Introduction for long-term monitoring in the sardine spawning area: seasonal and annual variations of plankton biomass and compositions.

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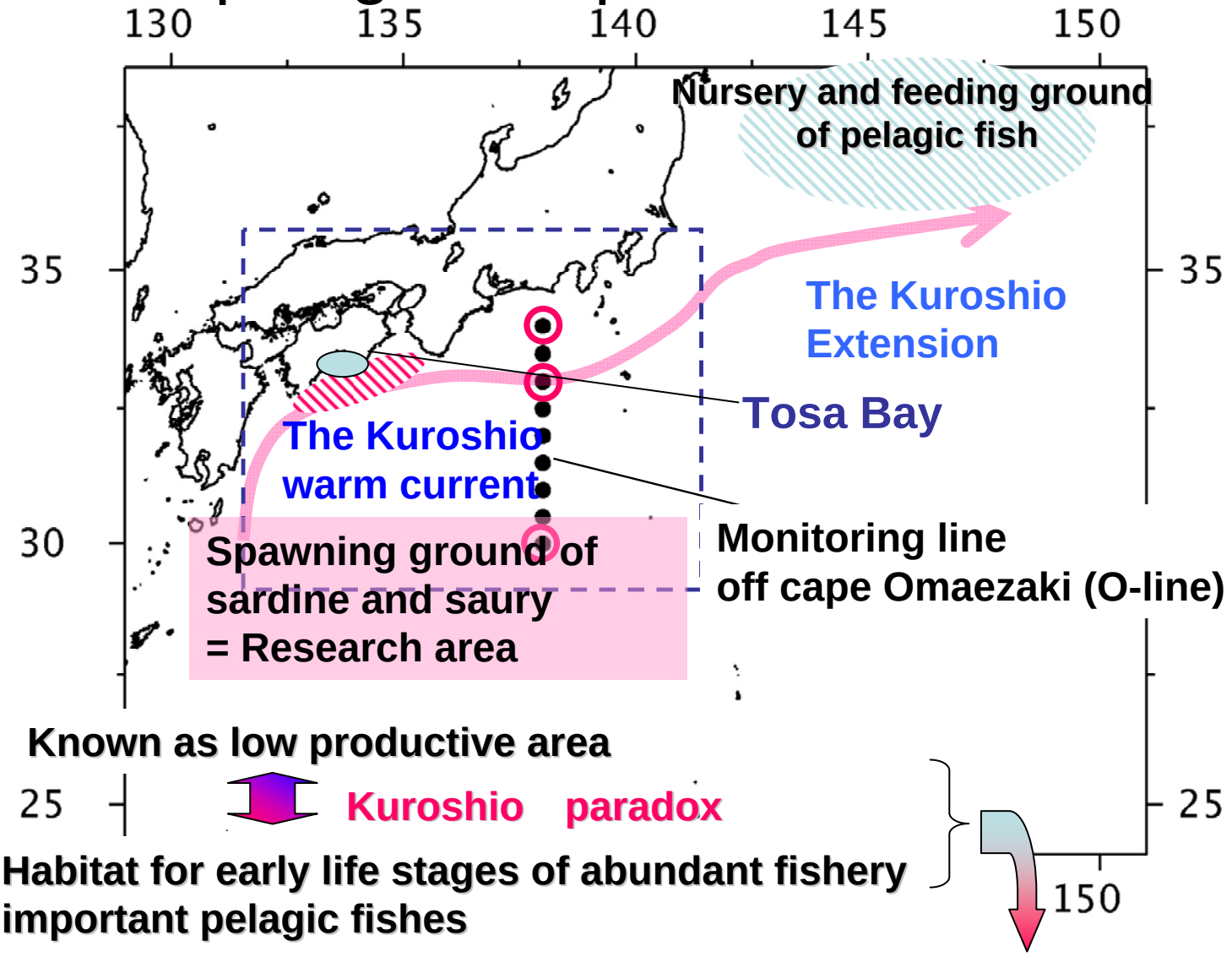
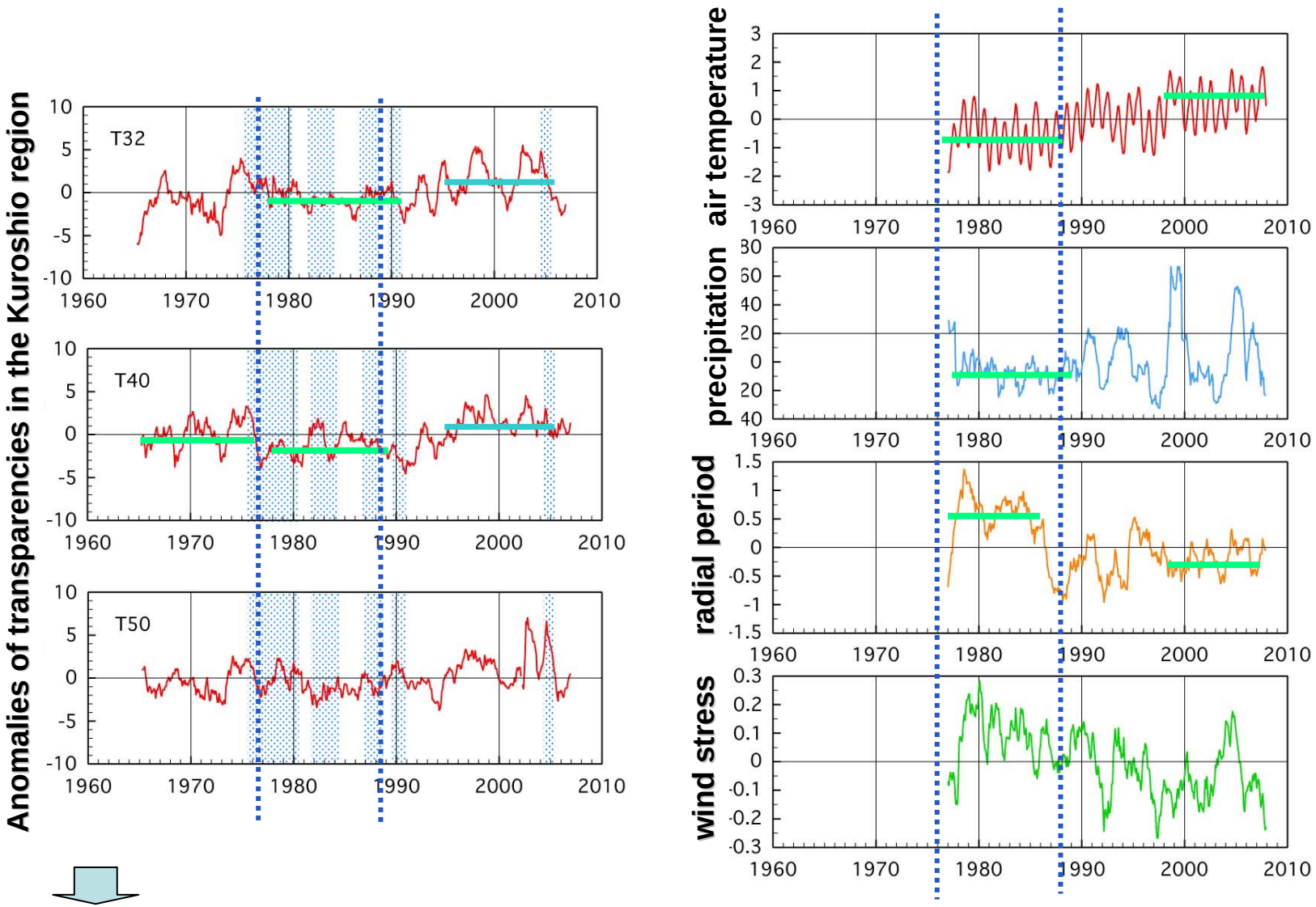
Importance of Kuroshio area for pelagic fish production



