 spp.



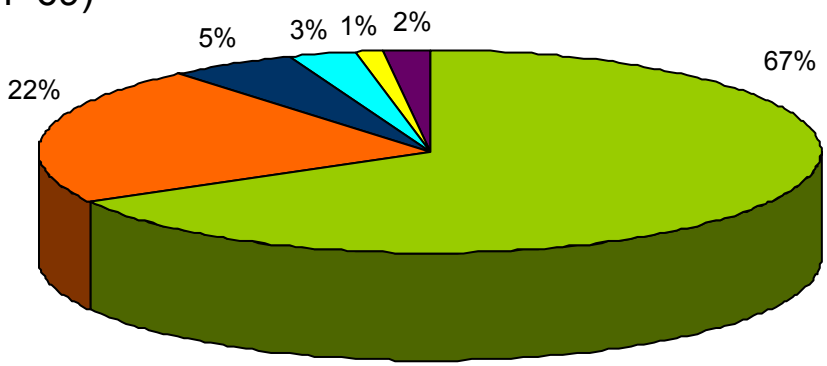
AT340
(n=49)

82 spp.



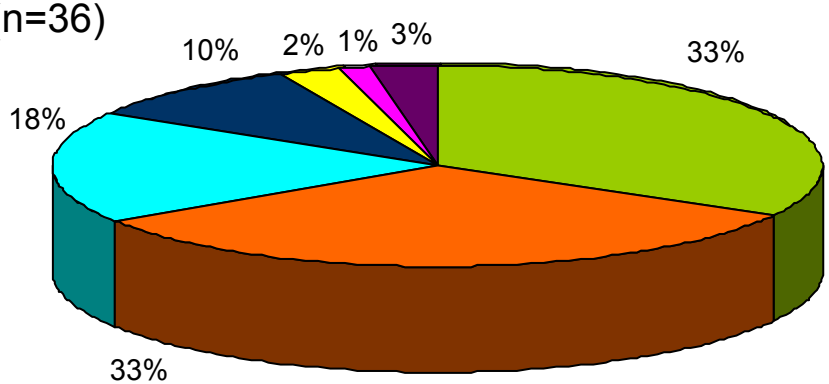
GC852
(n=69)

105 spp.



VK826
(n=36)

57 spp.



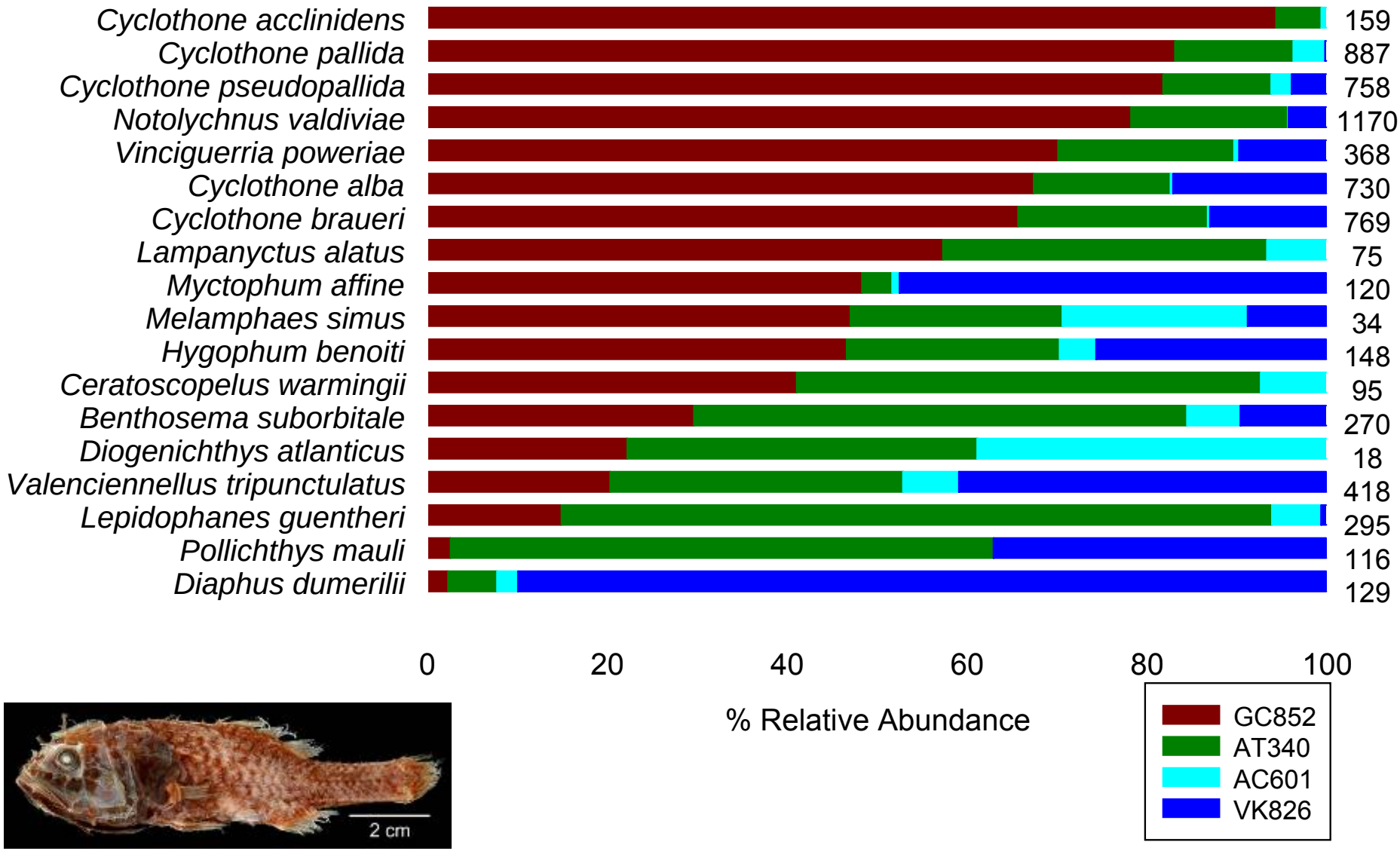
Gonostomatidae
Myctophidae
Sternoptychidae
Melamphaidae
Phosichthyidae
Stomiidae
Chlorophthalmidae
Bregmacerotidae
Other

Dominant Fishes over Cold Seep and Cold Coral Sites

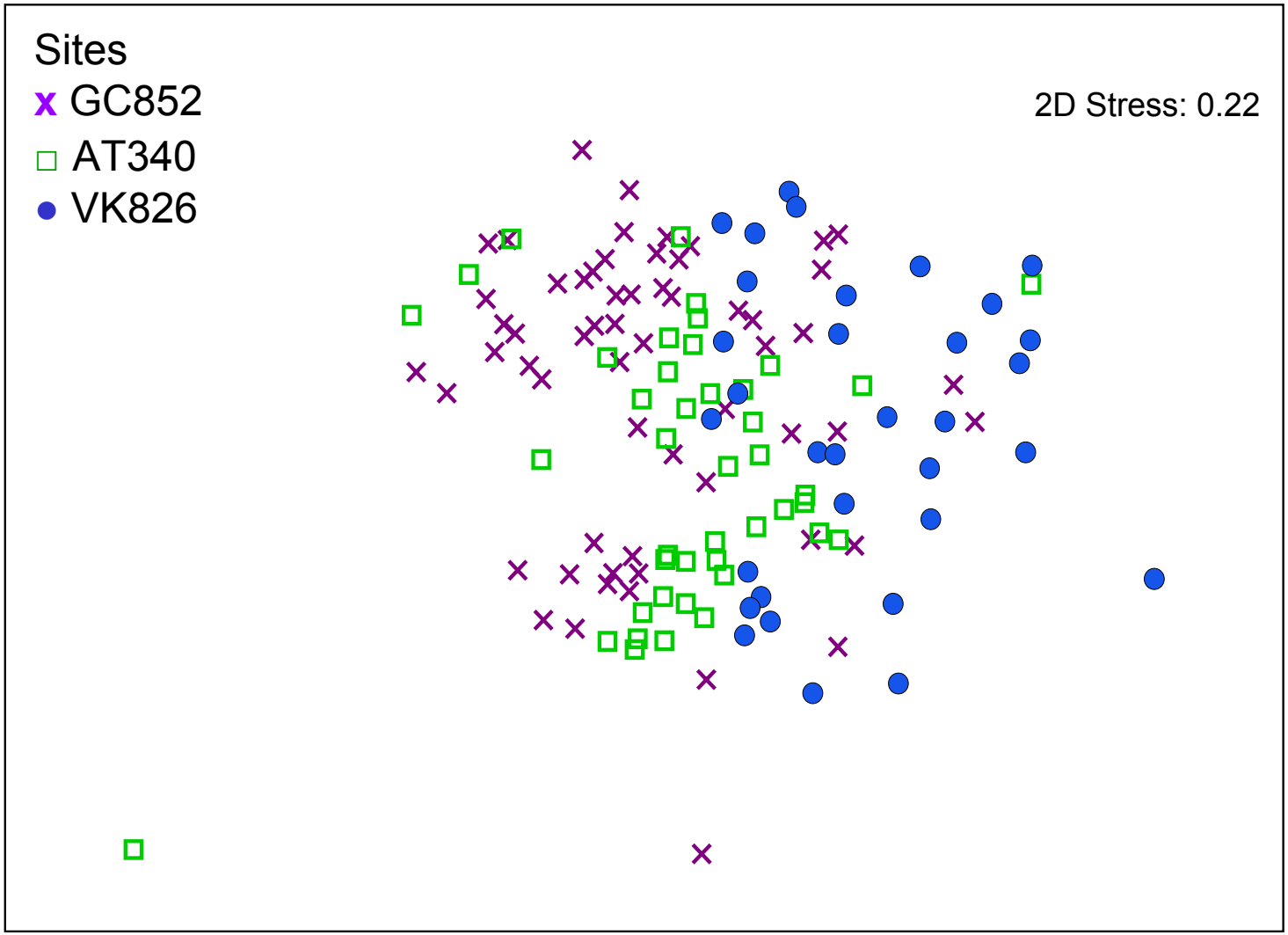
Taxa	AC601	GC852	AT340	VK826
Gonostomatidae				
Cyclothone acclinidens	*	2.42	*	
Cyclothone alba	*	7.94	4.96	**11.36**
Cyclothone braueri	*	88.155	**7.24**	9.09
Cyclothone pallida	**15.74**	**11.90**	5.23	*
Cyclothone pseudopallida	8.63	**10.01**	4.07	2.73
Sternoptychidae				
Valenciennellus tripunctulatus	**13.20**	1.37	6.08	**15.55**
Phosichthyidae				
Pollichthys mauli		*	3.13	3.91
Vinciguerria poweriae	*	4.17	3.22	3.27
Mycthophidae				
Benthosema suborbitale	**8.12**	1.29	6.62	*
Ceratoscopelus warmingii	3.55	*	*	
Diaphus dumerilii	*	*	*	**10.55**
Diogenichthys atlanticus	3.55	*	*	
Hygophum benoiti	3.05	1.11	*	3.45
Lampanyctus alatus	2.54	*	*	
Lepidophanes guentheri	**8.12**	*	**10.42**	*
Myctophum affine	*	*	*	5.18
Notolychnus valdiviae	*	**14.77**	**9.12**	4.55
Melamphaidae				
Melamphaes simus	3.55	*	*	*
Relative abundance (%)	70.05	63.13	60.08	69.64

* Species present but not within the top ten.

