Downward carbon transport by diel vertical migration of *Metridia* spp. in the Subarctic Pacific Ocean: Respiratory and mortality fluxes

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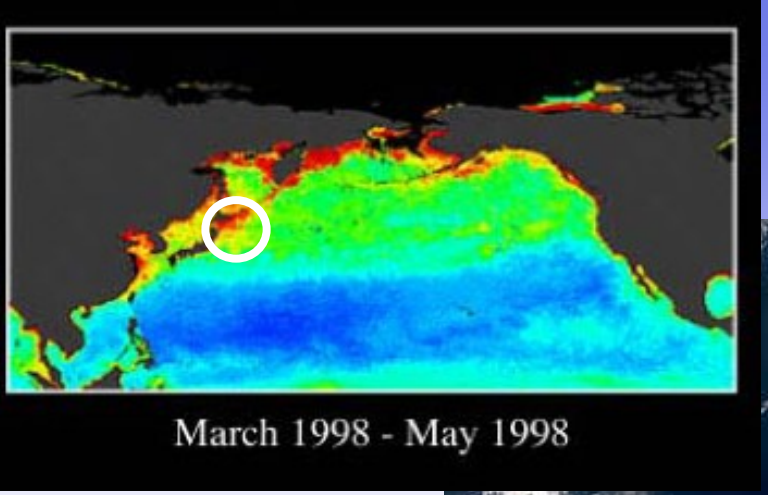
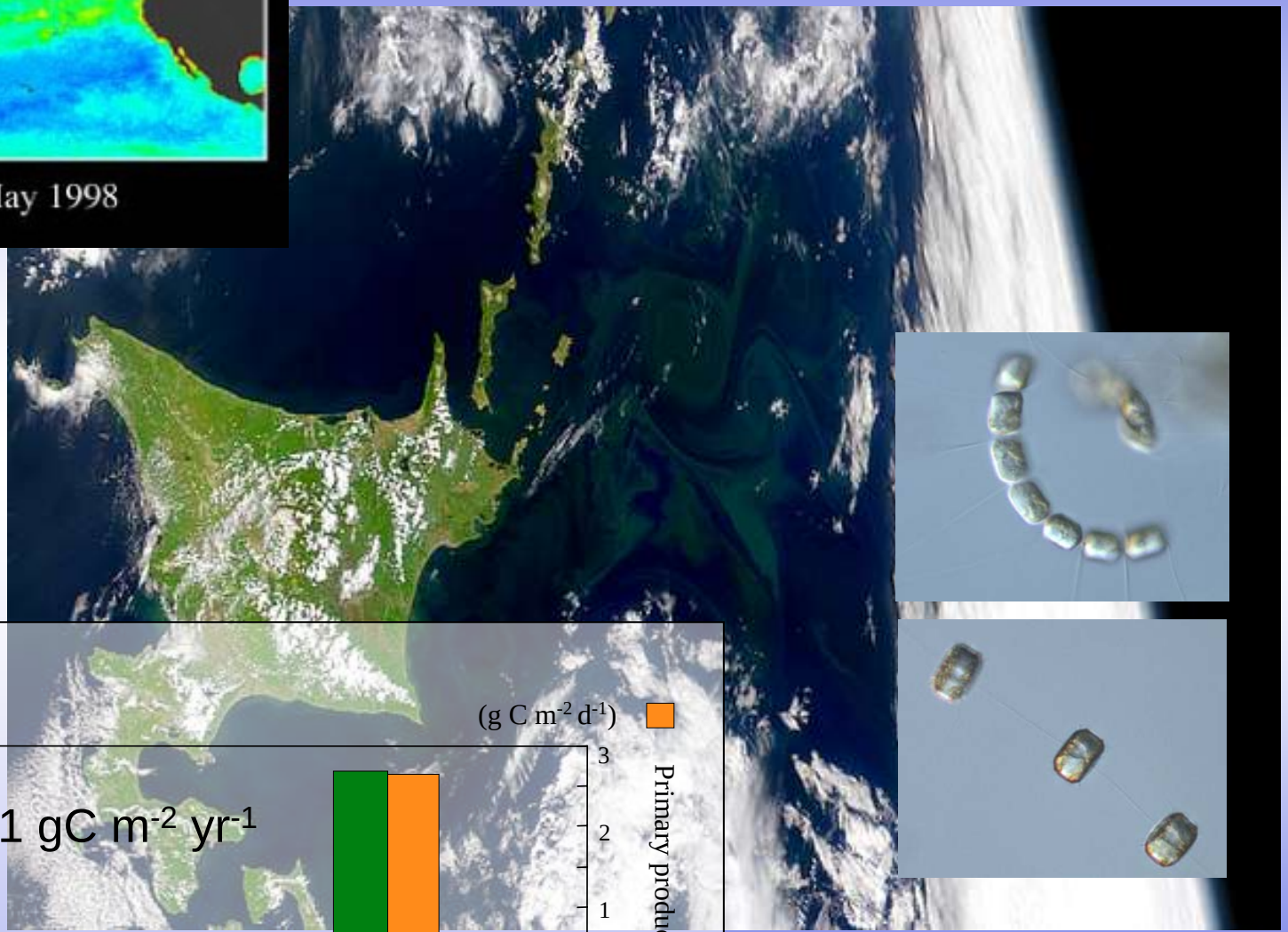
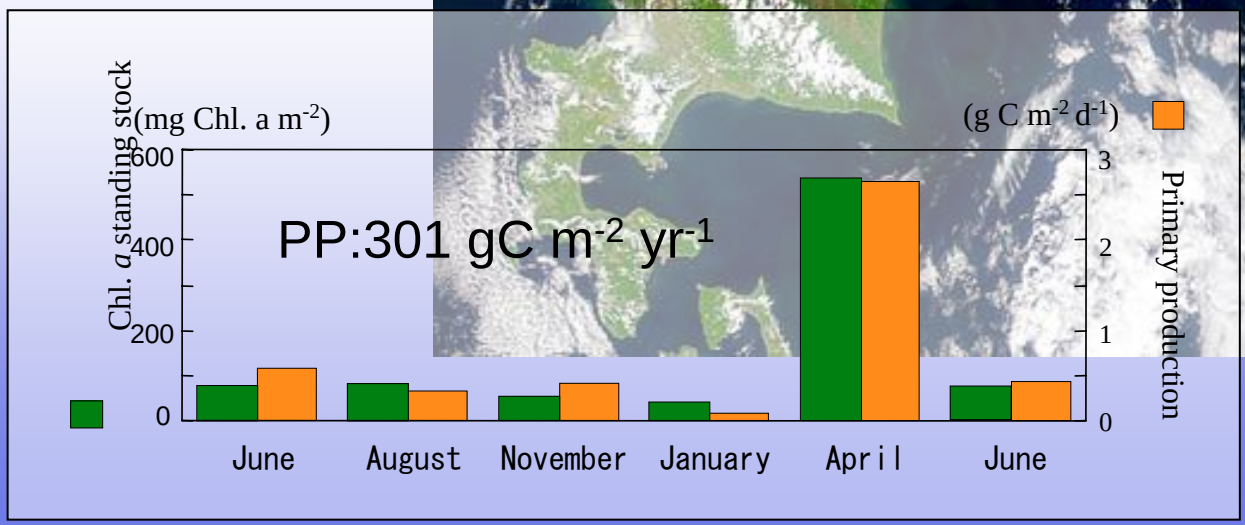
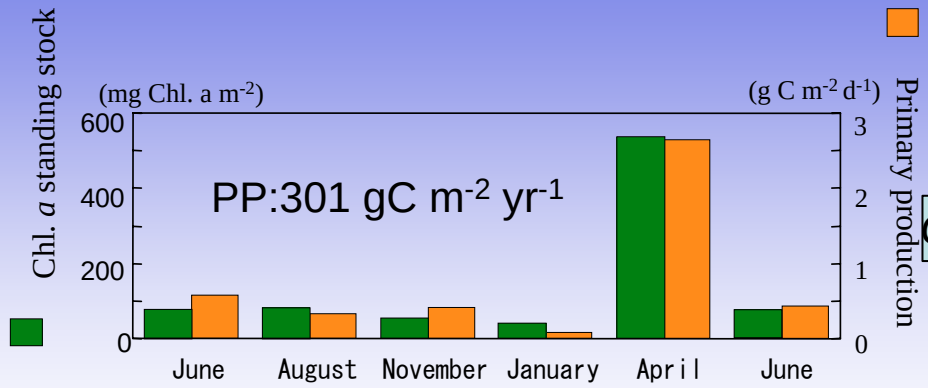


