

Feeding habits of mesopelagic fishes off the coast of western Kyushu, Japan

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Myctophum obtusirostre



Diaphus chrysorhynchus



Ceratoscopelus warmingii



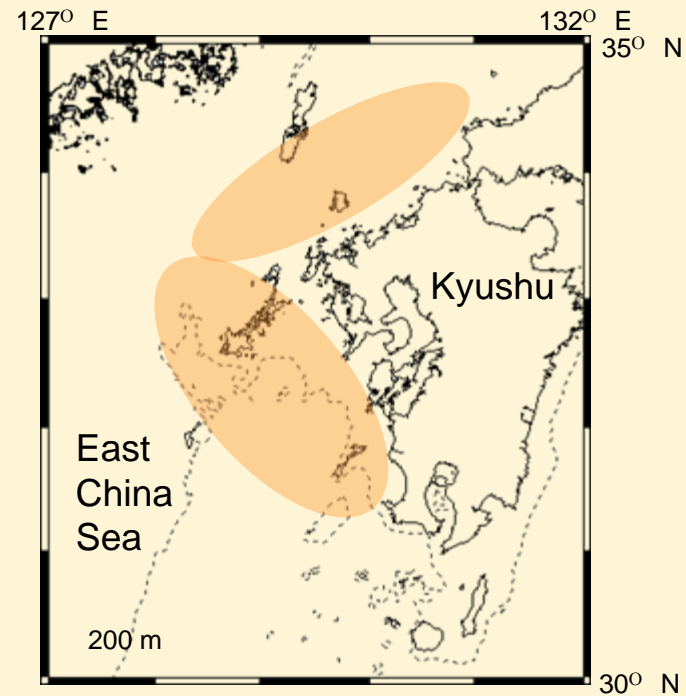
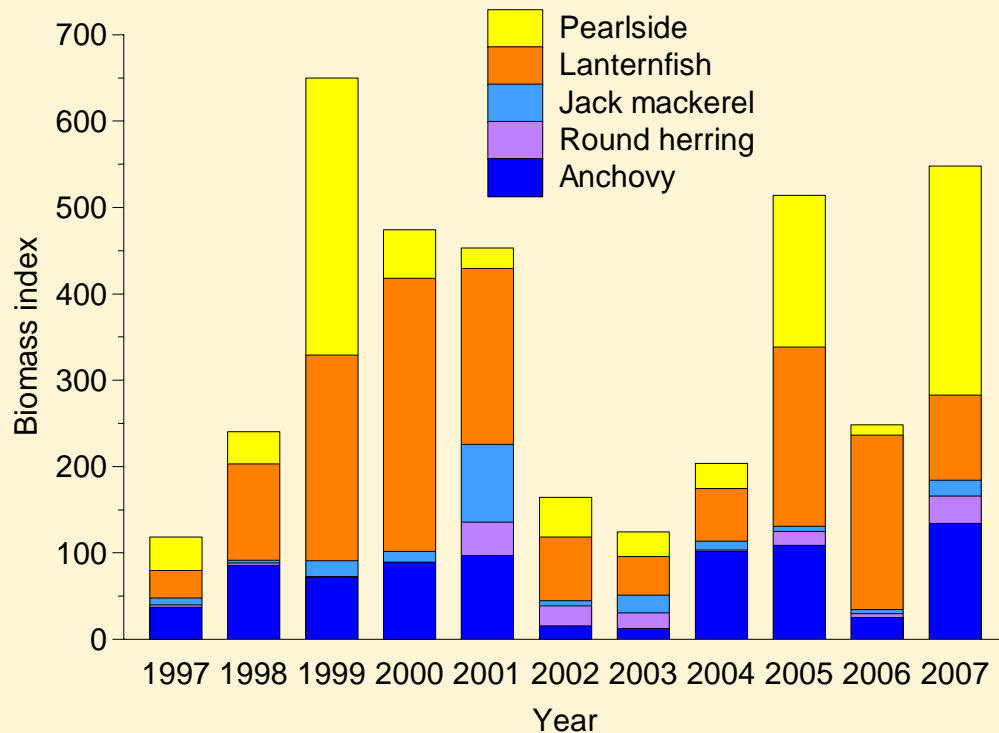
Myctophum asperum



Diaphus garmani

Background and Objective

- Mesopelagic fishes (e.g., Myctophidae) have large biomass in the East China Sea and its adjacent waters, where pelagic fish also co-exist.
- In general, myctophids feed on zooplankton in the epipelagic zone at nighttime in relation to their diel vertical migration (DVM).
- Trophic niche of mesopelagic fish is to be revealed especially from the viewpoint of relationship with pelagic fish.



Biomass index by acoustic surveys. (Ohshimo 2004, Ohshimo unpubl.)

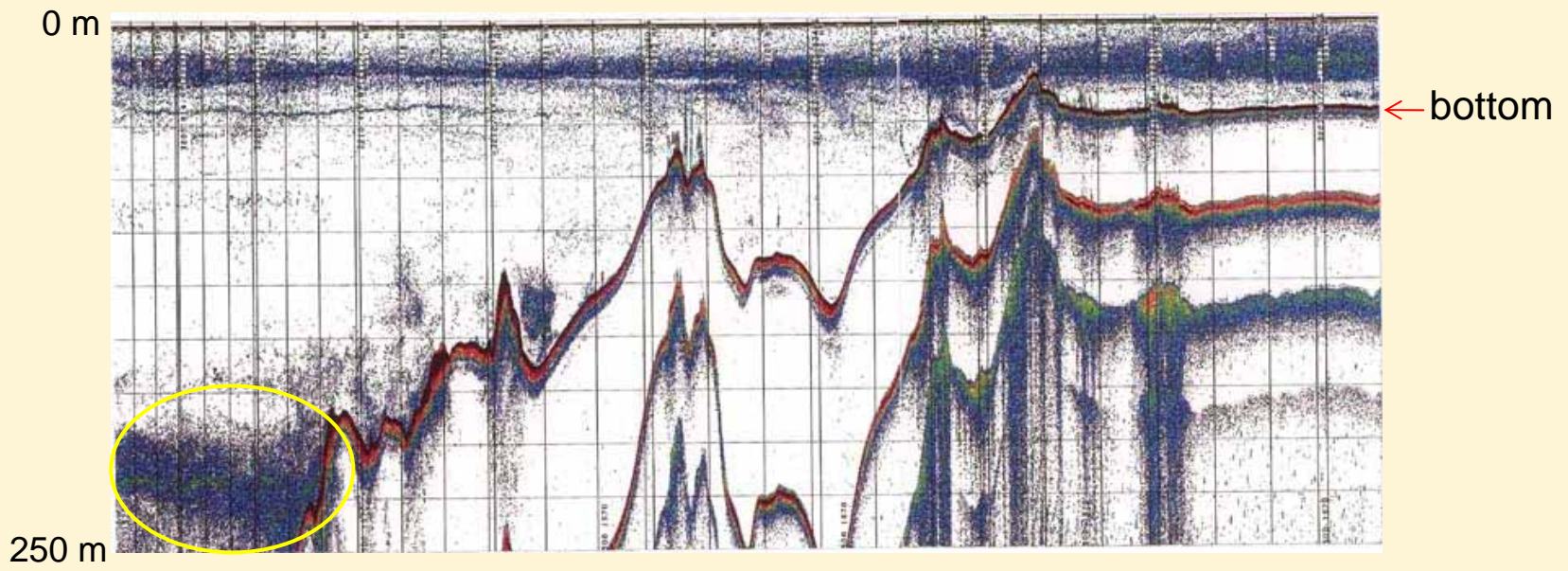
Materials (Sampling)