Top Ten Species over Cold Seep and *Lophelia pertusa* Sites



Multi-Dimensional Scaling (MDS): All Sites

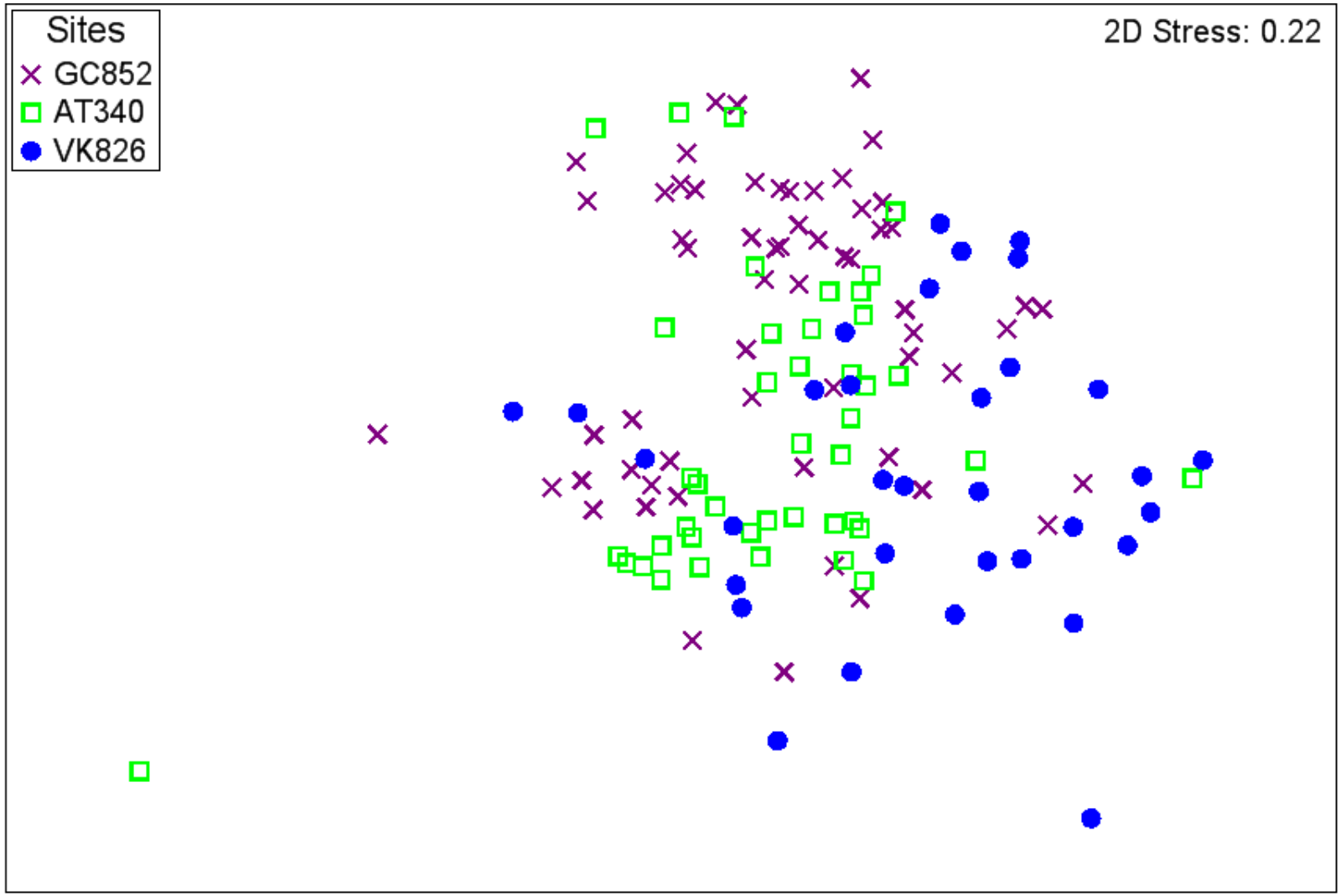


Analysis of Similarities (ANOSIM)

Fish assemblages are similar among sites.

(Global R=0.22, *p*=0.1%)

Multi-Dimensional Scaling (MDS): All Sites, Rare Species Removed

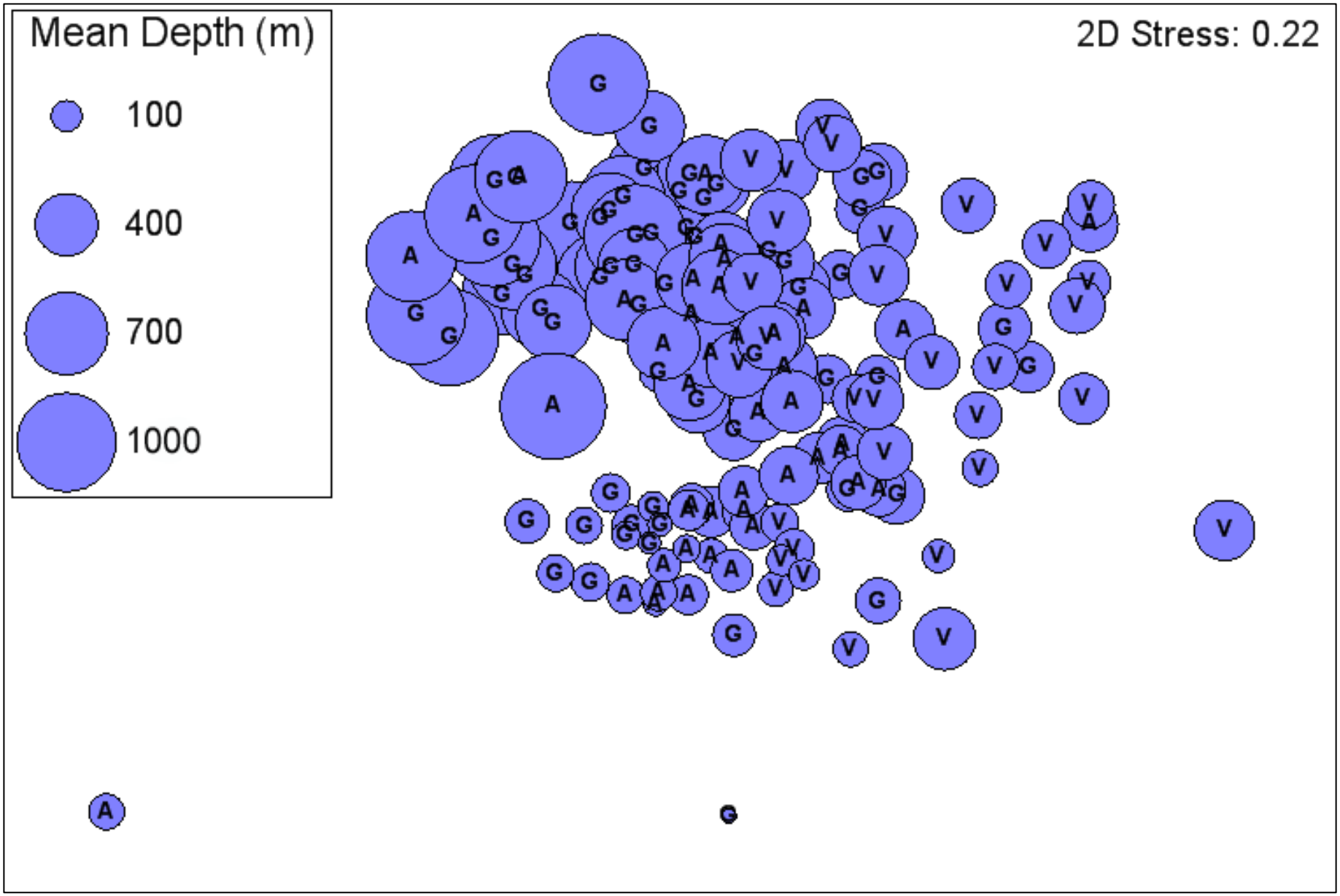


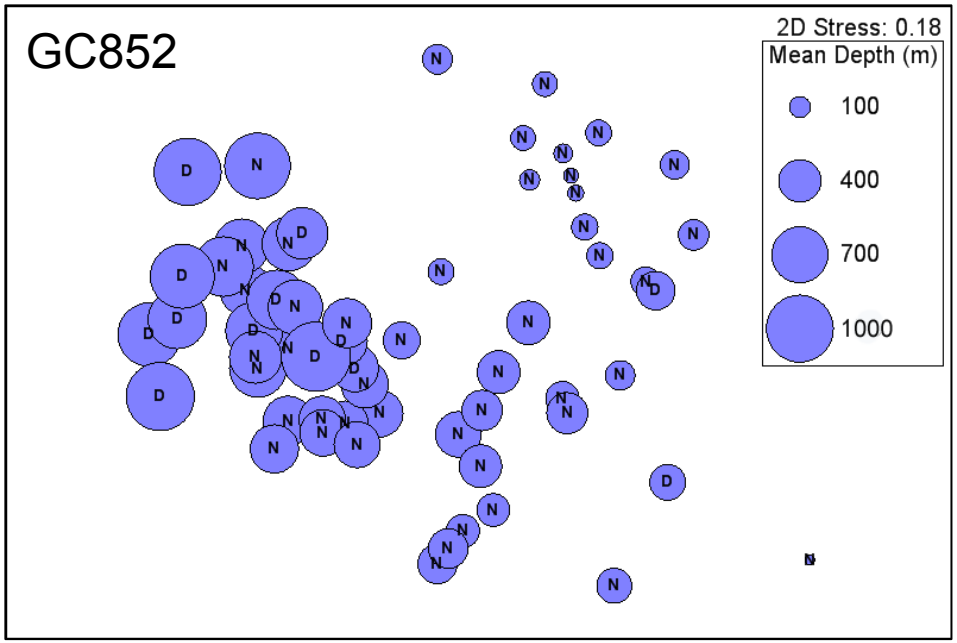
Analysis of Similarities (ANOSIM)

Fish assemblages are similar among sites.