Field monitoring to clarify the mechanism of abundant pelagic fish production

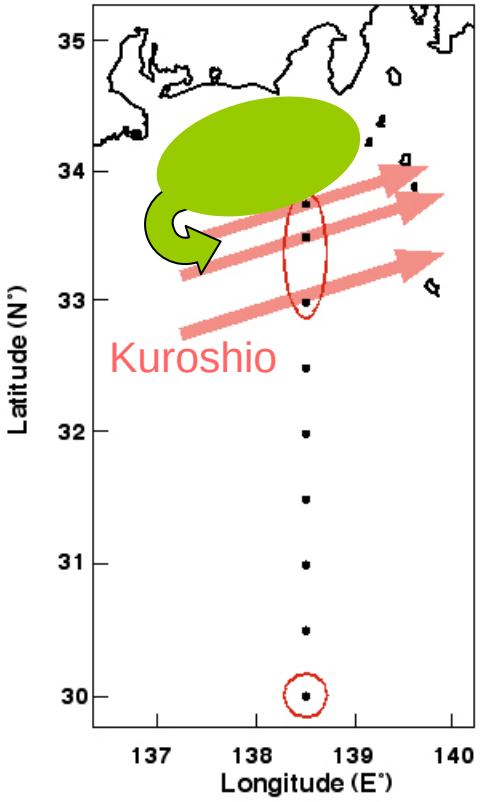
Long-term variation of transparencies of Sardine spawning area in relation to climate change



Physical – Chemical – Biological interactive observation is necessary to analyze The mechanism of biological production in this area

2. O-Line

history of 6 yrs, gradually developing



Each season (May, Jul-Aug, Nov, Jan, Mar)

2002-2005

T, S
macronutrients
Chl. a
meseZoopl. biomass
(0-200m)

2006-2010?

T, S
macronutrients
Chl. a
mesoZoopl. biomass
(0-200m)

bacteria
phytoplankton
(nano-, micro-)
ciliates
Zoopl. vertical distribution
(MOCNESS, 0-200m)
primary productivity