- Area: off the coast of western Kyushu
- Seasons and year: summer months (Aug. and Sep.) of 2002, 2003, and winter month (Jan.) of 2007
- Time: Night time (after sunset)
- Gear: Mid-water trawl
- Layer: 30-120 m

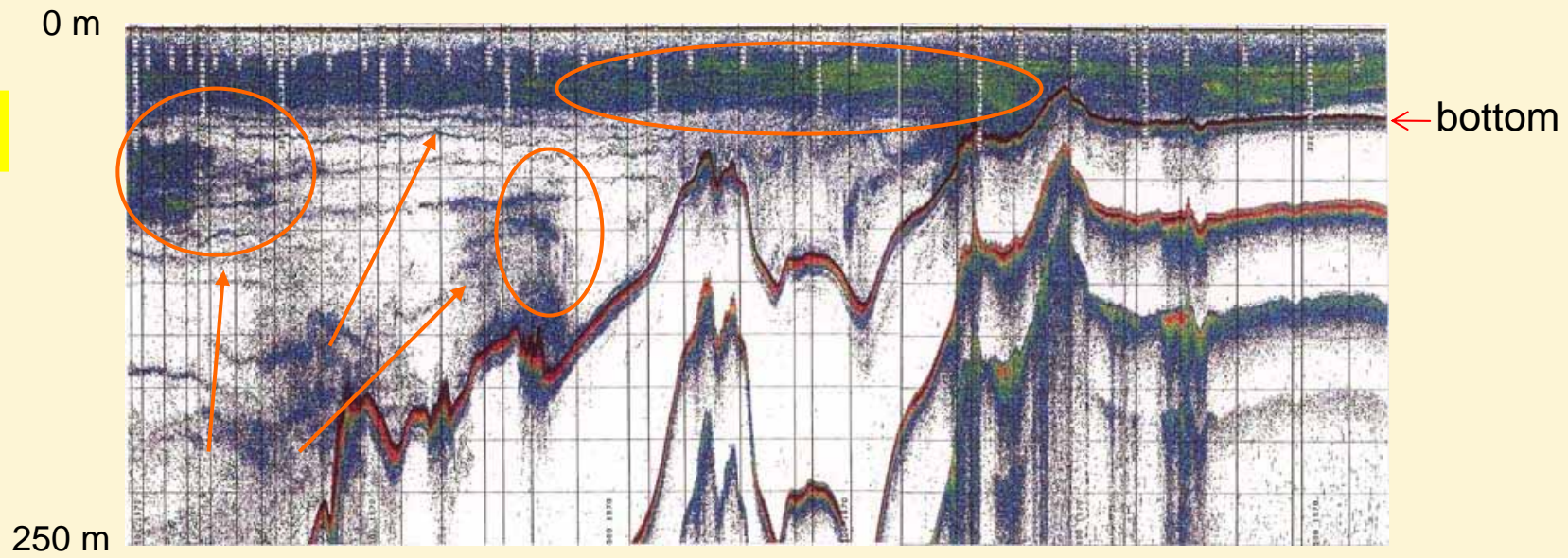


DVM observed by the acoustic survey

Day



Night



Species of myctophids

Dominant species (summer and winter)

Diaphus chrysorhynchus (n = 235, 48-105 mm BL)



Diaphus garmani (n = 190, 20-65 mm BL)



Total catch of myctophids collected in the western Kyushu waters from 2002 to 2006 (Sassa unpubl.)

Species	Weight (g)	Number
<i>Diaphus chrysorhynchus</i>	129332.3	23526
<i>Diaphus garmani</i>	101385.9	78971
<i>Lampanyctus nobilis</i>	5718.7	8938
<i>Myctophum obtusirostre</i>	4646.4	1774
<i>Bnthosema pterotum</i>	1094.0	644
<i>Myctophum asperum</i>	819.3	326
<i>Ceratoscopelus warmingii</i>	638.8	505
<i>Diaphus aliciae</i>	212.6	562
<i>Diaphus perspicillatus</i>	91.7	119
<i>Diaphus regani</i>	68.9	118
<i>Diaphus suborbitalis</i>	54.3	87
<i>Diaphus fulgens</i>	45.4	118
<i>Diaphus schmidti</i>	41.6	142
<i>Myctophum orientale</i>	18.0	19
<i>Myctophum nitidulum</i>	16.8	17
<i>Diaphus kuroshio</i>	7.6	24
<i>Diaphus nielsenii</i>	4.8	6
<i>Lampanictus spp.</i>	3.8	3
<i>Bnthosema fibulatum</i>	2.3	1

Other species (summer only)

Myctophum obtusirostre

(n = 56, 42-78 mm BL)



Myctophum asperum

(n = 40, 45-65 mm BL)