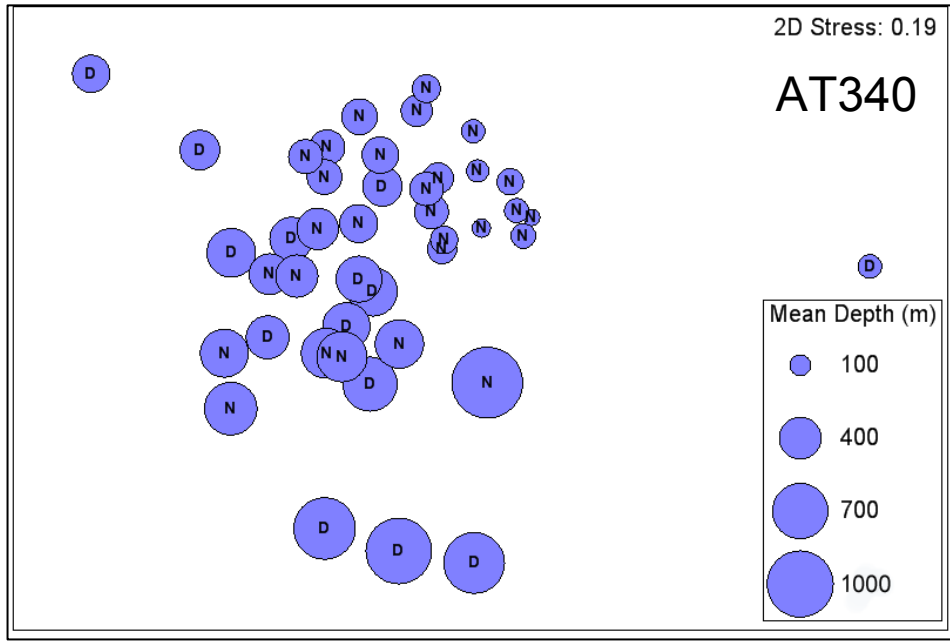
(Global R=0.22, *p*=0.1%)

MDS with Mean Depths Superimposed





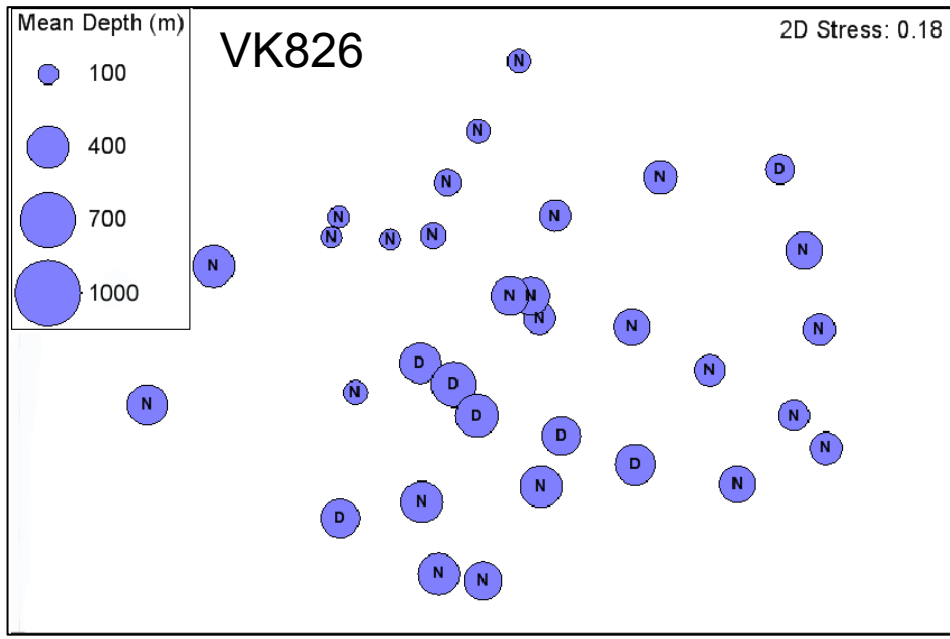
(Global R=0.07, *p*=16%)



(Global R=0.26, *p*=.1%)

<u>Analysis of Similarities (ANOSIM)</u>

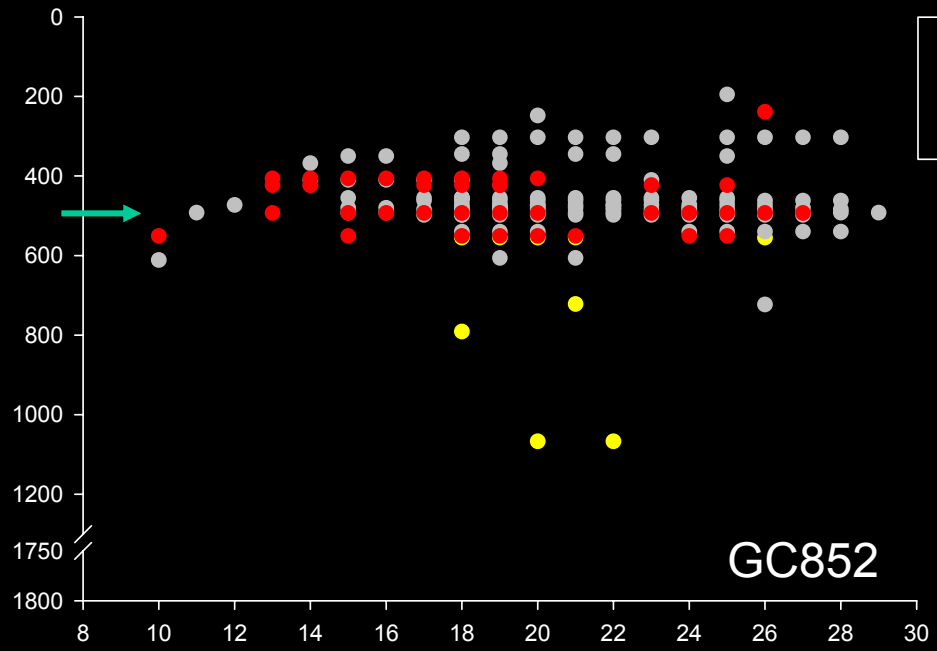
Fish assemblages are similar between day/night.

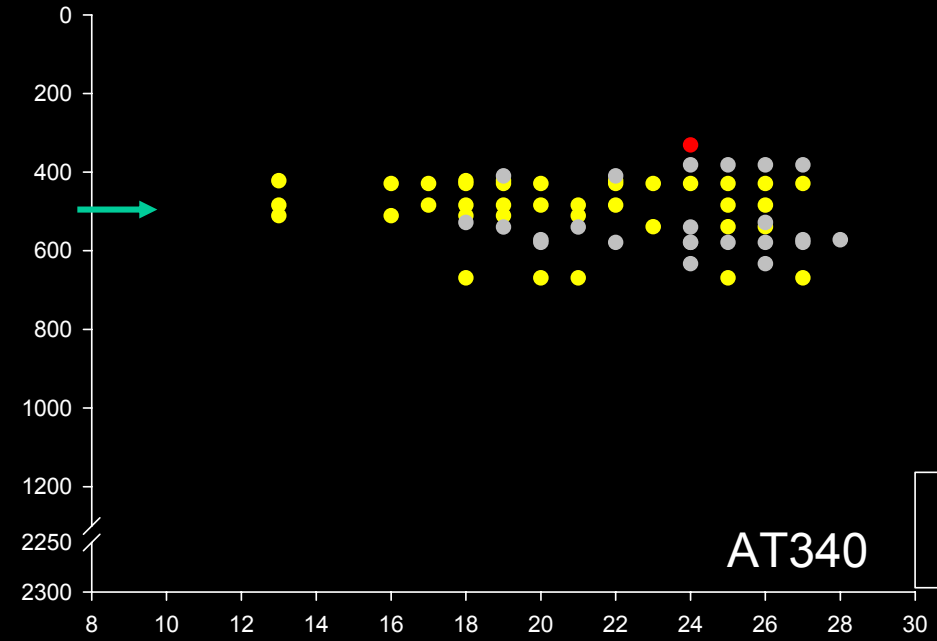


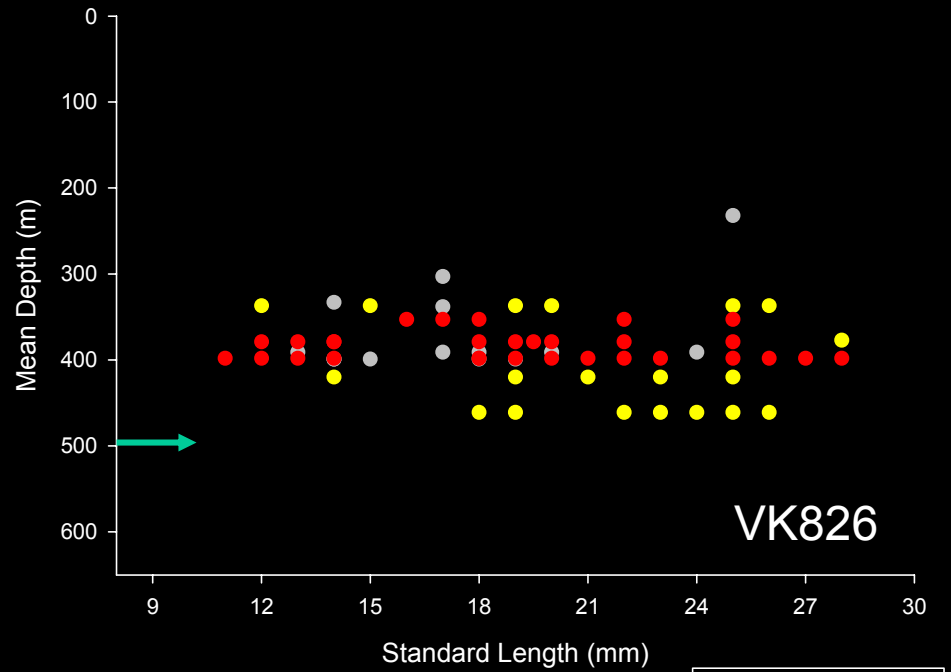
(Global R=-0.09, *p*=84%)