+

advection of

nutrients
phyto / zooplankton

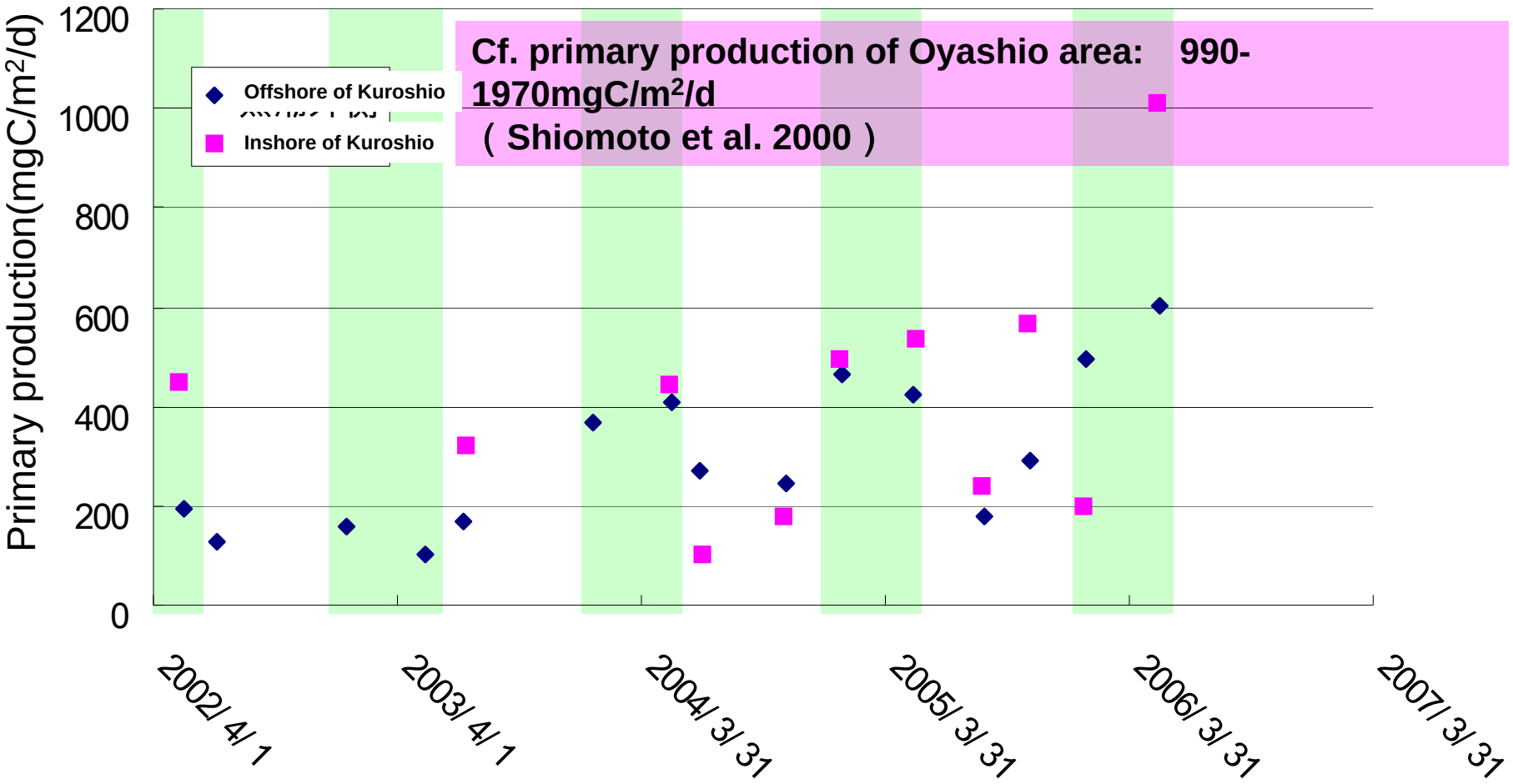
from slope water to Kuroshio

Questions about the ecosystem of Kuroshio

- Is it true that Kuroshio area is low productive ?
- How is the biological response to seasonal variation?
- How is the long-term variation of biological production in response to climate change

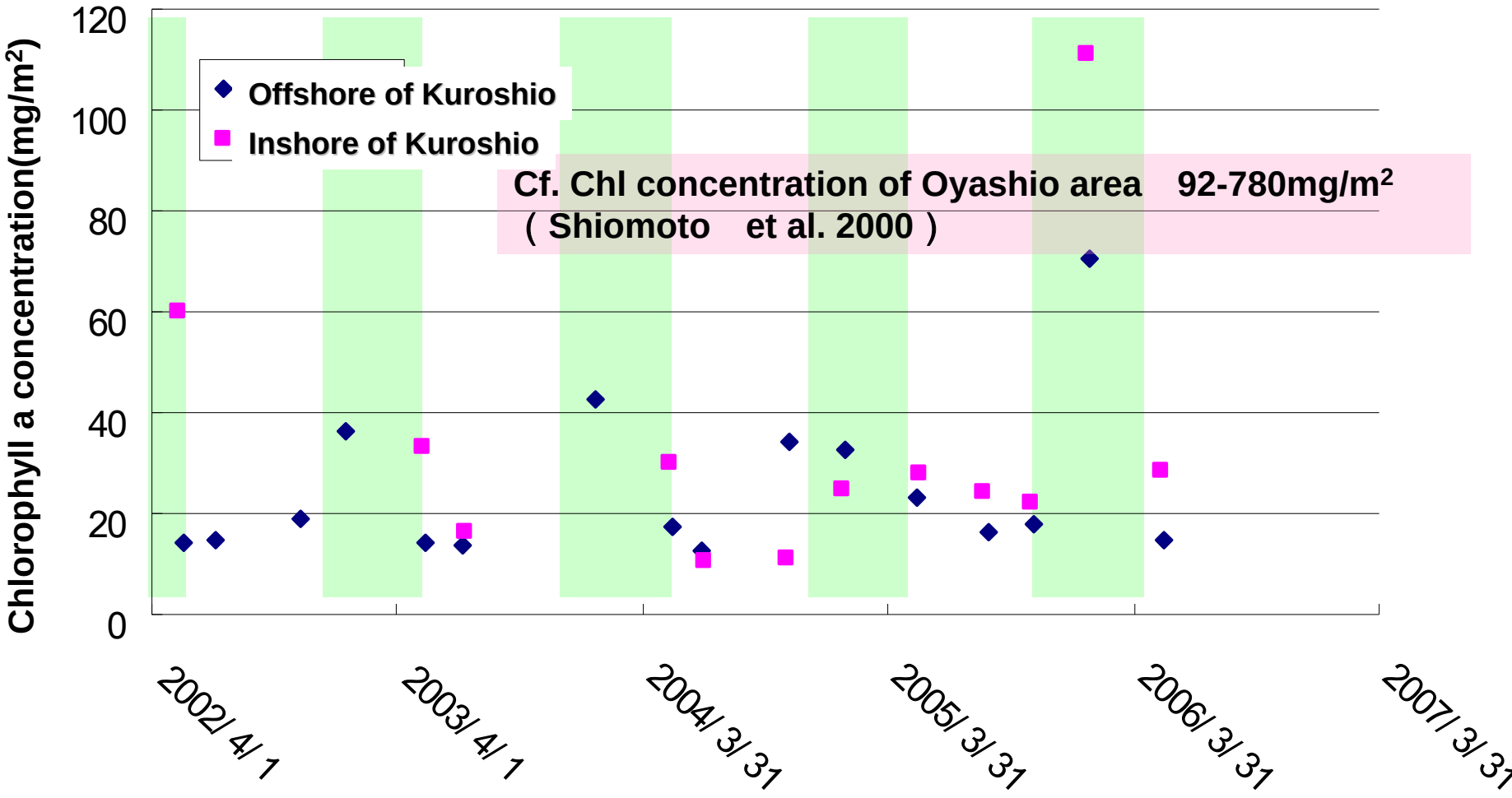
= Keys to solve the paradox of Kuroshio

Seasonal and annual variations of primary production



1. High production was observed during winter and spring at the offshore of Kuroshio area
2. The annual trend of increasing was observed (?)
3. The values have been low even inshore of Kuroshio