Ceratoscopelus warmingii

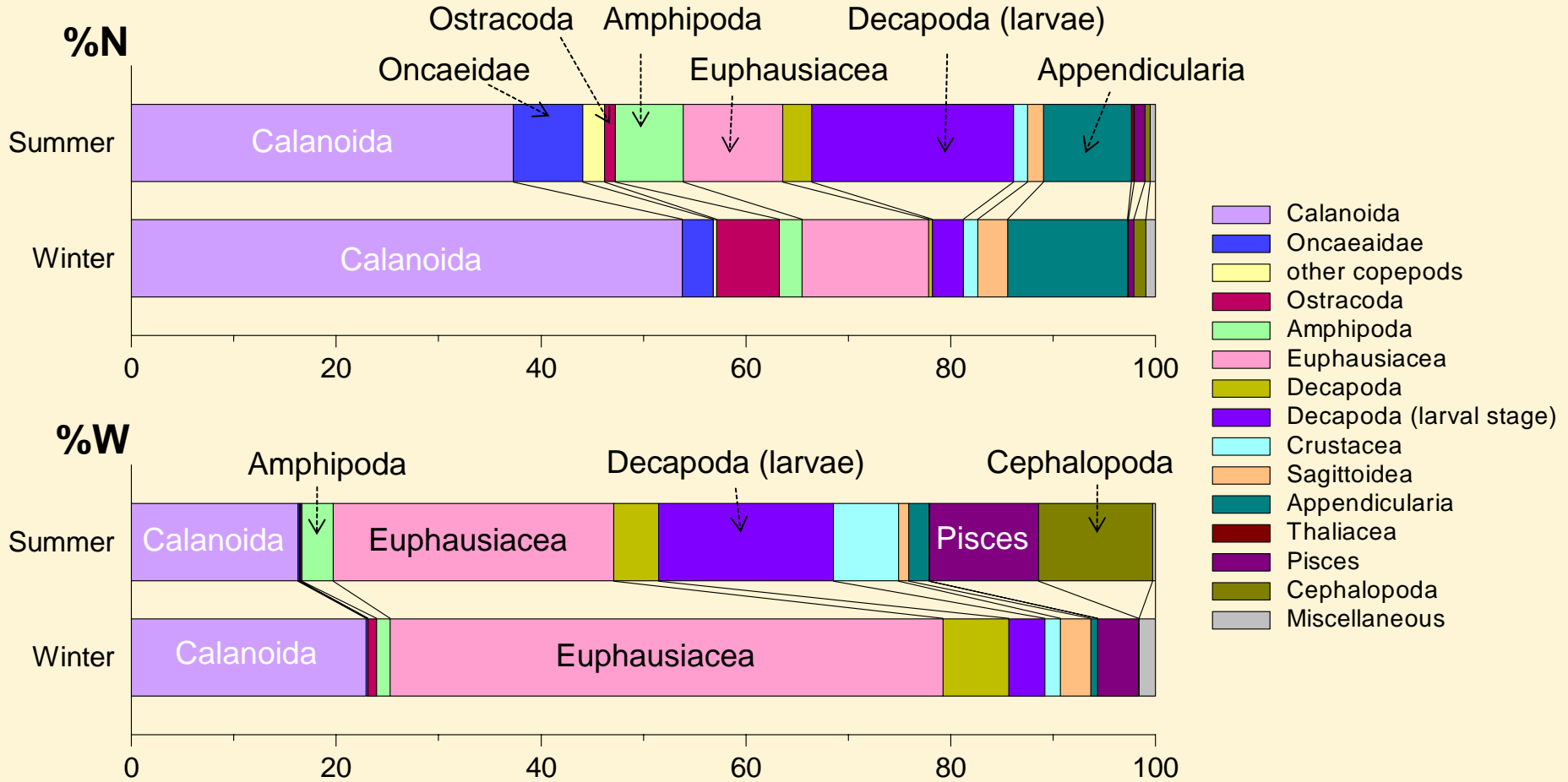
(n = 20, 45-59 mm BL)



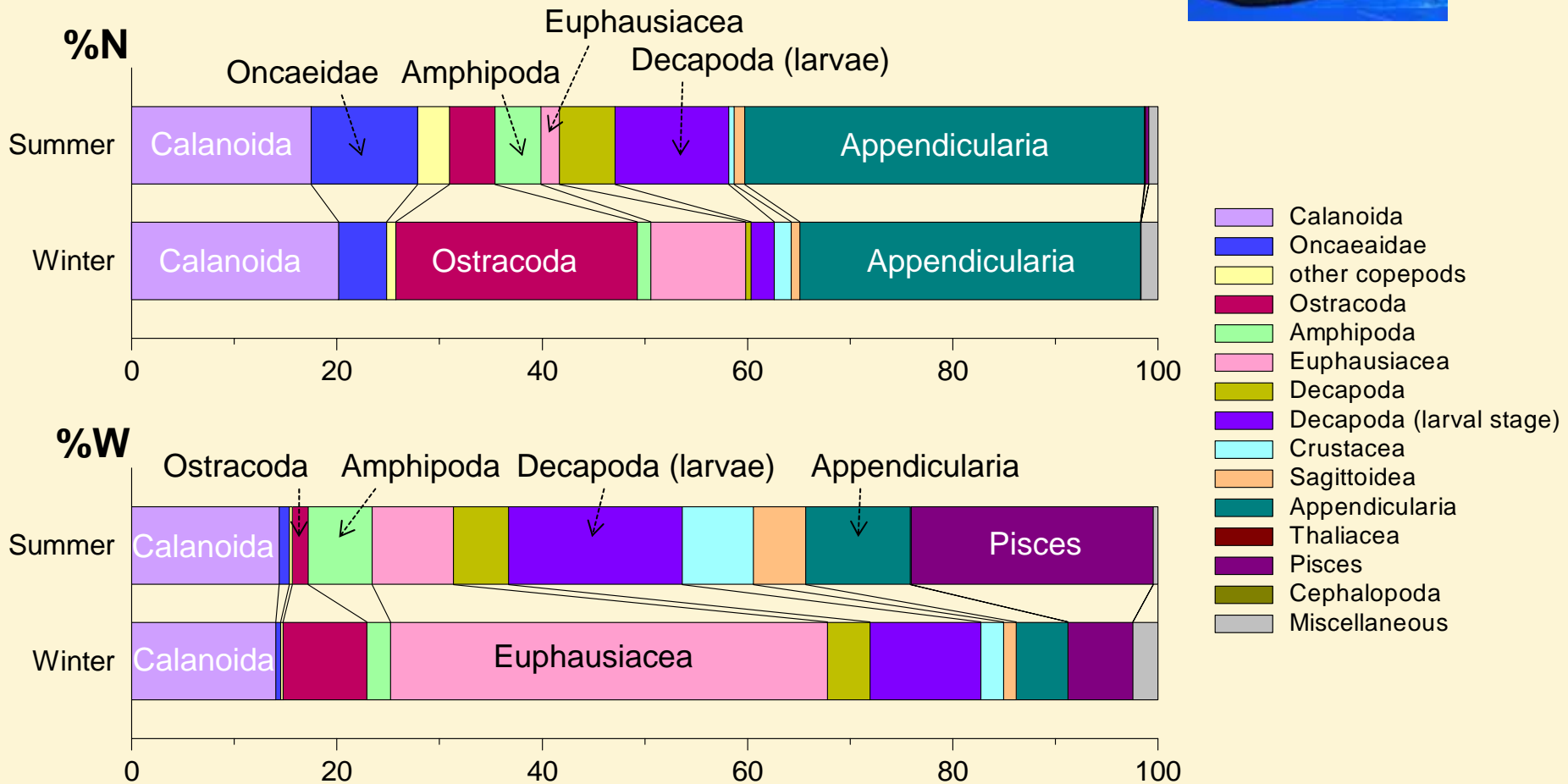
Methods

- Stomach content analysis:
 - Observation: count, weigh, and measure of prey organisms
 - %N (number), %W (weight), %F (frequency)
 - IRI (Index of relative importance) = $\frac{(\%N + \%W) \times \%F}{100}$
- Stable isotope analysis ($\delta^{13}\text{C}$ and $\delta^{15}\text{N}$):
 - Dorsal muscle was used
 - All samples were defatted before the analysis to remove lipids
 - Mass spectrometer (Delta Plus Advantage) with an elemental analyzer (EA1100, Thermo Electron)
 - $\delta^{13}\text{C}, \delta^{15}\text{N} = \left[\frac{R_{\text{sample}}}{R_{\text{standard}}} - 1 \right] \times 1000$
($R = {}^{13}\text{C}/{}^{12}\text{C}$ or ${}^{15}\text{N}/{}^{14}\text{N}$)

Stomach content composition (*D. chrysorhynchus*)