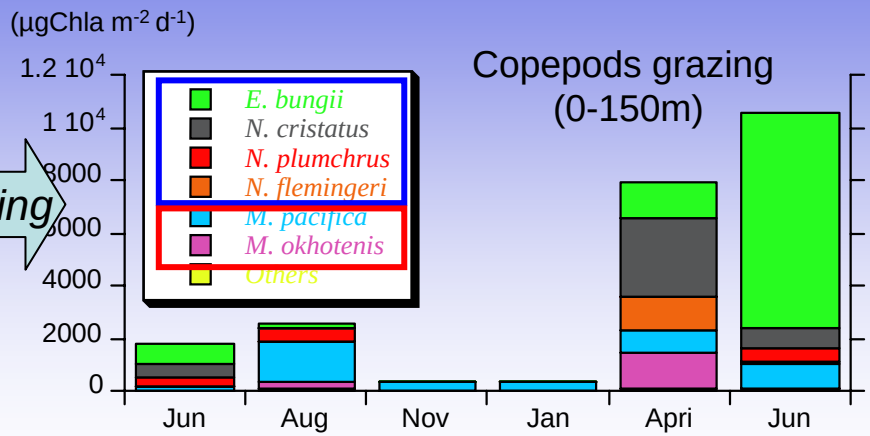




Biological Pump in the Oyashio region



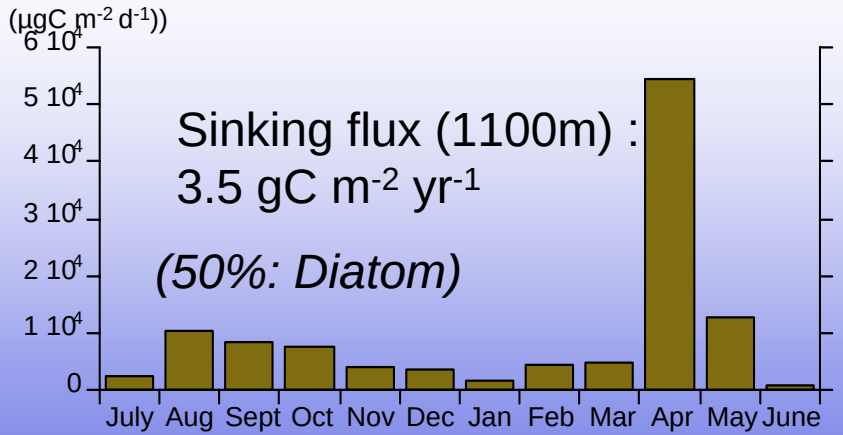
Grazing



Sinking

Defecation
Molting

Vertical
migration



Ontogenetical Vertical Migration

Neocalanus spp.

Respiration & Mortality at depth

4.3 gC m^{-2} yr^{-1}

(Kobari et al. 2003)

Diel Vertical Migration

Metridia spp.