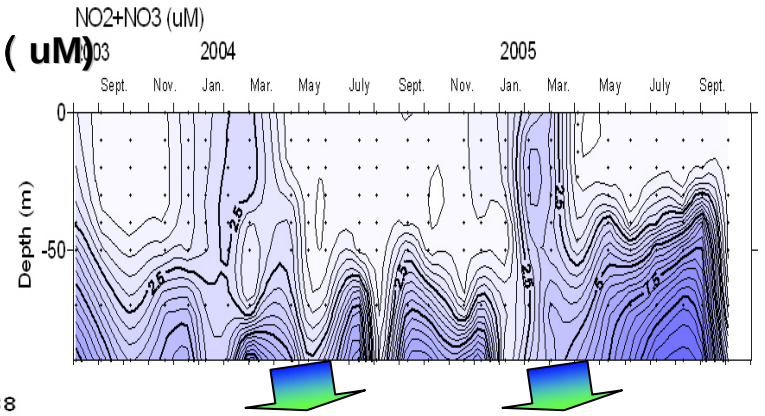
Seasonal and annual variations of Chlorophyll a concentration



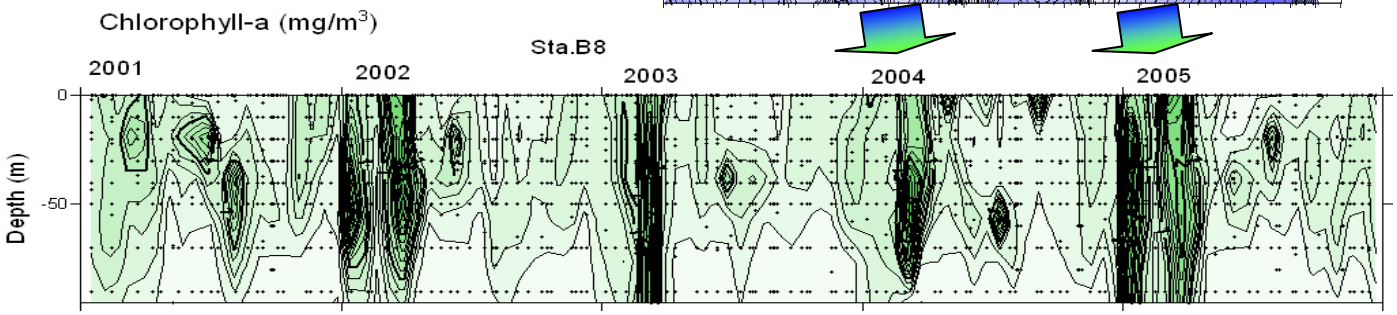
1. High concentration was observed during winter and spring
2. The values have been low even inshore of Kuroshio area

Interaction between nutrient - phytoplankton production - zooplankton production

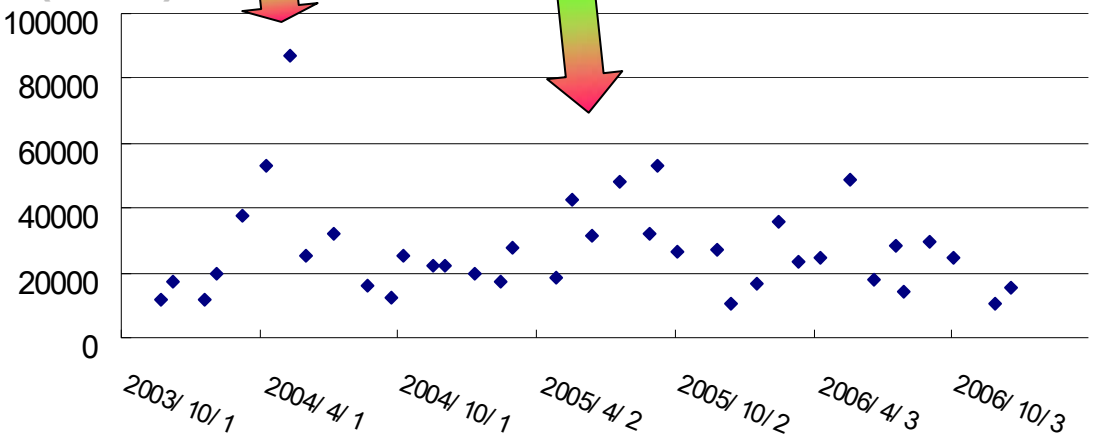
nitrate + nitrite concentration (uM)



Chla concentration (mg/m3)