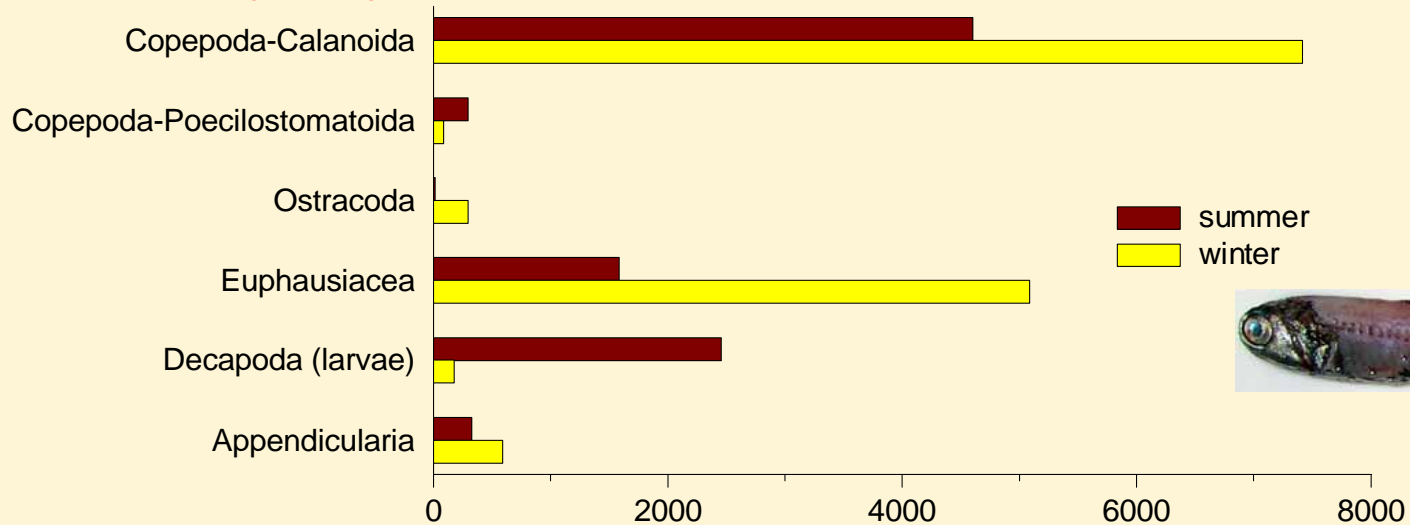


Stomach content composition (*D. garmani*)

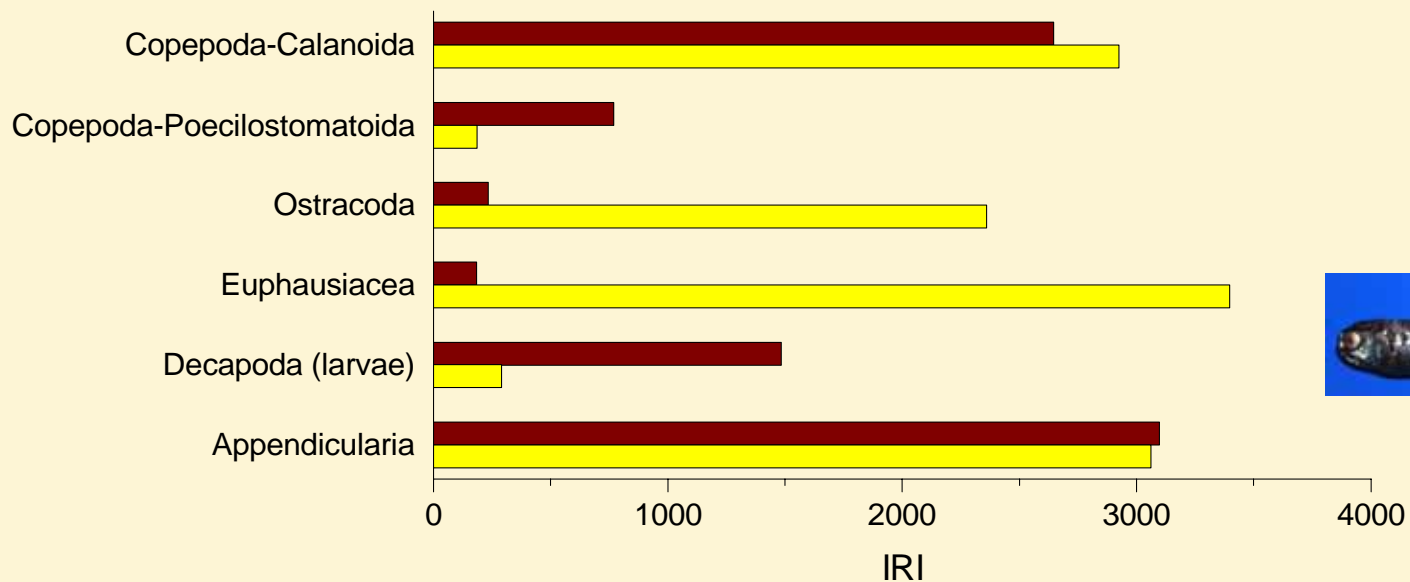


IRI of major prey items (summer vs. winter)