Respiration & Mortality below halocline

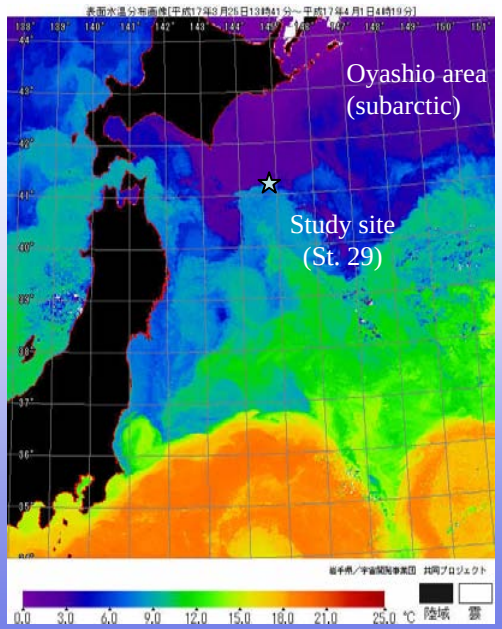
?

Objectives

To estimate the seasonal change of carbon flux due to respiration and mortality through DVM in *Metridia* spp.

To discuss the role of *Metridia* spp, in the biological pump in the subarctic Pacific Ocean.

Methods *-Biomass of migrating population*

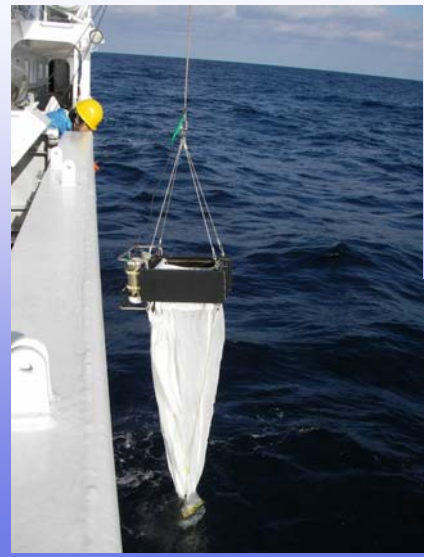


・Jun., Aug., Nov., 2001 and Jan., Apr., Jun.,2002

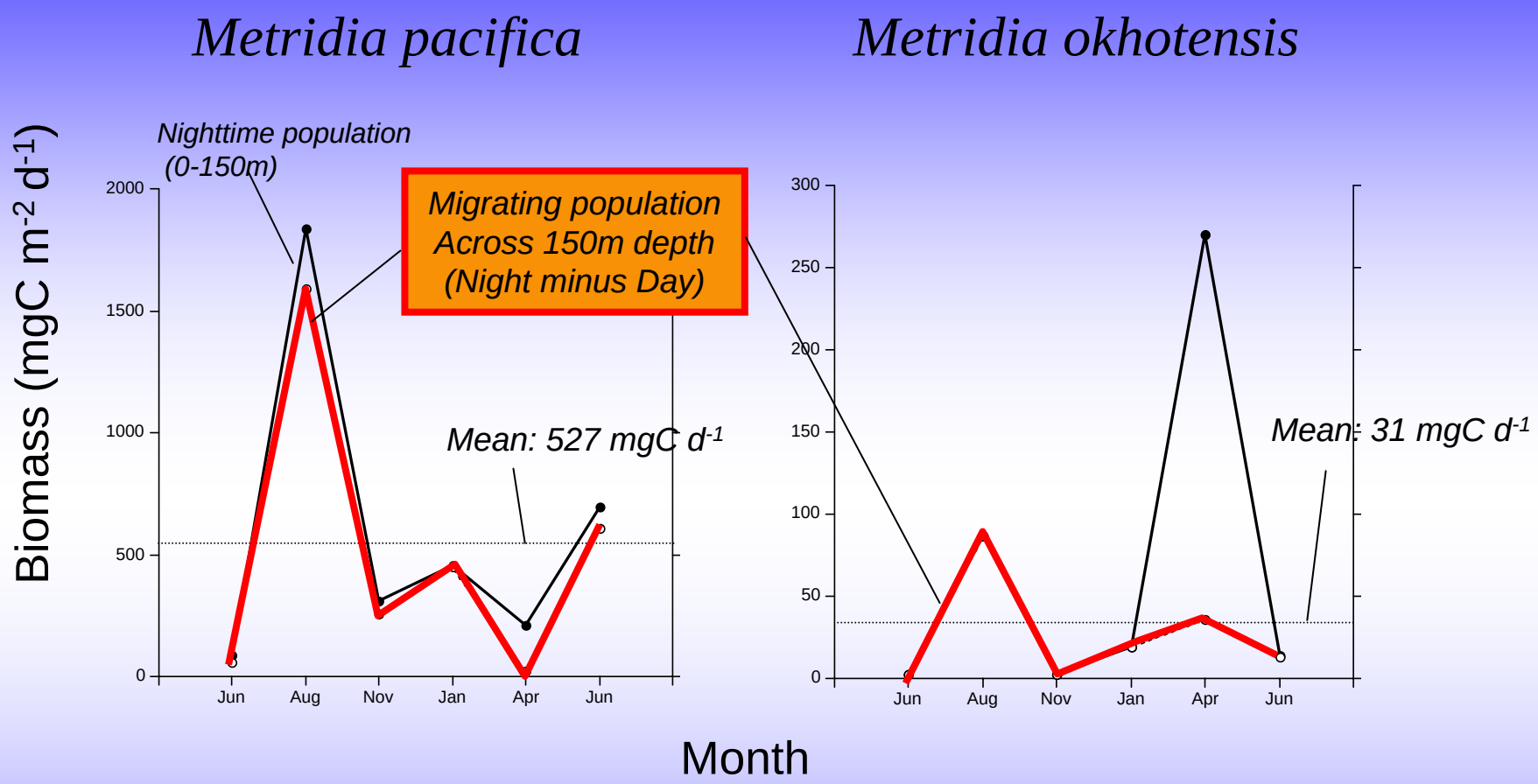
・OICE-Line Stn 29 (41° N, 144.4° E)