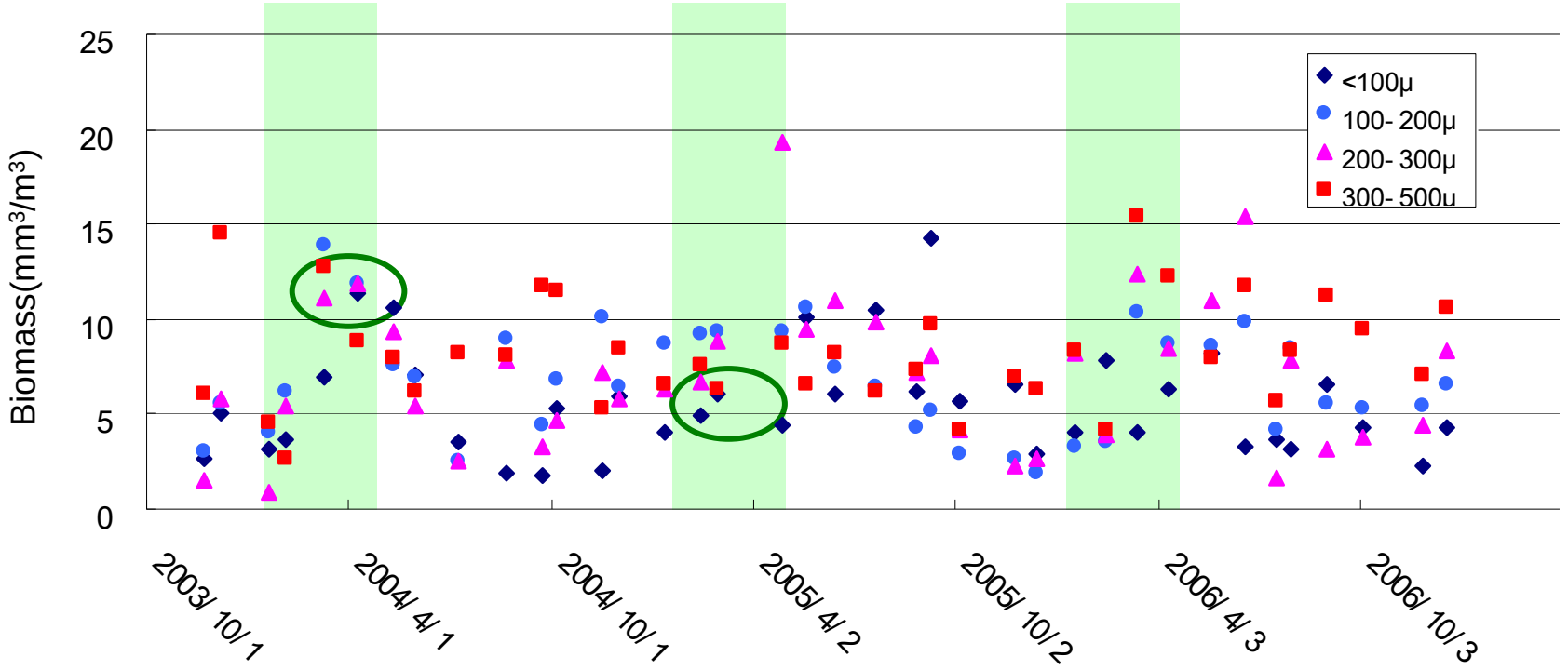
Small (<100μm) copepod abundance (ind/m³)



In 2005, nutrient and Chl concentrations were high, while abundance of small copepods was low

Not preferable situation for larval pelagic fish?

Seasonal and annual variations of copepod biomass

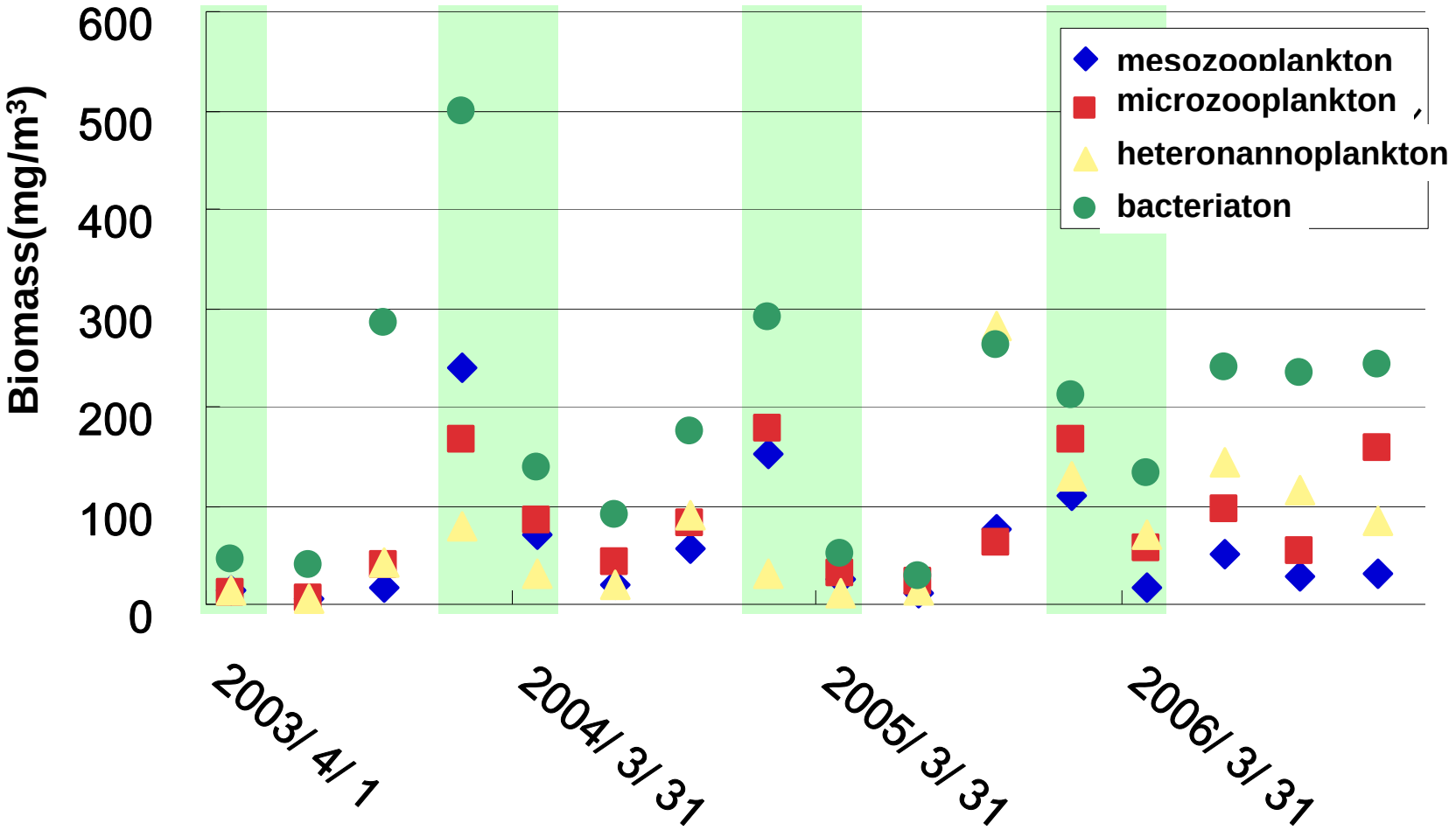


1. **High abundant during winter and spring = preferable for spawning of pelagic fishes (e.g. sardine and saury)**
2. **In 2005, small copepods were not abundant, but large copepods were relatively abundant**

→ preferable situation for adult pelagic fish?