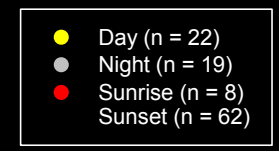
(Some samples overlap and thus appear to be missing in figure)

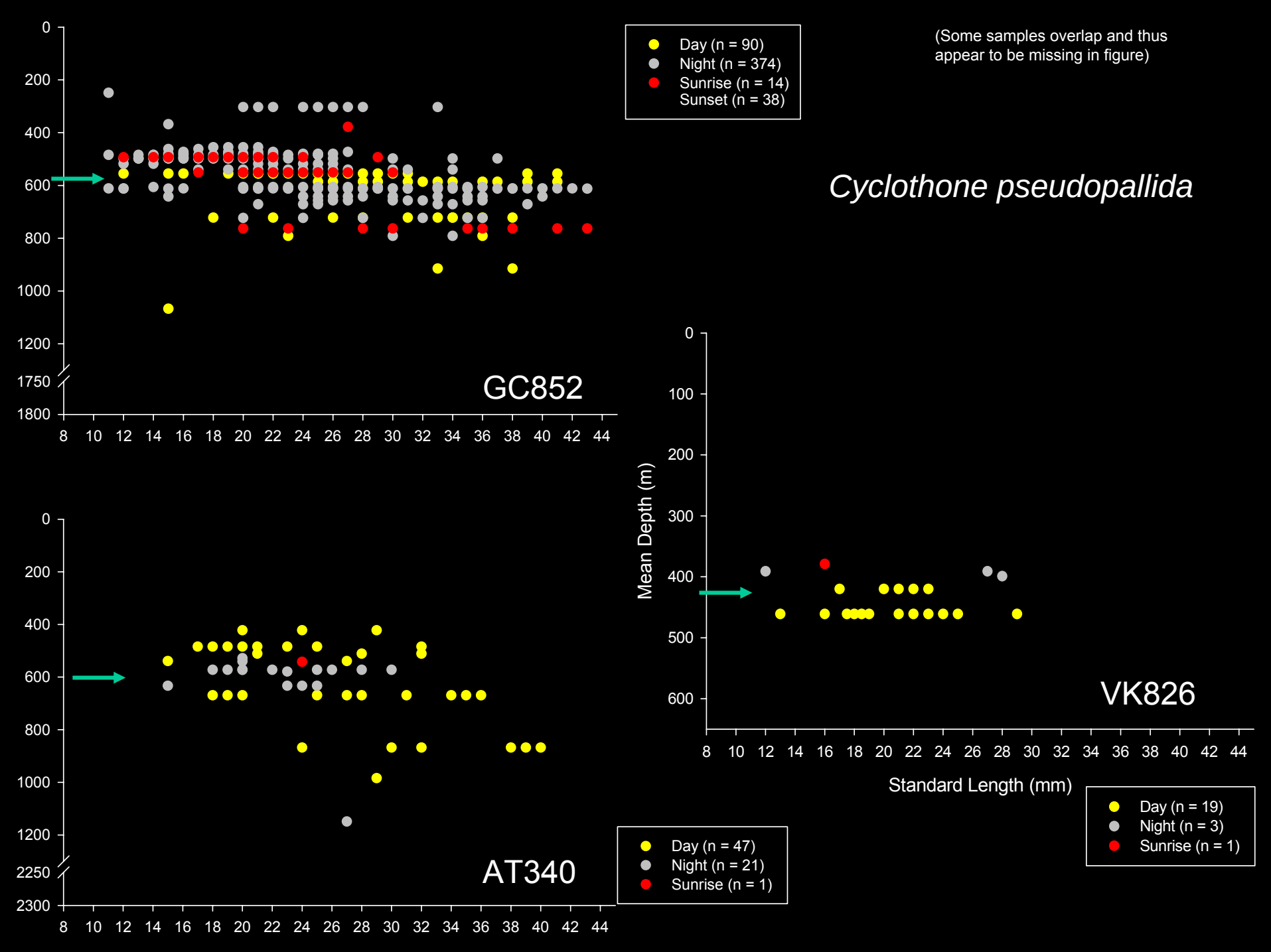
Cyclothone alba

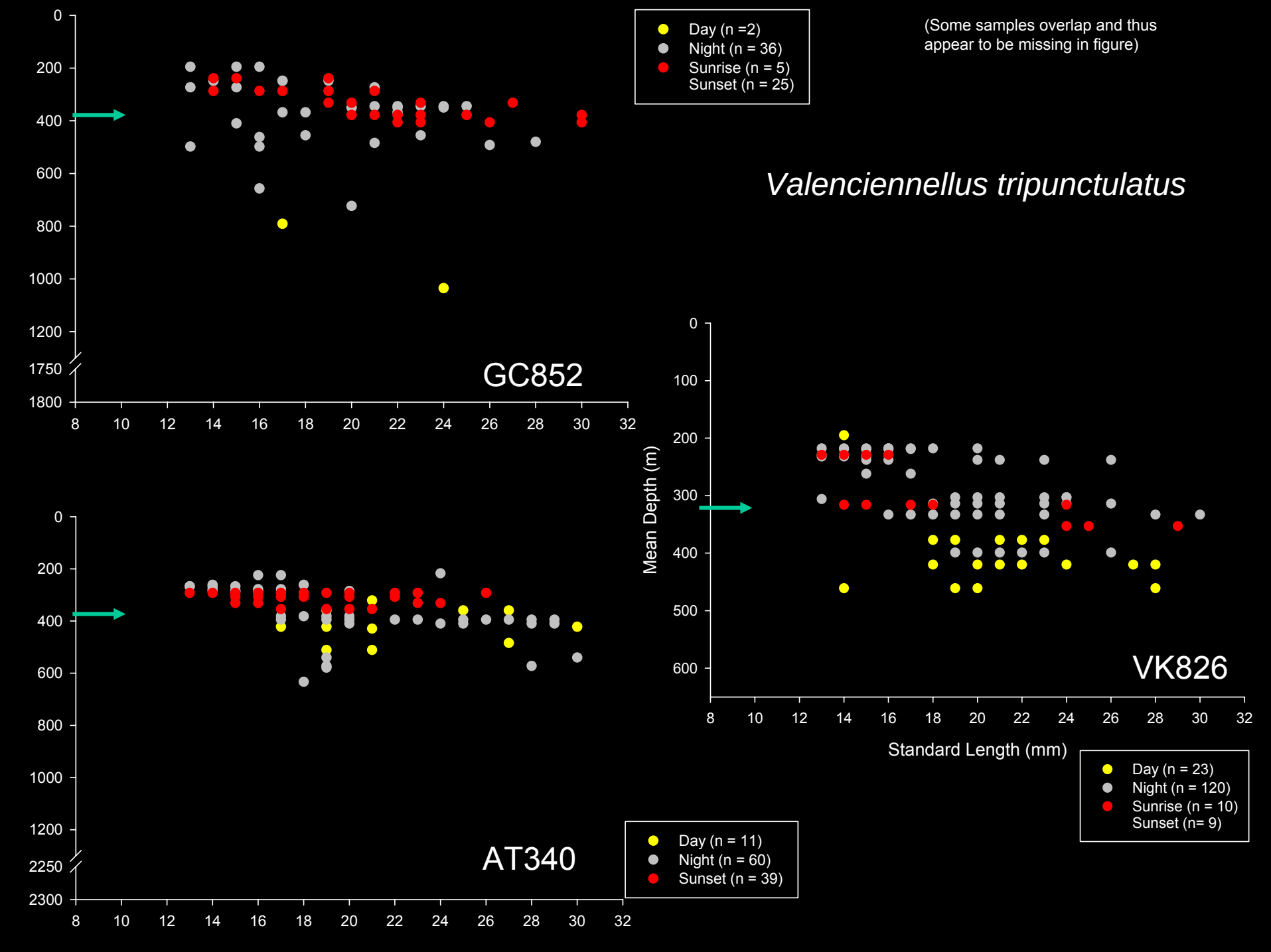


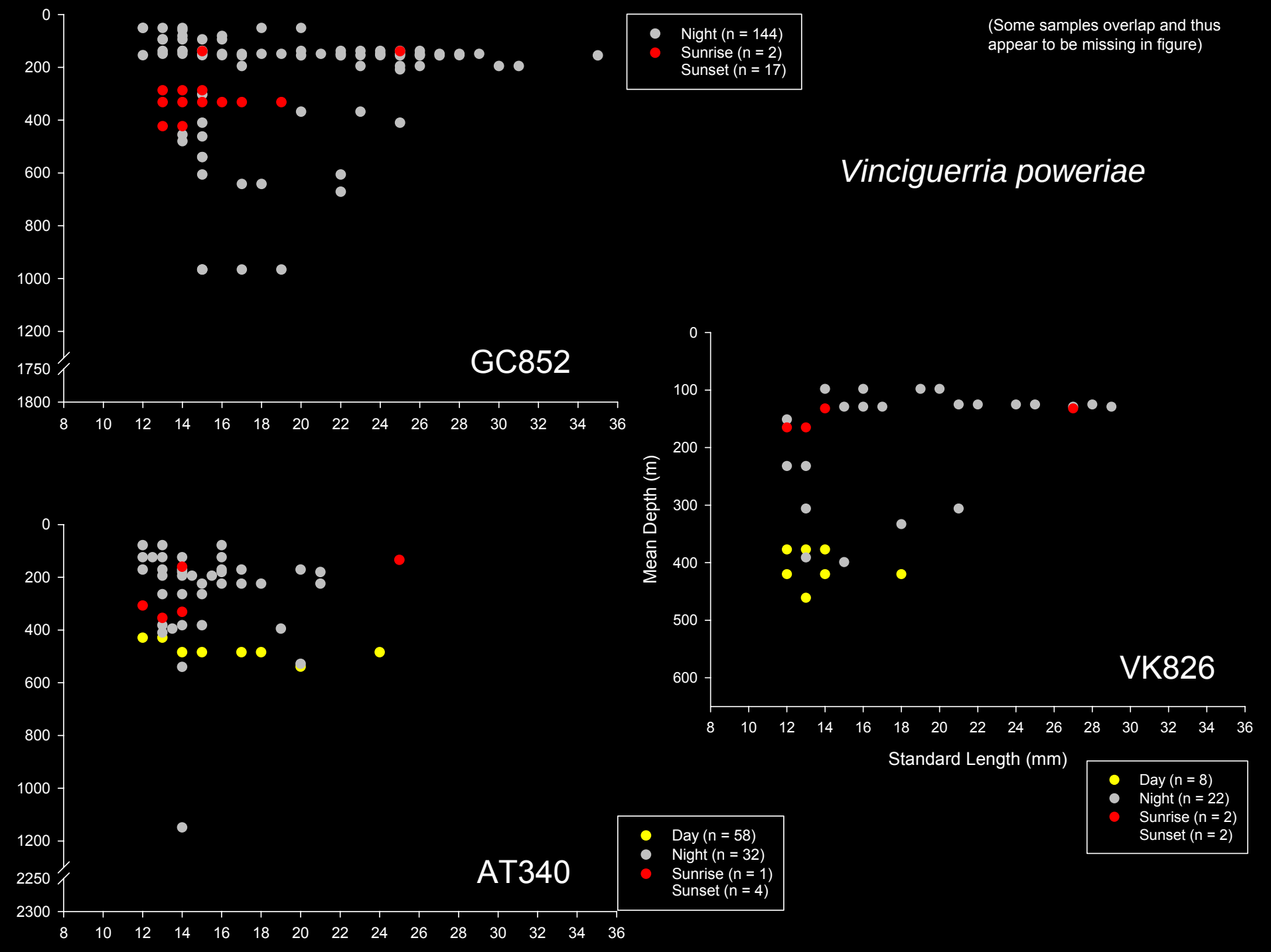


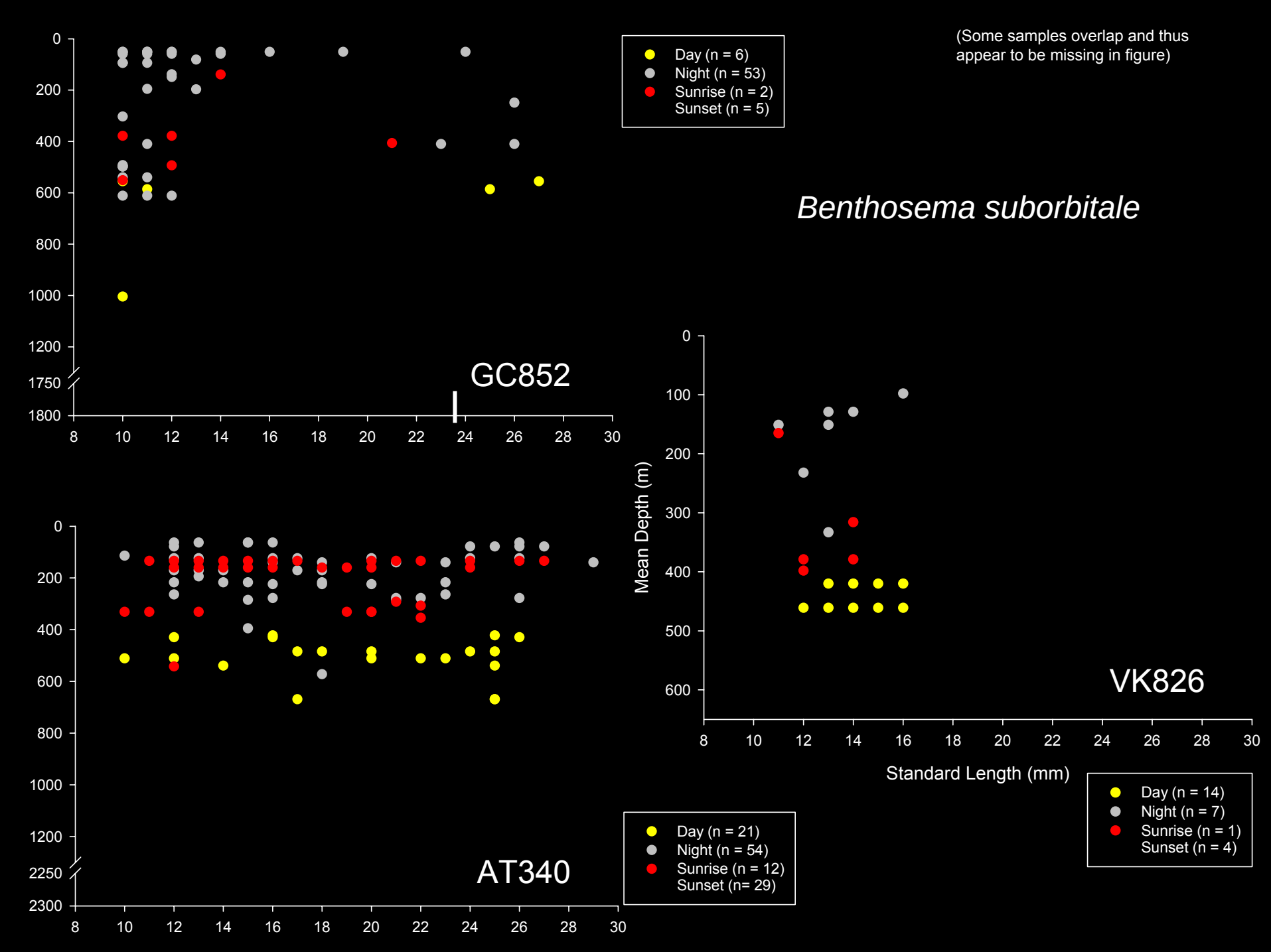


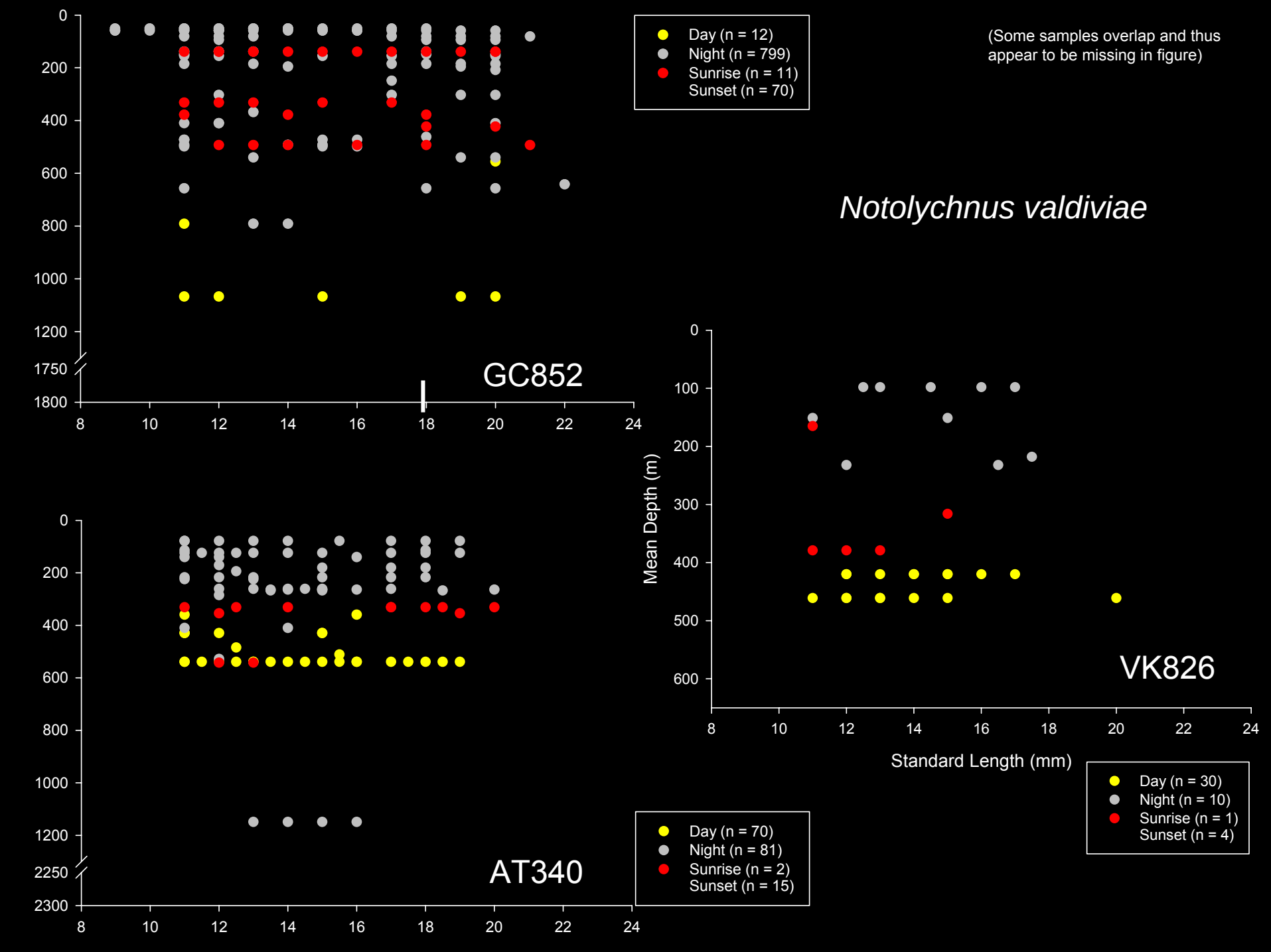



Day (n = 90)
Night (n = 374)
Sunrise (n = 14)
Sunset (n = 38)
(Some samples overlap and thus appear to be missing in figure)
Cyclothone pseudopallida
GC852
AT340
VK826
Mean Depth (m)
Standard Length (mm)
Day (n = 47)
Night (n = 21)
Sunrise (n = 1)
Day (n = 19)
Night (n = 3)
Sunrise (n = 1)


Day (n =2)
Night (n = 36)
Sunrise (n = 5)
Sunset (n = 25)
(Some samples overlap and thus appear to be missing in figure)
Valenciennellus tripunctulatus
GC852
AT340
VK826
Mean Depth (m)
Standard Length (mm)
Day (n = 11)
Night (n = 60)
Sunset (n = 39)
Day (n = 23)
Night (n = 120)
Sunrise (n = 10)
Sunset (n= 9)