・Stratified sampling from 500 m to surface with the VMPS-net

Population migrated daily across 150m depth = *Migrating population*



Biomass of migrating population in *Metridia* spp.in the Oyashio region



Mean Migrating biomass

Metridia spp.	558 mgC m^{-2} d^{-1}
BATS[1]	50 (0-123)
HOT[2]	142

References: [1]Steinberg et al. (2000), [2]Al-Mutairi & Landry (2001)

Estimation of DVM fluxes in *Metridia* spp.

Respiratory Flux

$$F_R = B_{Migrator} \times C_R \times D_{Day}$$

$B_{migrator}$: Biomass of migrating population

C_R : Respired Carbon per hour (calculated according to Ikeda 1985)

D_{Day} : Length of daytime (h)

Mortality Flux

Main predators: the 3 dominant myctophid fishes in the Oyashio region,
Diaphus theta, Stenobrachius leucopsarus, *S. nannochir*

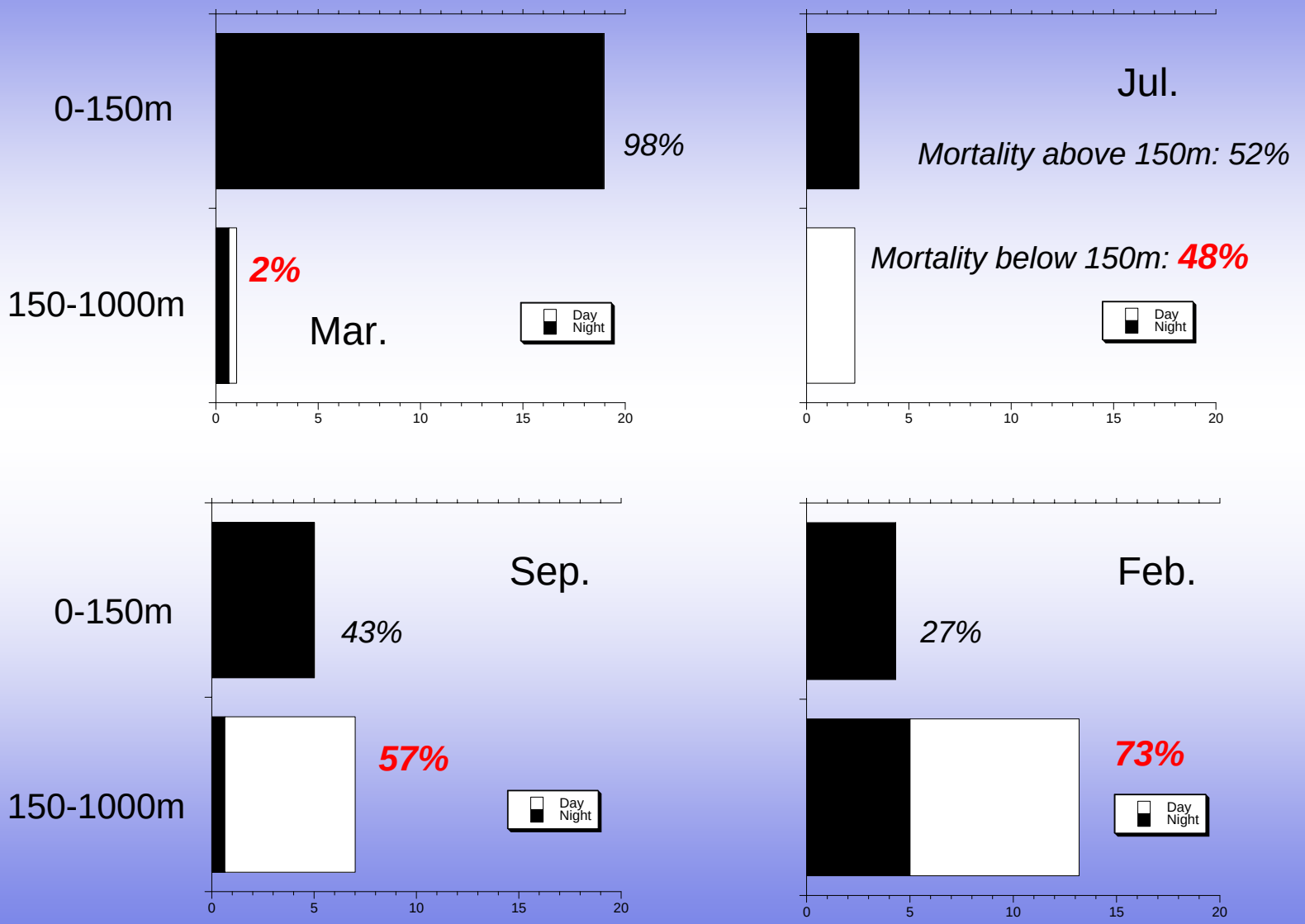
$$F_M = B_{Migrator} \times 0.01 \times \%P_{Deep}$$

Daily mortality by the Myctophid fishes predation is assumed as 1% (cf. Batchelder & Miller 1989)

Fraction of mortality due to predation occurred below 150 m

–Inferred from gut content analysis of myctophid fishes

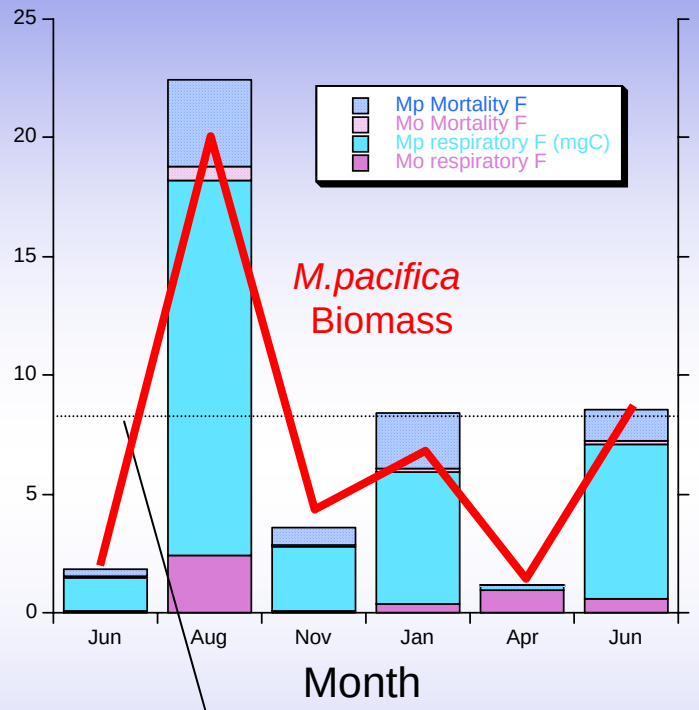
Seasonal change of diel and vertical variation of predation pressure on *Metridia* spp.by Myctophid fishes in Oyashio region