⇨ **Feeding condition of pelagic fish may alter annually**

Seasonal and annual variations of zooplankton communities

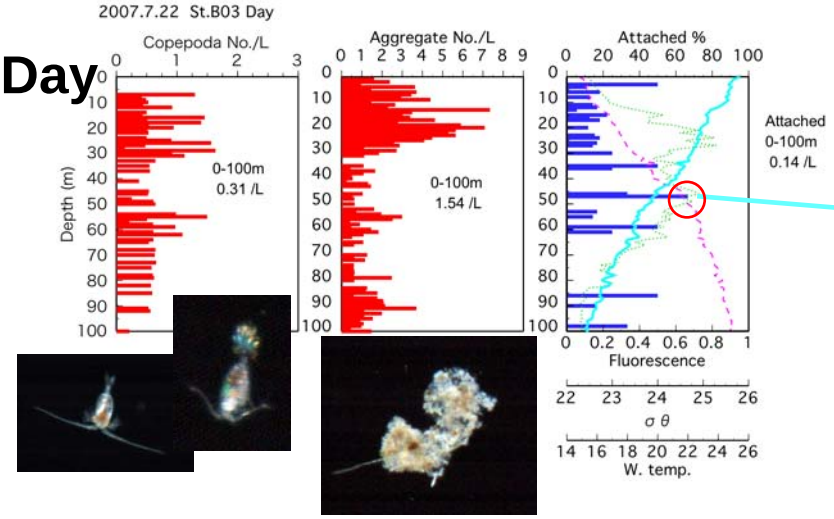


1. High abundance was observed during winter
2. Composition of plankton alters annually

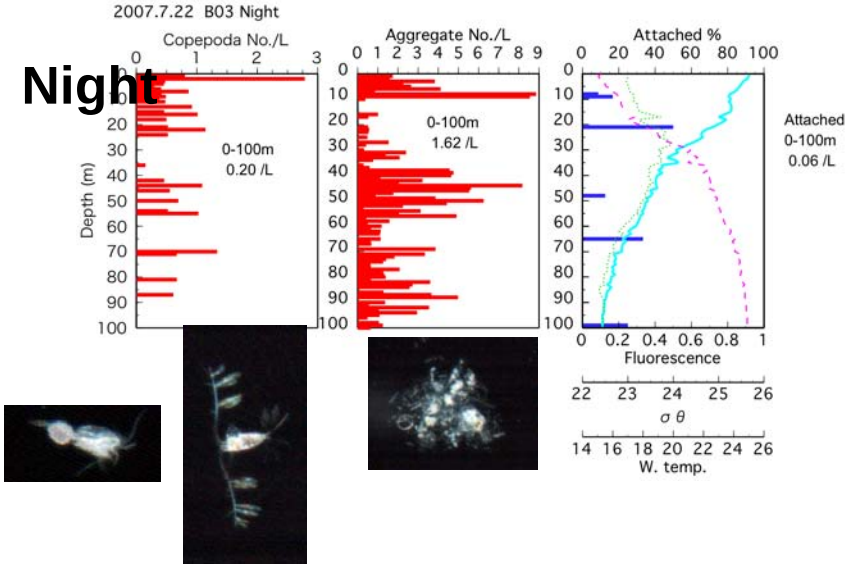
In situ video plankton recorder (VPR) observation

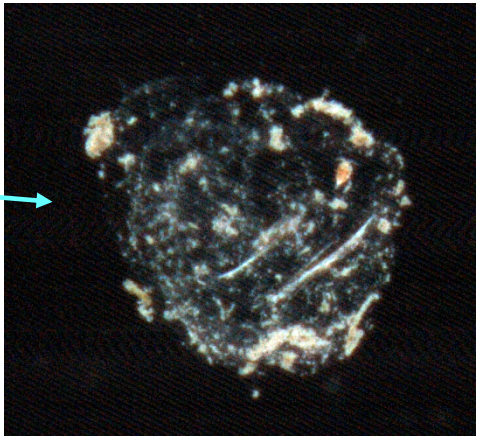
Zooplankton distribution and species composition are analyzed quickly and precisely