(Some samples overlap and thus appear to be missing in figure)
Vinciguerria poweriae
Night (n = 144)
Sunrise (n = 2)
Sunset (n = 17)
GC852
AT340
VK826
Mean Depth (m)
Standard Length (mm)
Day (n = 58)
Night (n = 32)
Sunrise (n = 1)
Sunset (n = 4)
Day (n = 8)
Night (n = 22)
Sunrise (n = 2)
Sunset (n = 2)


(Some samples overlap and thus appear to be missing in figure)
Benthosema suborbitale
Day (n = 6)
Night (n = 53)
Sunrise (n = 2)
Sunset (n = 5)
GC852
0
200
400
600
800
1000
1200
1750
1800
8
10
12
14
16
18
20
22
24
26
28
30
Mean Depth (m)
Standard Length (mm)
VK826
0
100
200
300
400
500
600
Day (n = 14)
Night (n = 7)
Sunrise (n = 1)
Sunset (n = 4)
AT340
0
200
400
600
800
1000
1200
2250
2300
Day (n = 21)
Night (n = 54)
Sunrise (n = 12)
Sunset (n= 29)


Day (n = 12)
Night (n = 799)
Sunrise (n = 11)
Sunset (n = 70)
(Some samples overlap and thus appear to be missing in figure)
Notolychnus valdiviae
GC852
VK826
AT340
Mean Depth (m)
Standard Length (mm)
Day (n = 30)
Night (n = 10)
Sunrise (n = 1)
Sunset (n = 4)
Day (n = 70)
Night (n = 81)
Sunrise (n = 2)
Sunset (n = 15)

Community and Depth Distribution Summary

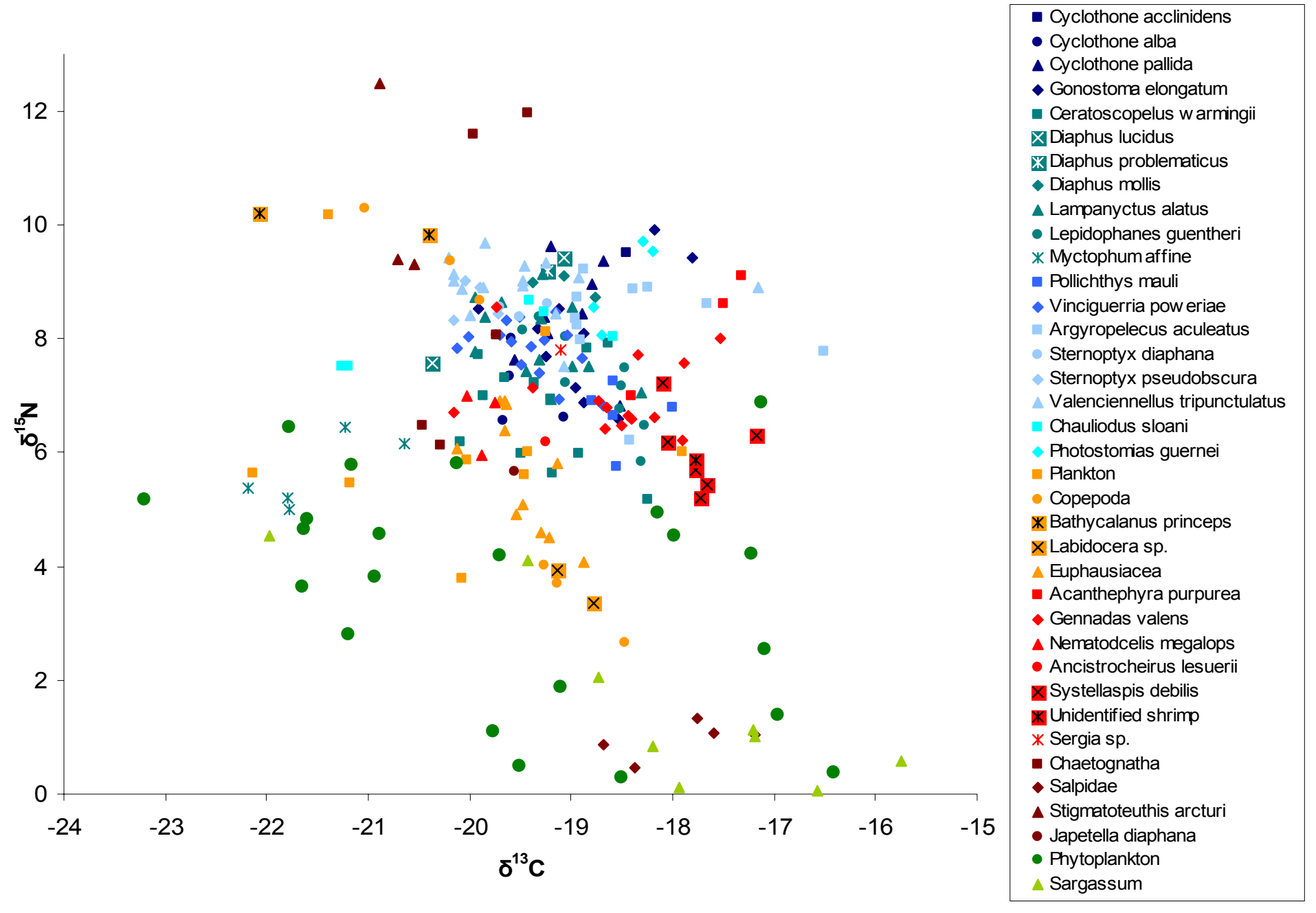
- Mesopelagic fish community generally similar throughout GOM.
- Depth related faunal differences in deeper sites.
- Non-migrators and strong diel migrators are prominent in mesopelagic community at all sites.
- Size based migration differences not clear, nor consistent.
- Nearly all species shift distributions upward over the shallower, inshore site.
- No strong evidence that full moon influenced distributions.

Trophodynamics

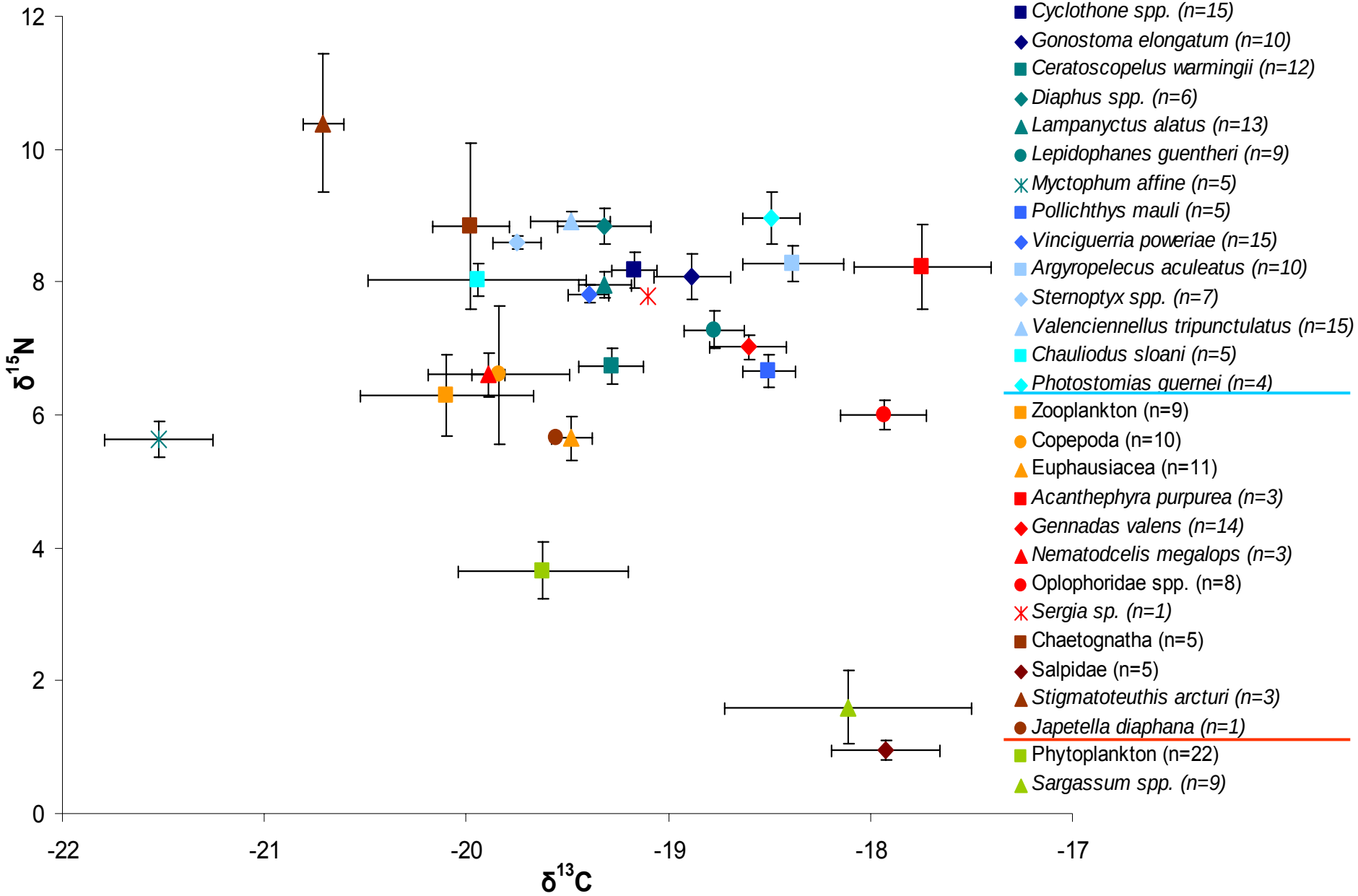
- General trophic structure of whole midwater community
- Detailed feeding data for fishes (location, timing)
- Evidence for chemosynthetic impacts?

- 235 non-benthic samples analyzed for stable isotopes (131 fishes = 19 spp.).
- Stomachs (n=1,203) analyzed for 10 fish spp. to date from 3 seep sites.