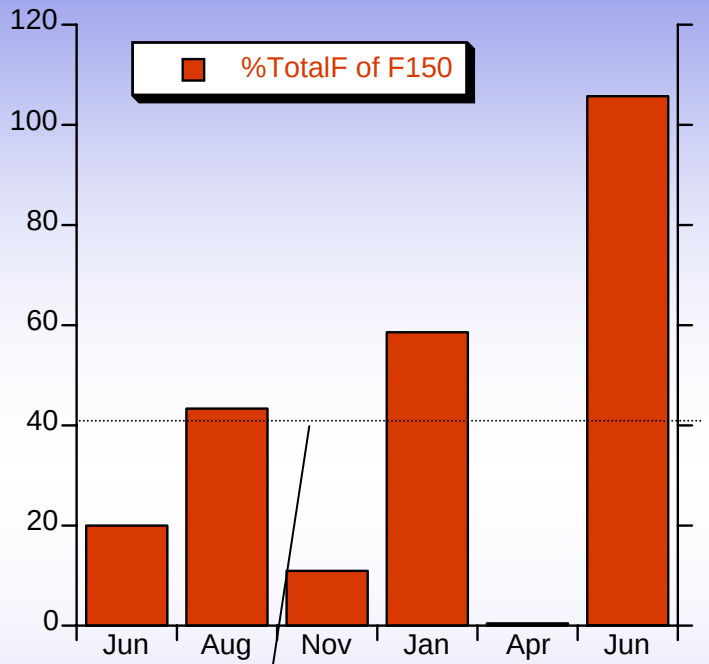
Number of *Metridia* spp. predated by Myctophids (inds m^{-2} d^{-1})

Downward carbon export through DVM in *Metridia* spp.

Downward flux (mgC m^{-2} d^{-1})



% of POC flux at 150 m



Migratory flux (*mgC m^{-2} d^{-1}*)		**% of POC at 150 m**
Metridia	*8.2 (1-23)*	*40 (1-106)*
BATS[1]	*2.0 (0-9.9)*	*8 (0-39)*
HOT[2]	*3.6 (6-25)*	*15 (6-25)*

References: [1]Steinberg et al. (2000), [2]Al-Mutairi & Landry (2001)

Importance of copepods as a carbon transporter in the Oyashio region

Particle flux
(diatom, feces)

Neocalanus
(Kobari et al.)

Eucalanus
(Tsuda unpub.)

Metridia
(This study)

OVM

OVM

DVM

Depth

150 m

200 m

1000 m

19

15

3.9

4.3

0.9

3.0 gC m^{-2} y^{-1}

8.2 gC m^{-2} y^{-1}
(43% of particle flux at 150 m)