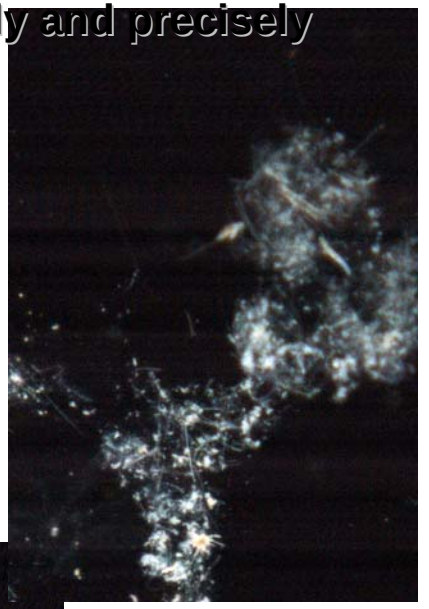
Day

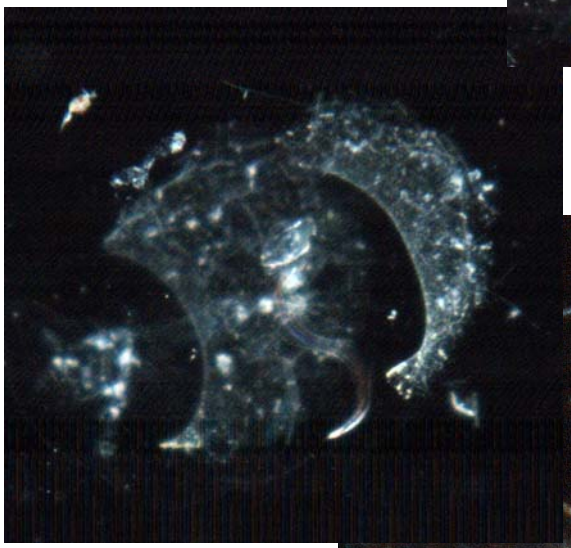


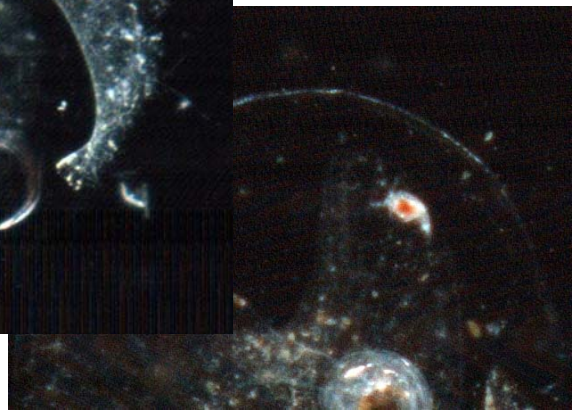
Night







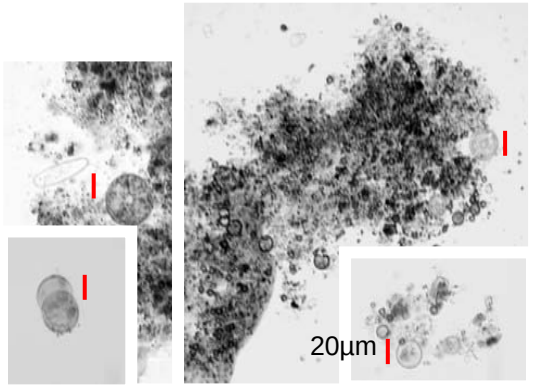




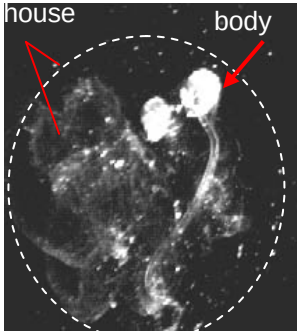
Gelatinous object often observed and they may be important for zooplankton habitat and food.

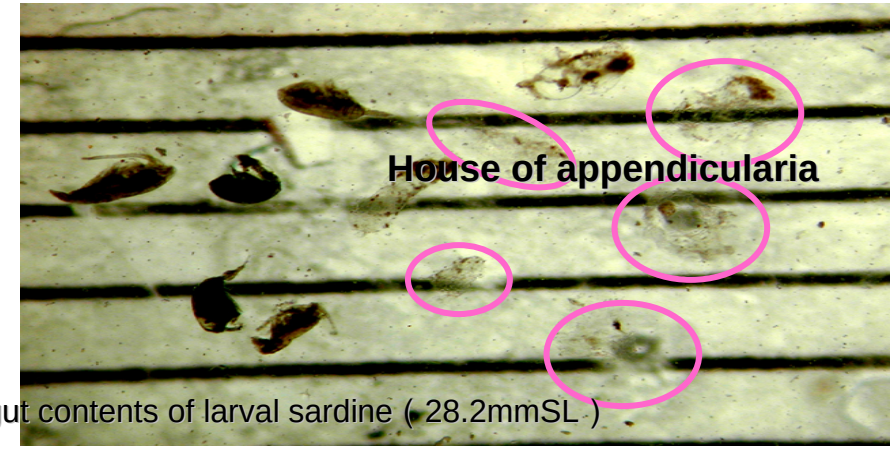
Those are not able to be observed from plankton net collection samples.