Diaphus chrysorhynchus

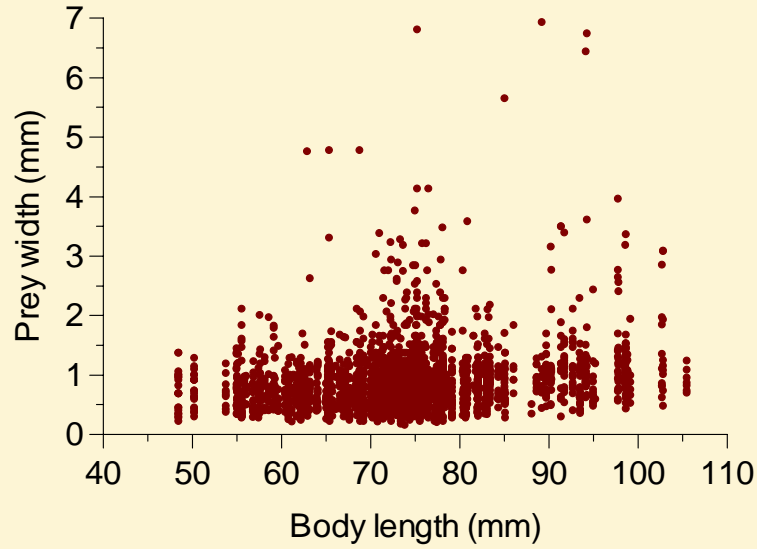


Diaphus garmani

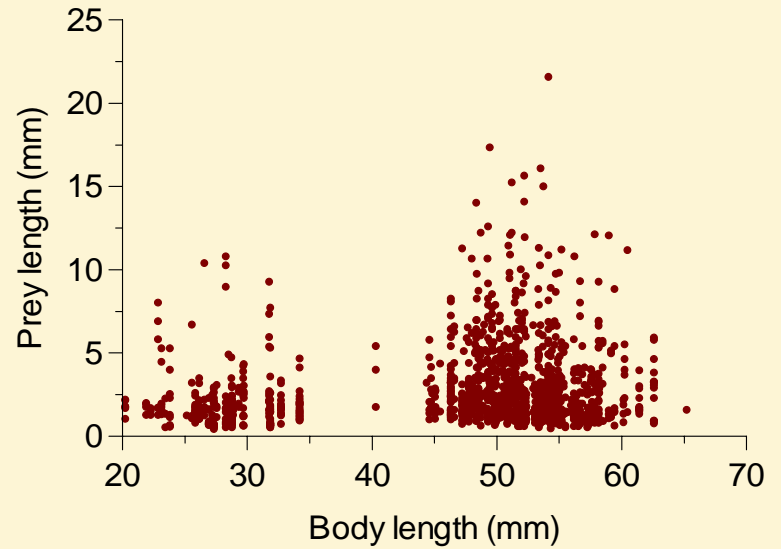
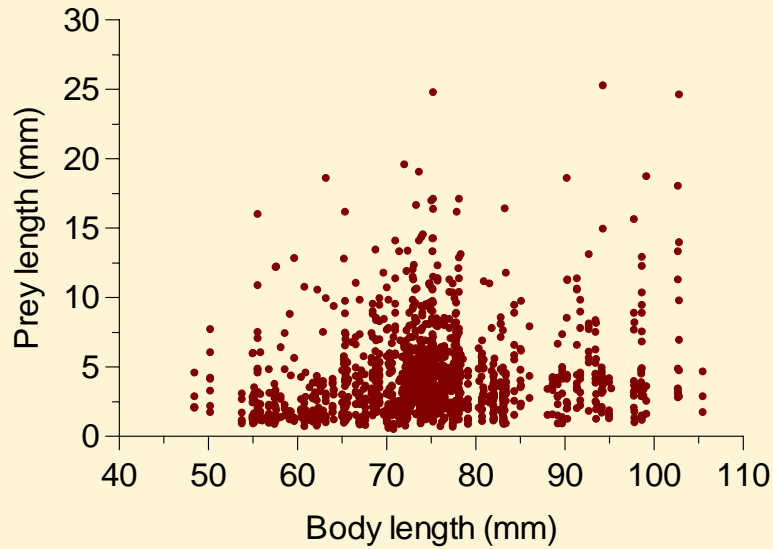
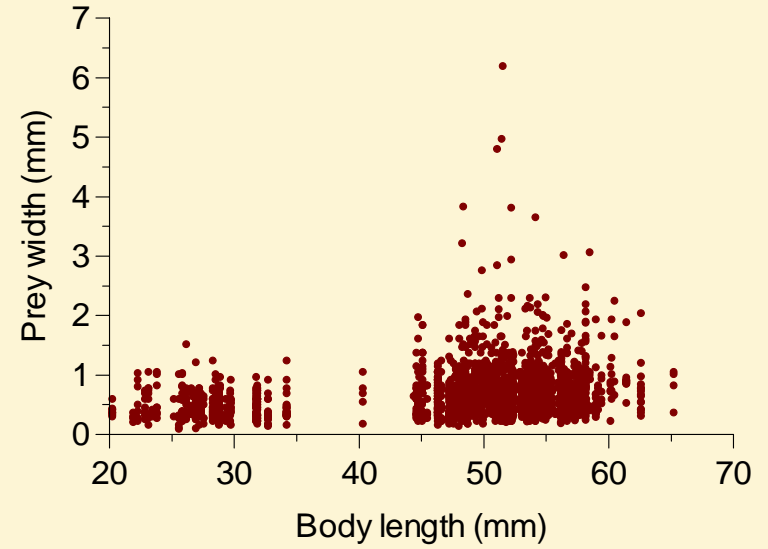


Prey size

D. chrysorhynchus

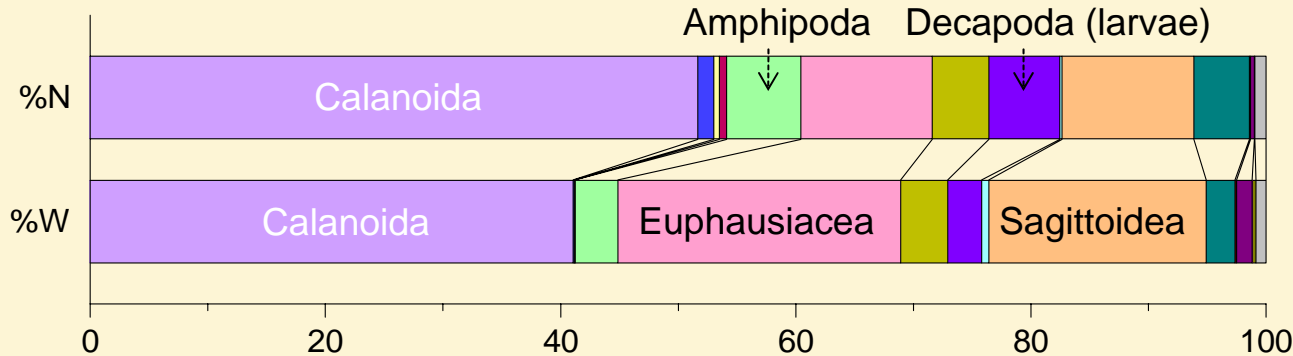


D. garmani

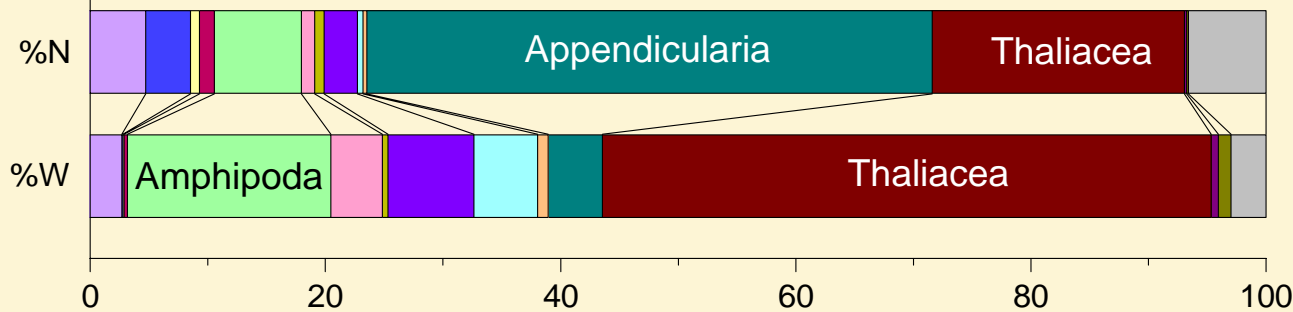


Stomach content composition (other species)