N vs C data for all non-benthic taxa collected over chemo sites in the GOM



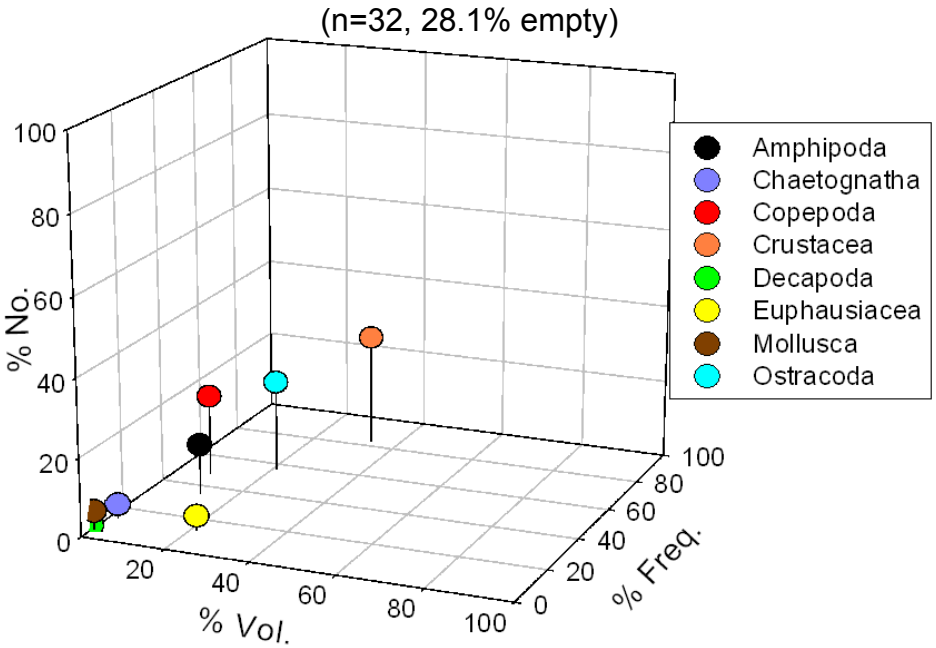
Stable isotope data for 3 offshore GOM seep sites (means +/- SE)

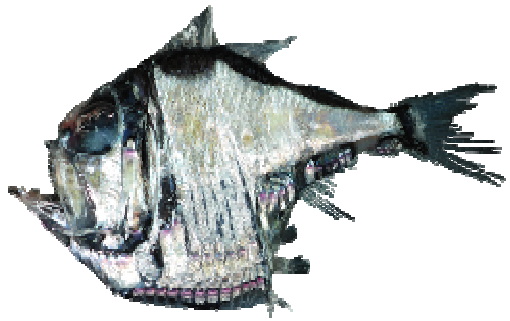


ISOTOPE DATA SUMMARY

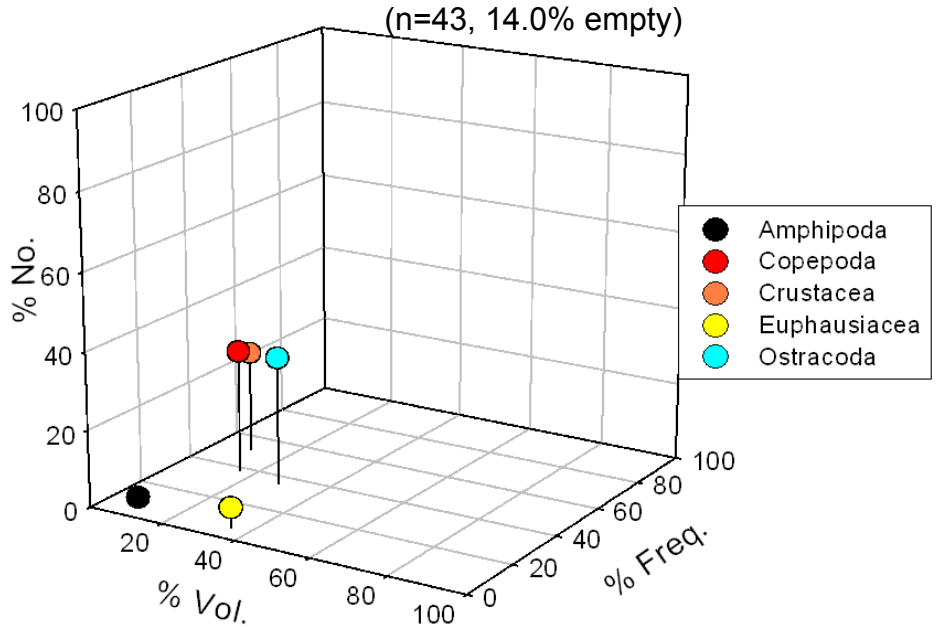
- Mesopelagic micronektonic community has phytoplankton based food web.
- Typical enrichment of ^{15}N with increasing faunal size.
- Fairly consistent feeding behavior within fishes. Diets dominated by various zoopankton.
- No evidence for chemosynthetic influence on feeding.
- But that does not mean it never occurs.

Prey items for *Argyropelecus aculeatus*





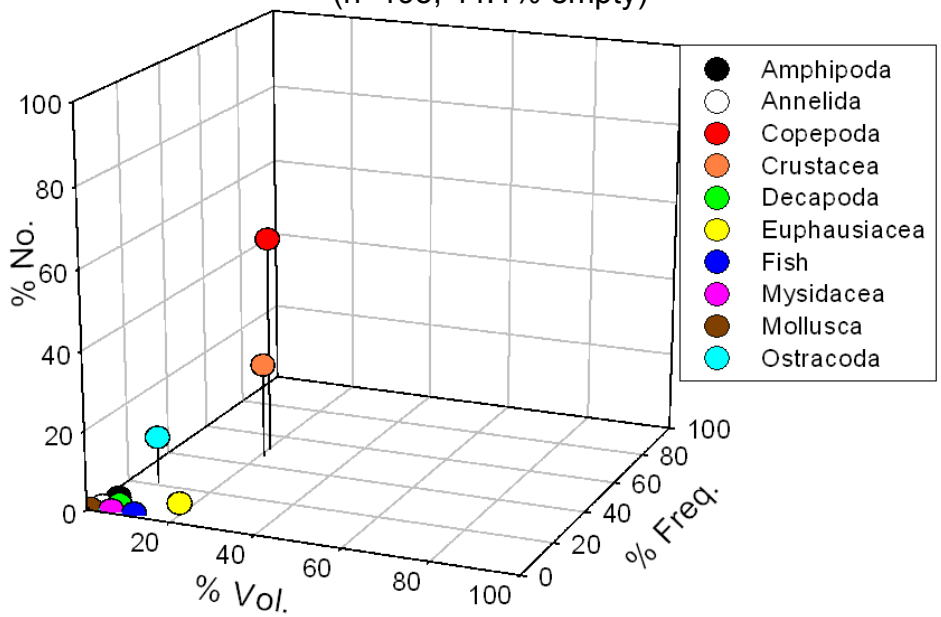
Prey items for *Pollichthys mauli*



- A pair of generalist crustacean feeders
- Ostracods dominate diet
- Followed closely by copepods

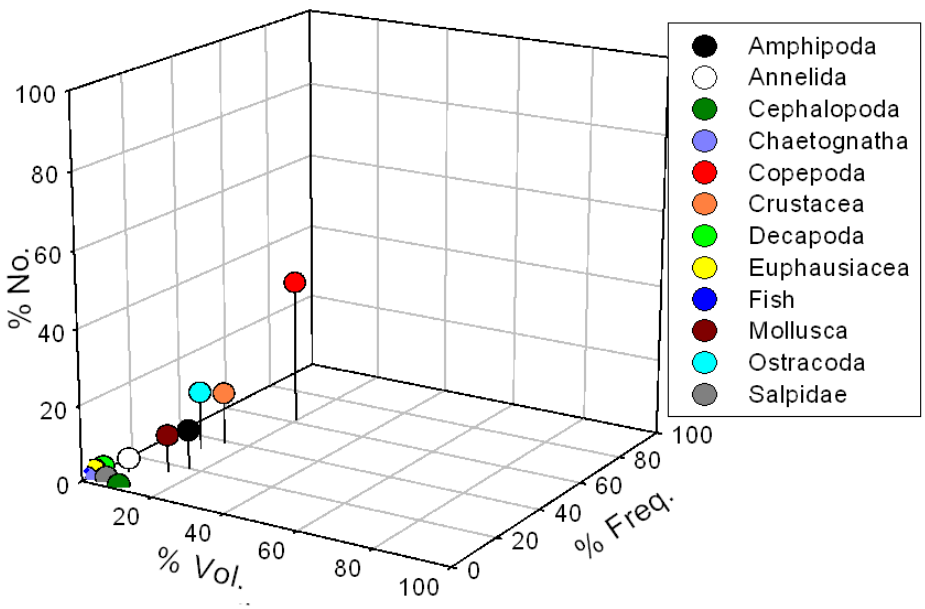
Prey items for *Benthosema suborbitale*

(n=195, 44.1% empty)



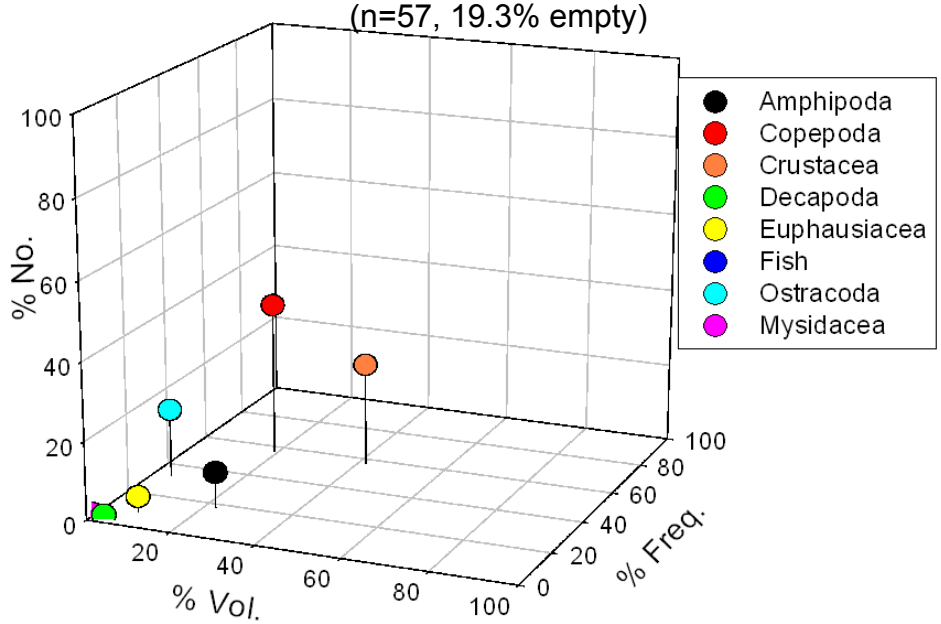
Prey items for *Ceratoscopelus warmingii*