Biological Pump in the Oyashio region

Passive Sinking

Flux at 150m

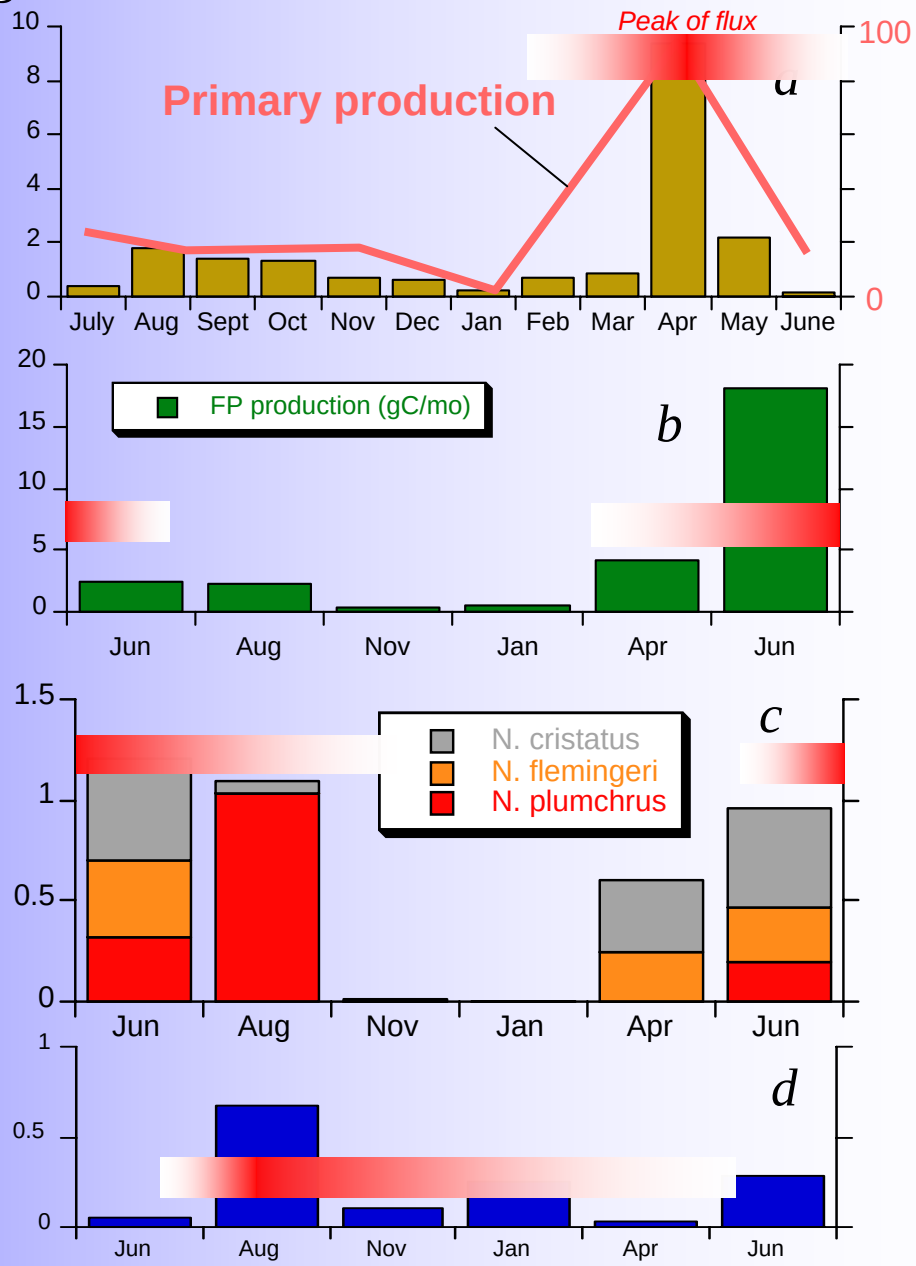
Fecal pellet
Production by copepods

at 0-150m
(30% of POC grazing)

Neocalanus spp. CV
Biomass at 0-150m

(as an index of **OVM flux**)

DVM Flux
by *Metridia* spp.



Unit: *gC m^{-2} mo^{-1} (a,b,d))*
gC m^{-2} (c)

Conclusions

- Annual carbon export through DVM in *Metridia* spp. in the Oyahsio region is 3.0gC m^{-2} (respiration: 2.6, mortality: 0.4), corresponding to 16 % of sinking flux at 150 m depth

- DVM in *Metridia* spp. is important process in downward carbon transport as well as the OVM in *Neocalanus* spp, and *Eucalanus bungii* in Oyashio region

- Since DVM in *M. pacifica* is more active during the period when gravitational flux and OVM flux are low, this species plays an important role in driving the biological pump efficiently in subarctic Pacific during summer-winter

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