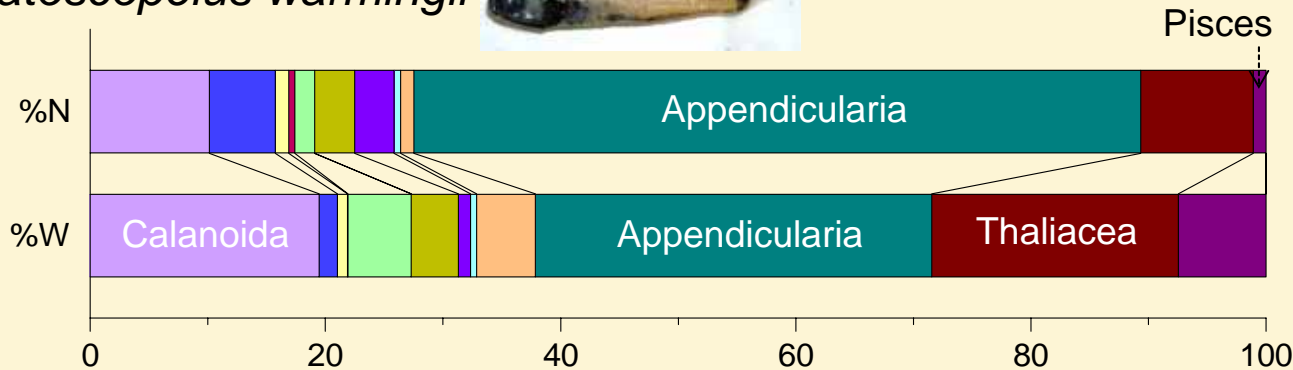
Myctophum obtusirostre



Myctophum asperum



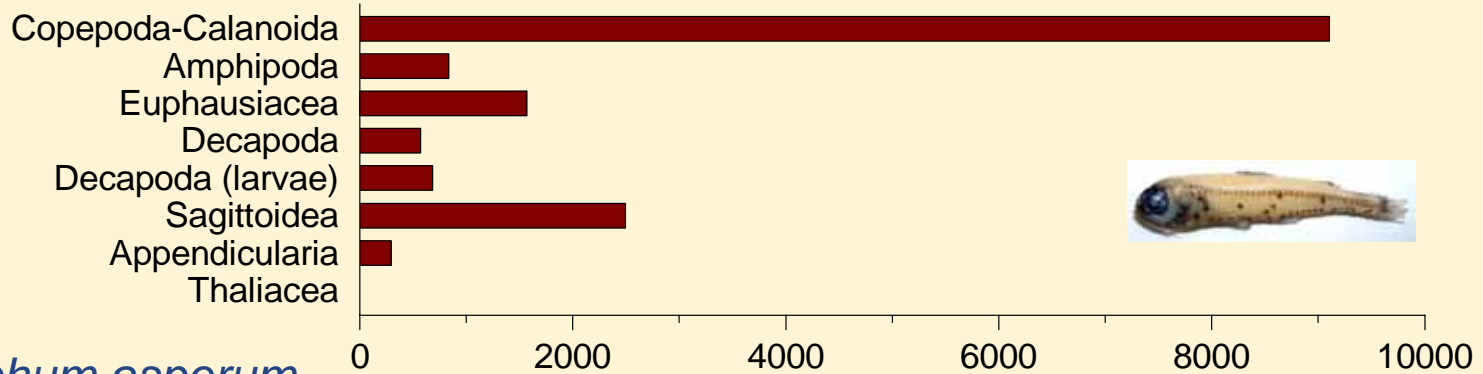
Ceratoscopelus warmingii



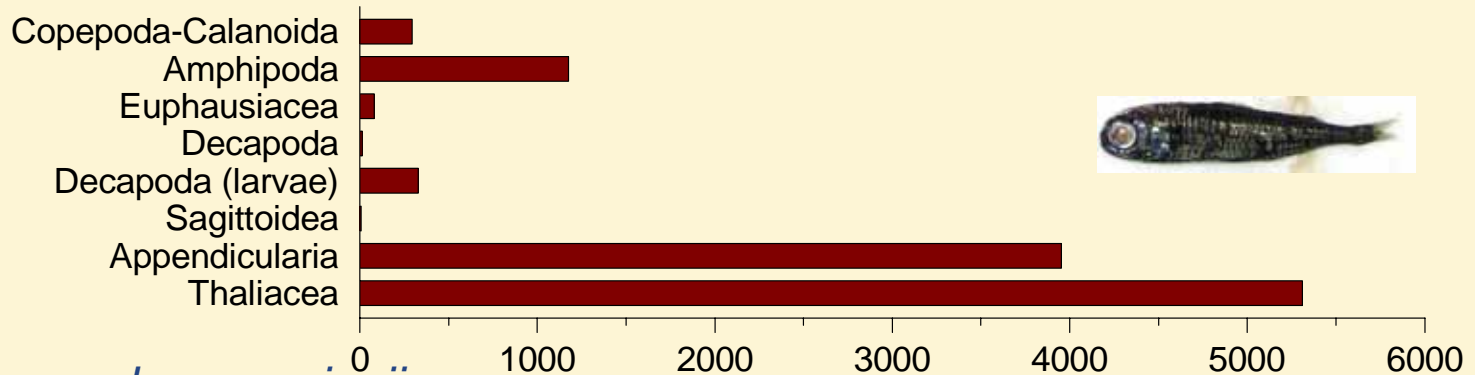
- Calanoida
- Oncaeidae
- other copepods
- Ostracoda
- Amphipoda
- Euphausiacea
- Decapoda
- Decapoda (larval stage)
- Crustacea
- Sagittoidea
- Appendicularia
- Thaliacea
- Pisces
- Cephalopoda
- Miscellaneous