Importance of gelatinous plankton for larval fish production

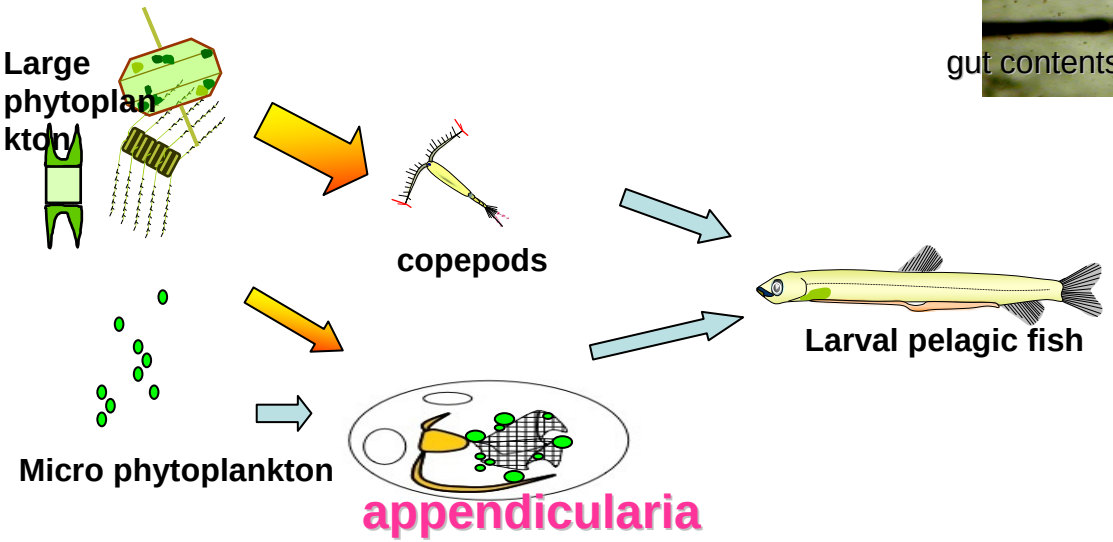


appendicularia = their ecology is not known well

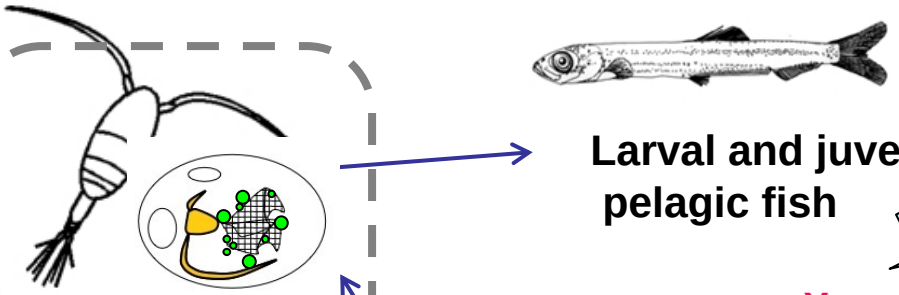




gut contents of larval sardine (28.2mmSL)



Larval fish may be able to utilize micro phytoplankton production through the gelatinous plankton



Prey for larval pelagic fish

Meso-zooplankton
(copepods, appendicularia)

Larval and juvenile pelagic fish

Young pelagic fish can survive
If the food web conditions alter
because of climate change

Low trophic level ecosystem

Microzooplankton (ciliates etc.)

phytoplankton
(diatoms etc.)

Heterotrophic nannoflagellates ("HNF")

Climate change

bacteria

Picophytoplankton
(coccoliths etc.)

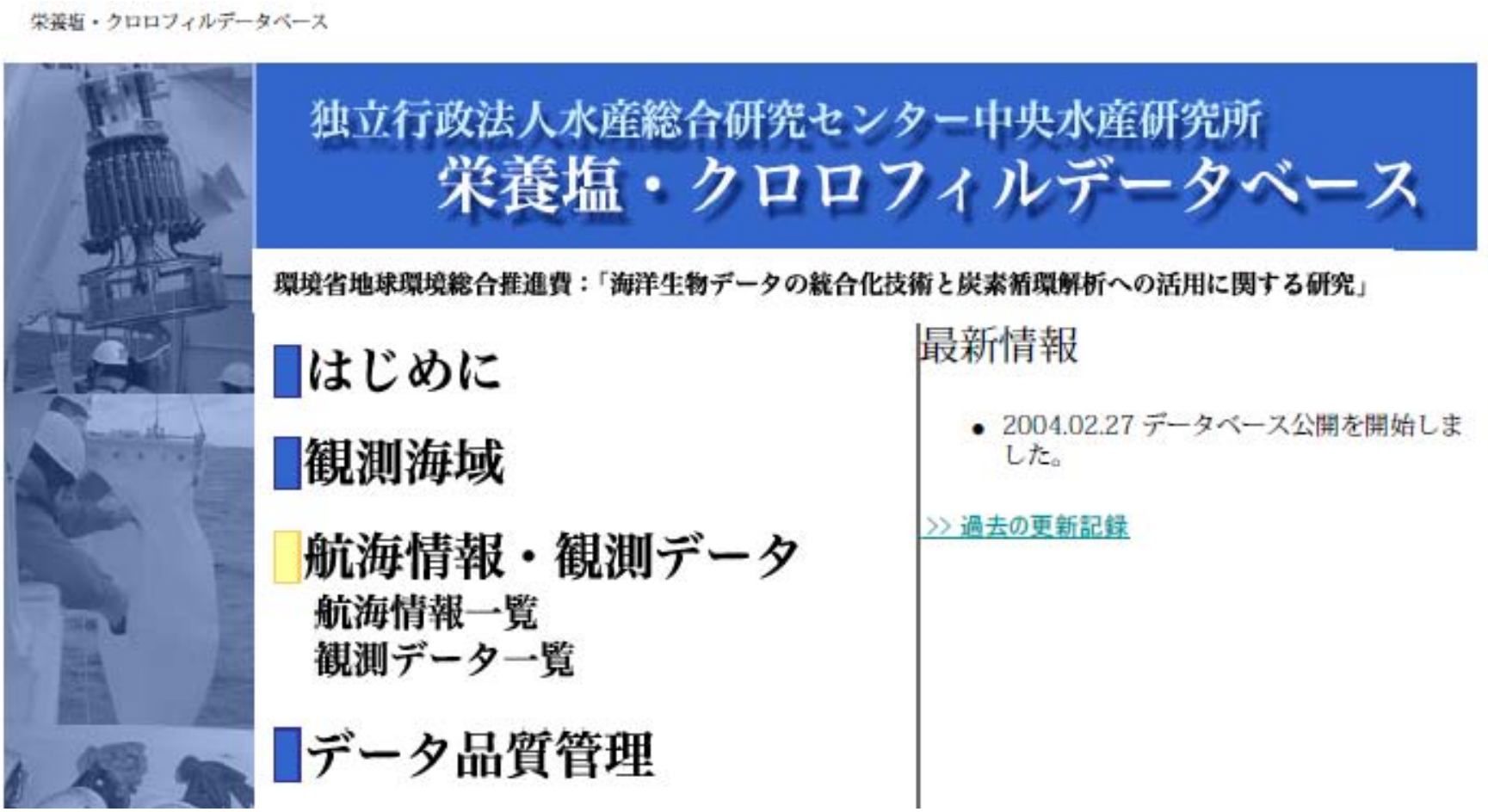
Continuous field monitoring is necessary

- Species composition
- Life history
- Biomass of each species
- Seasonal variation
- Annual (decadal) variation

Data base is partly open at this Site

(http://nrifs.fra.affrc.go.jp/eiyo/)

- **Unfortunately Japanese only now...**



- **This data base is contributed to the ecosystem model (e.g. e-NEMURO)**