(n=74, 12.2% empty)



Prey items for *Lampanyctus alatus*

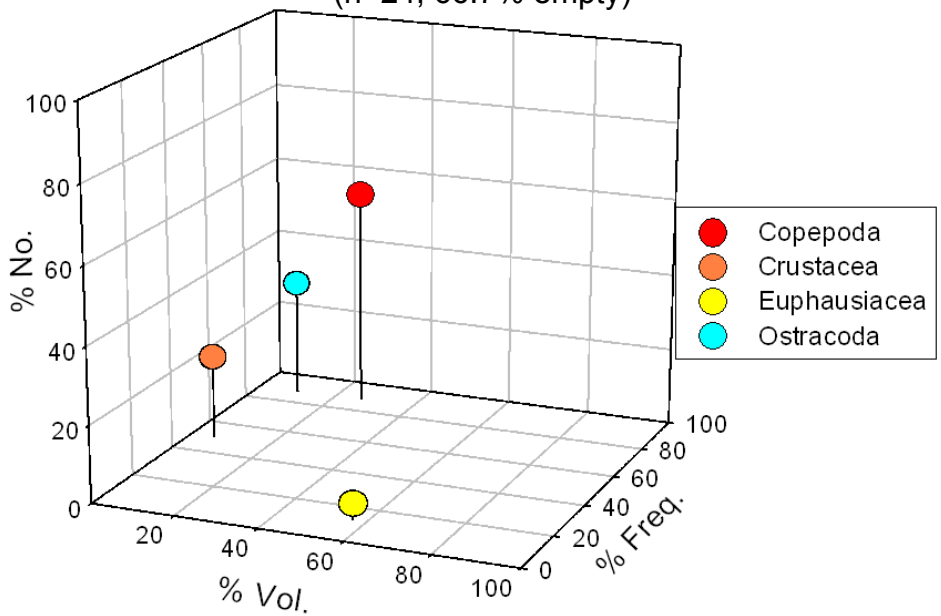
(n=57, 19.3% empty)



- Myctophidae spp.
  - Mainly generalist feeding patterns
  - Consume variety of prey at low levels
  - Mainly prey on copepods

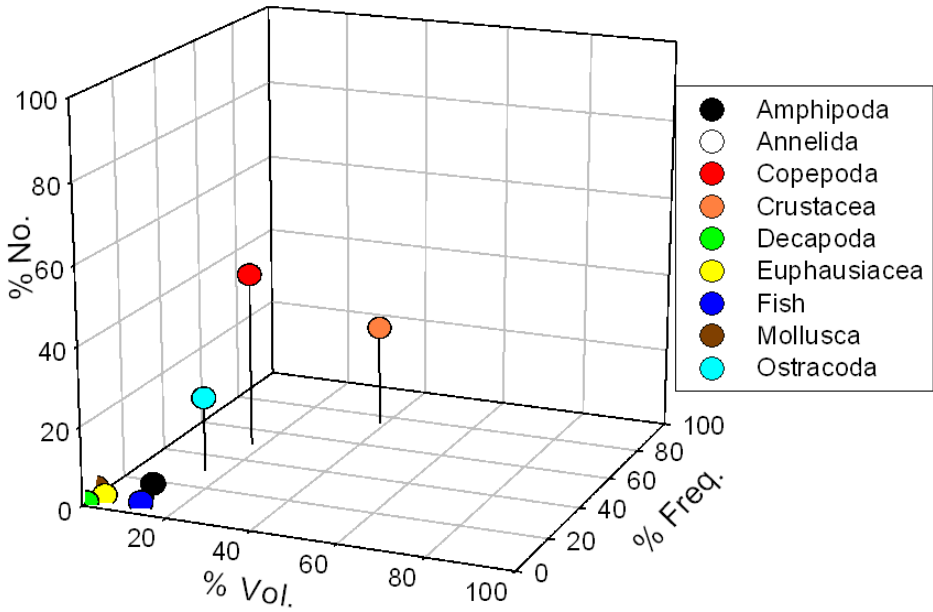
Prey items for *Argyropelecus hemigymnus*

(n=24, 66.7% empty)



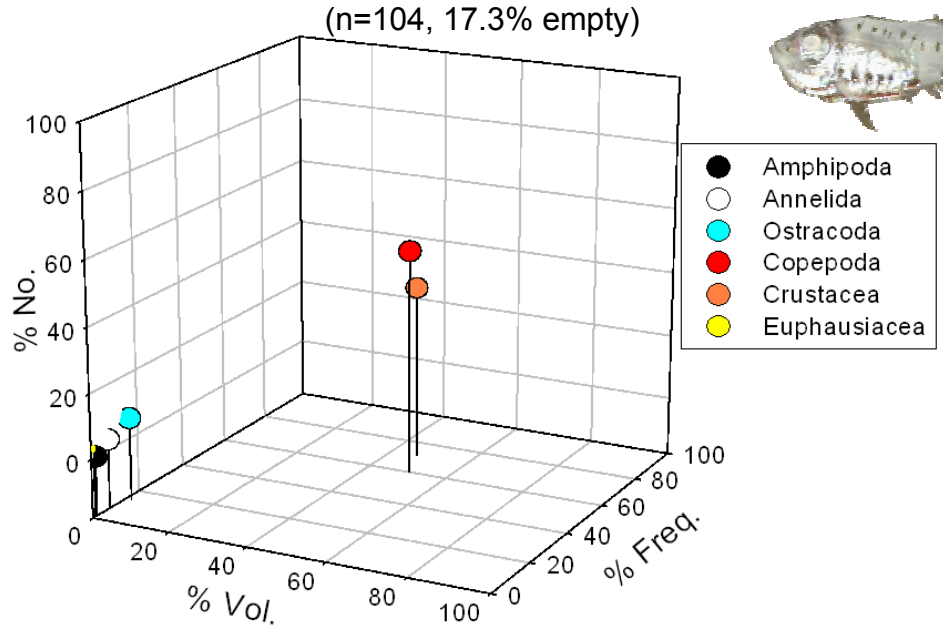
Prey items for *Vinciguerria poweriae*

(n=99, 23.2% empty)



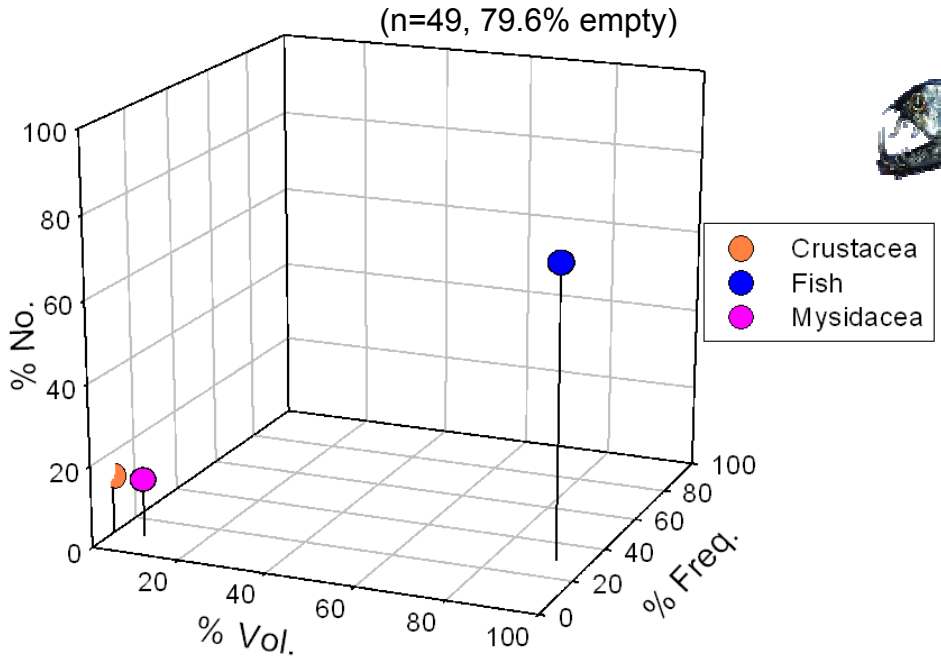
Prey items for *Valenciennellus tripunctulatus*

(n=104, 17.3% empty)



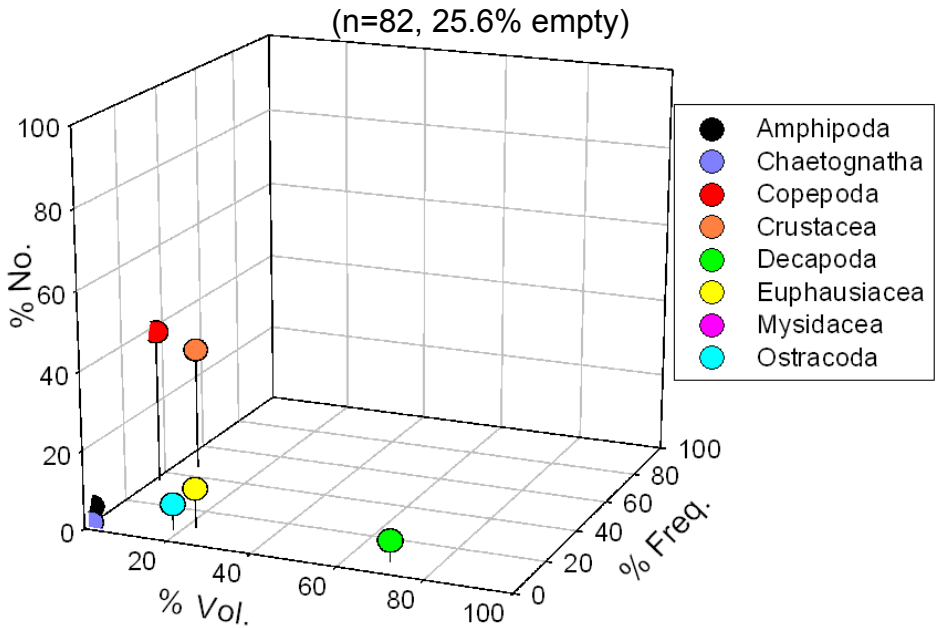
- These fishes = small crustacean feeders
- Copepods dominate diets

Prey items for *Chauliodus sloani*



- More specialized and uniform diet
- Fish dominant food

Prey items for *Gonostoma elongatum*



- Large crustaceans dominate diet (euphausids/decapods)

References

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