IRI of major prey items

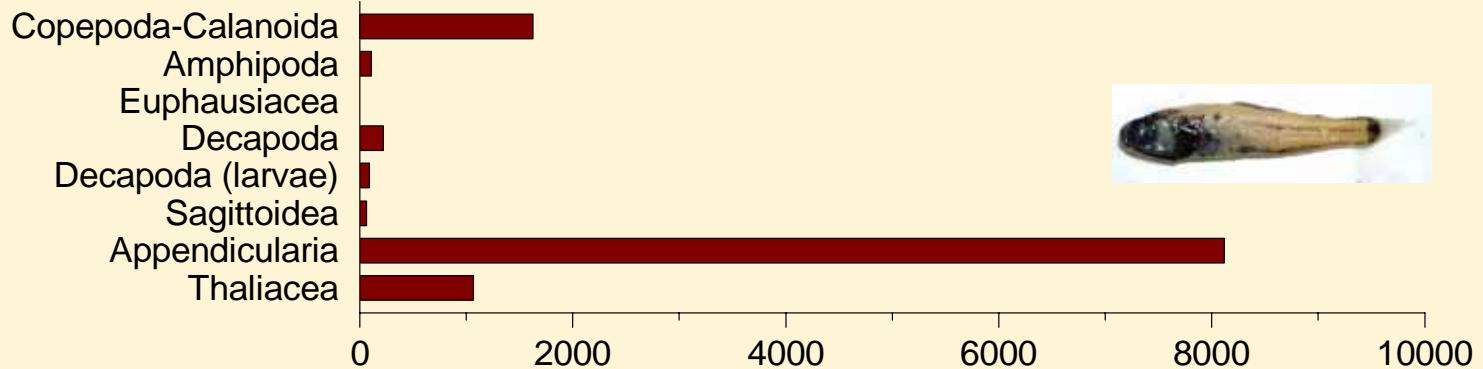
Myctophum obtusirostre



Myctophum asperum

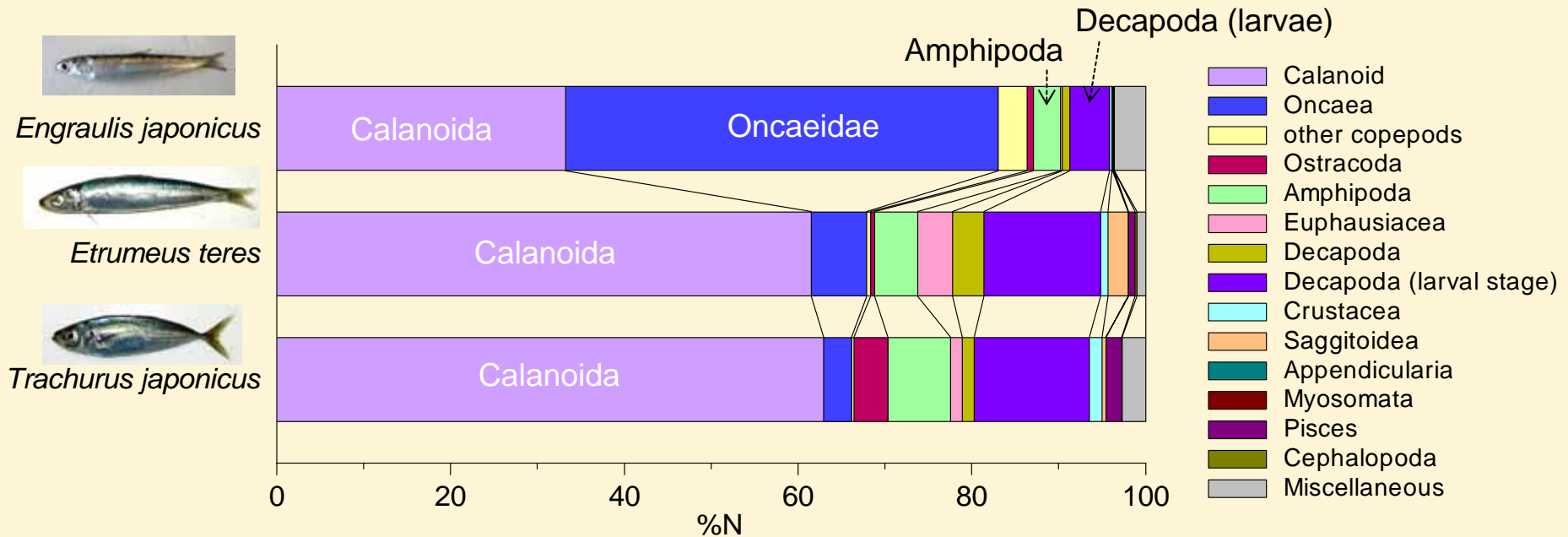


Ceratoscopelus warmingii



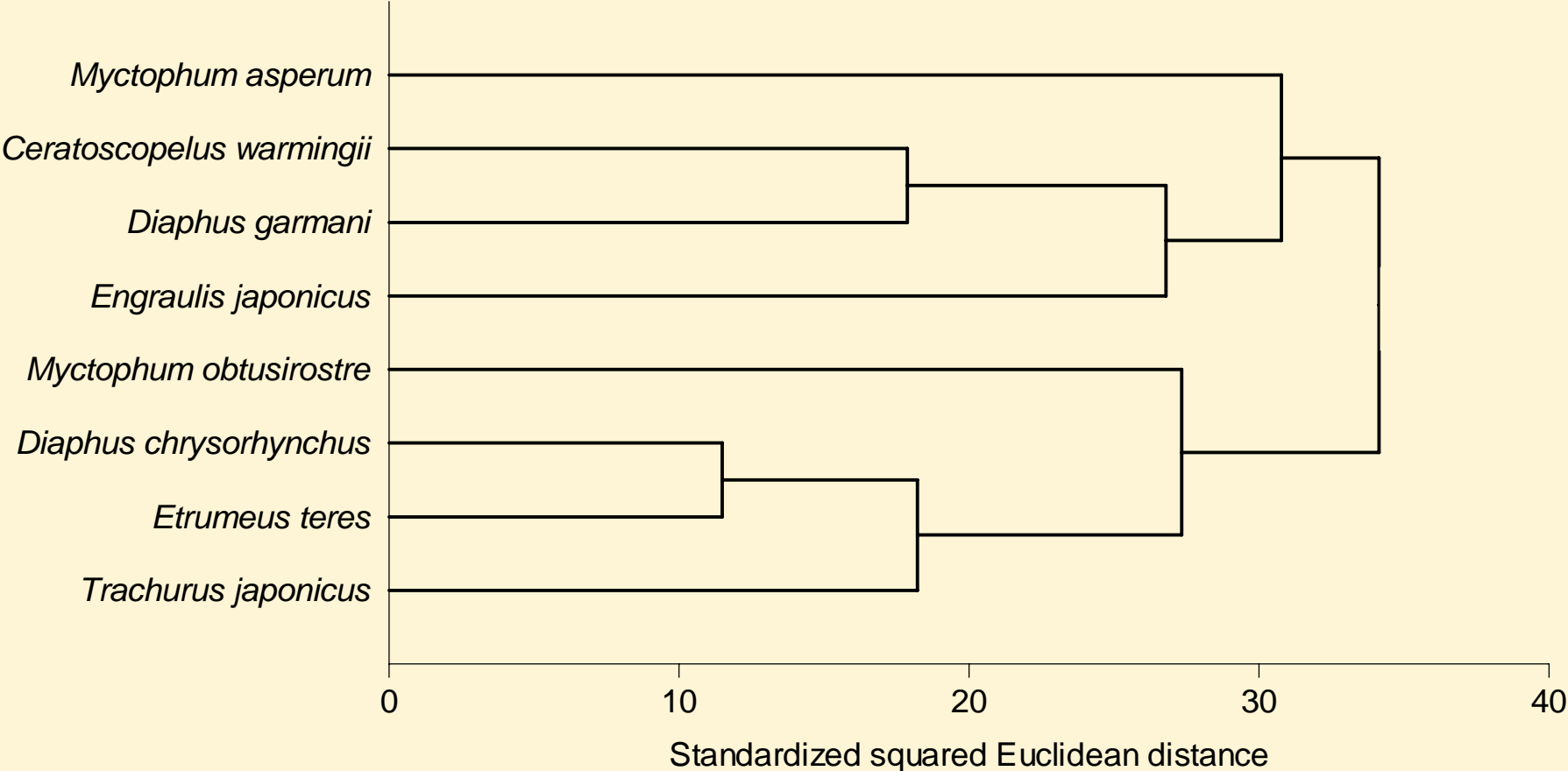
Relationship between pelagic and mesopelagic fish

Feeding habits of pelagic fish (80-140 mm body length) in the northwestern Kyushu in summer months from 2001 to 2003 (Tanaka 2006; Tanaka et al. 2006):

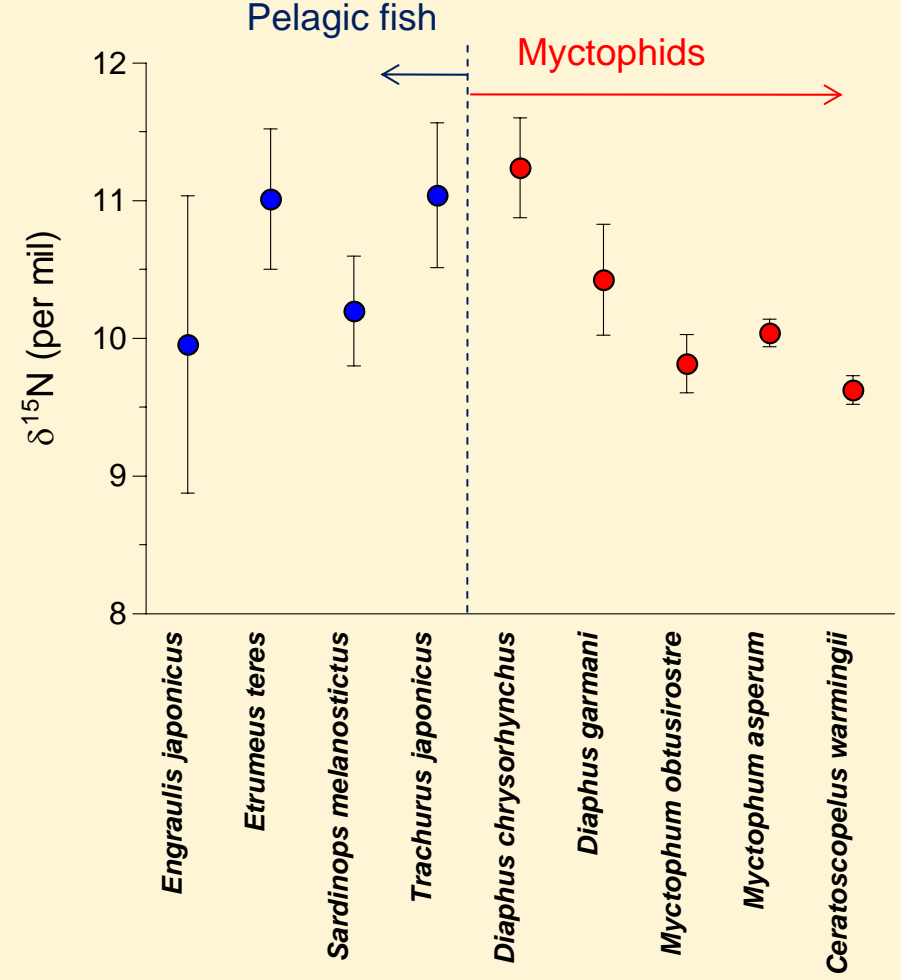
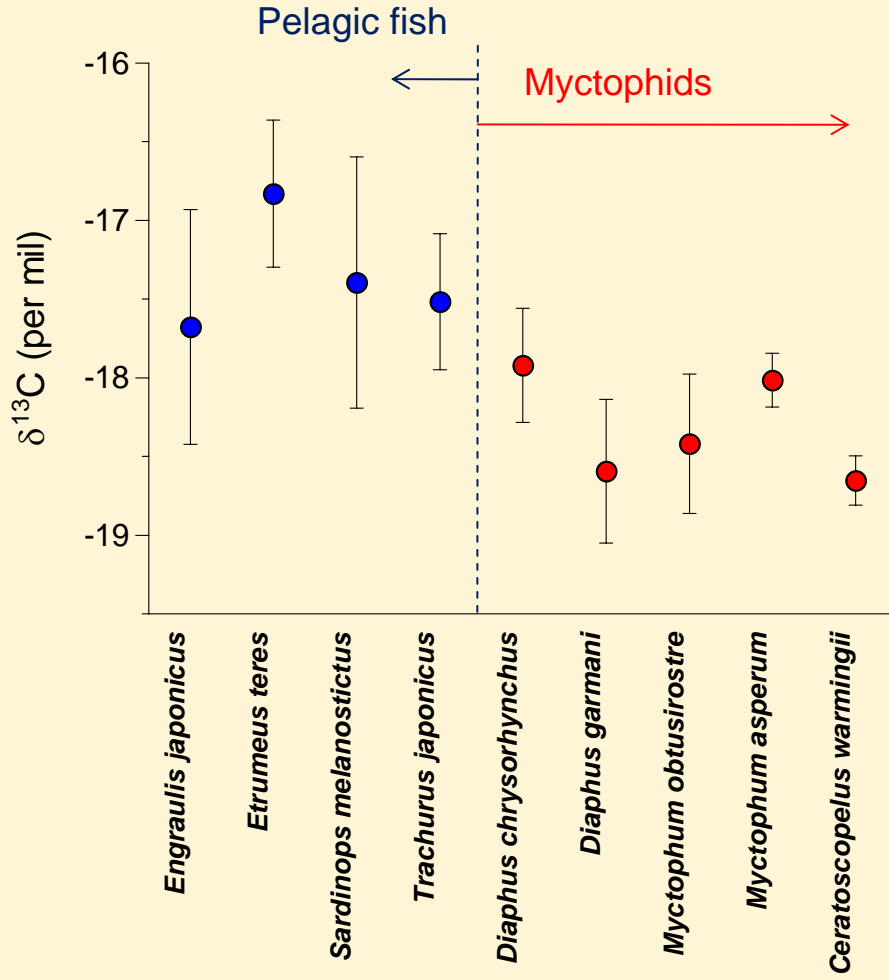


Copepods (Calanoida, Poecilostomatoida) are the major prey items in the pelagic fish diet.

Cluster analysis



Stable isotope ratios



Summary

Feeding habits of myctophids

- *D. chryсорhynchus*: crustacean such as copepods, euphausiids, and larval decapods
- *D. garmani*: crustaceans and appendicularians.
- Seasonal variation (summer vs. winter): euphausiids, ostracods, and larval decapods
- *M. obtusirostre*: crustaceans, sagittoids
- *M. asperum* & *C. warmingii*: appendicularians, thaliaceans

Relationship between pelagic and mesopelagic fish

- Comparisons of stomach contents and stable isotope ratios ($\delta^{13}\text{C}$) suggest the difference in the trophic niche between pelagic fish and myctophids, so a potential for competition should be low in the qualitative sense for the most of the fishes, but..,
- Overlap of trophic niche found to be relatively high between *D. chryсорhynchus*, *Etrumeus teres* and *Trachurus japonicus* (juveniles).
Further study: Quantitative analysis (daily ration) for *D. chryсорhynchus*