Long-term variation of plankton community of Kuroshio warm current area, the spawning ground of Japanese sardine

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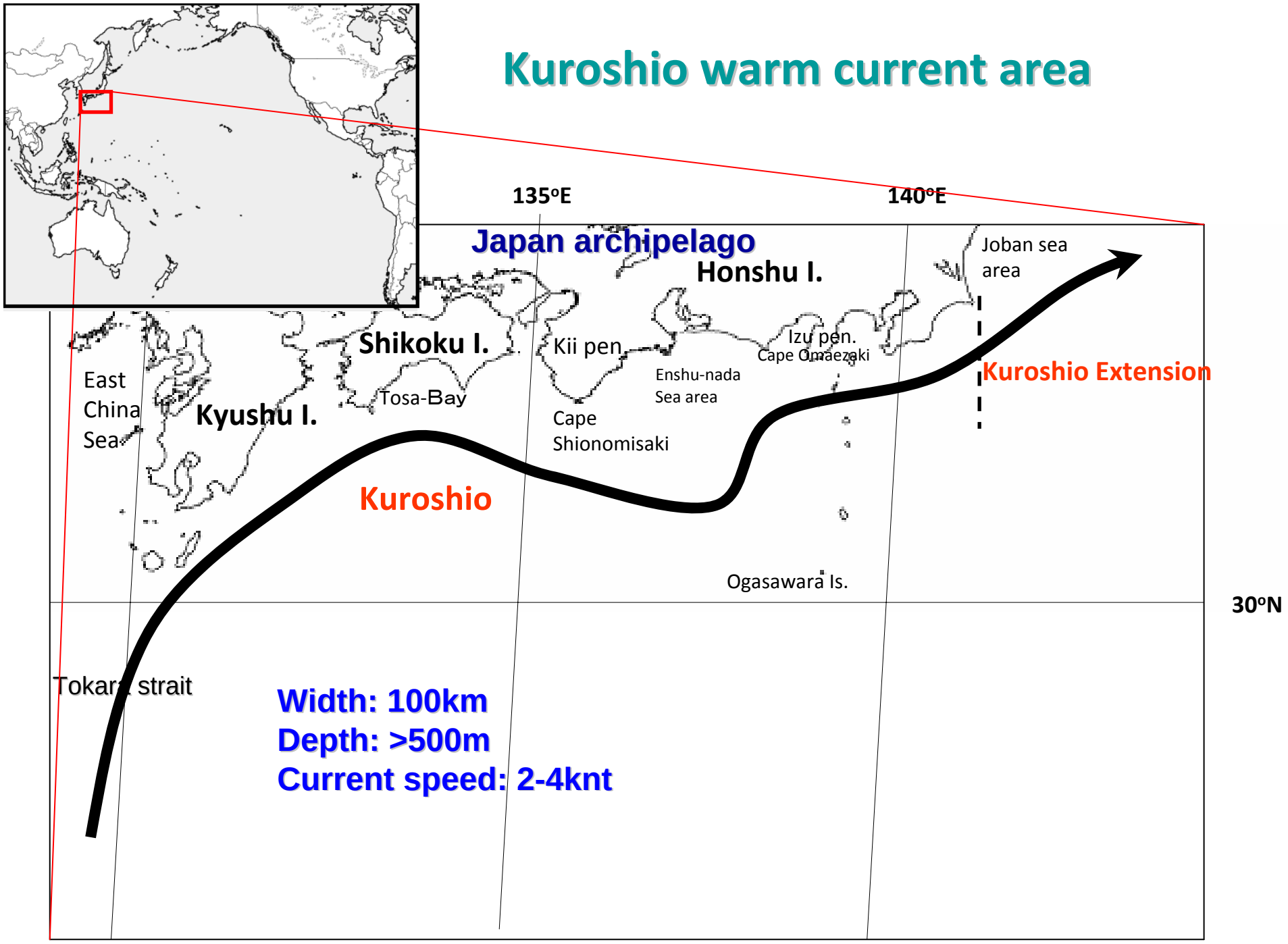
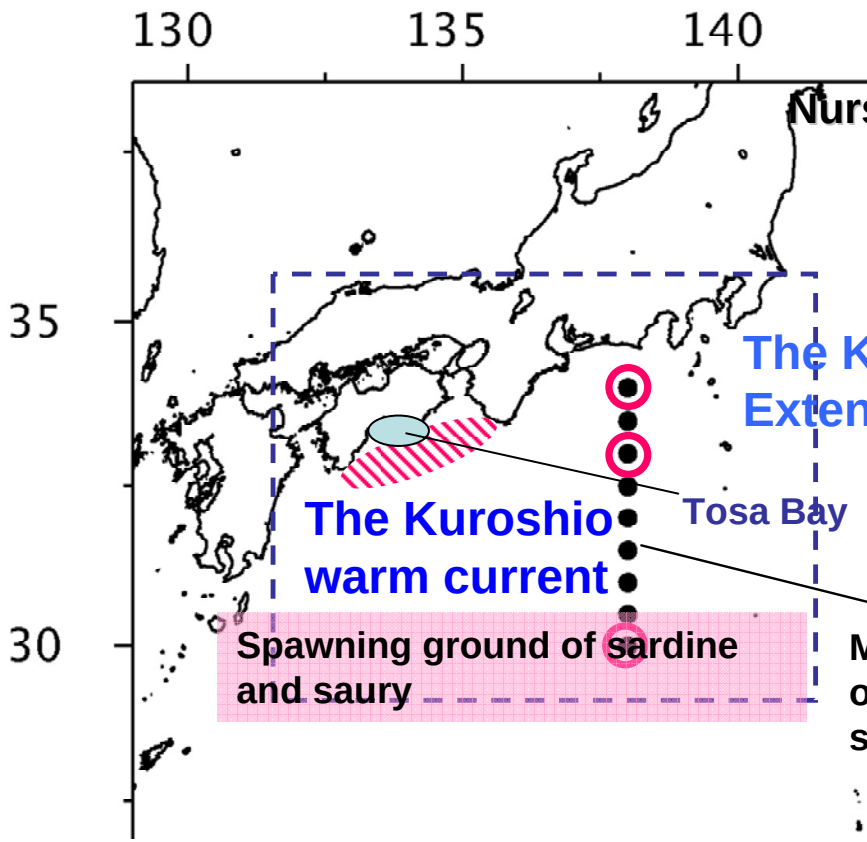
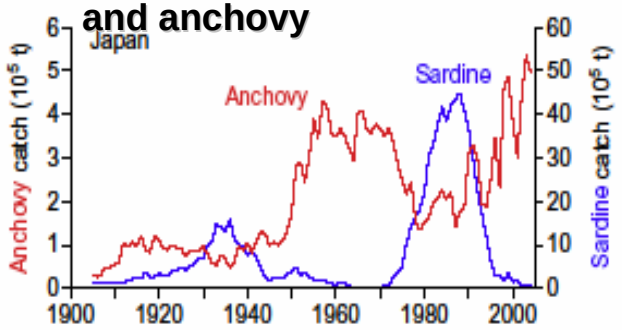
Kuroshio warm current area



Importance of Kuroshio area for pelagic fish production



Kuroshio is very important area for early life stage of sardine and anchovy



Monitoring line off cape Omaezaki (138°E：O-line) since 1999.

Long term variation of stock size of the pelagic fishes has been observed, and it implies that the variation is relating to climate change.

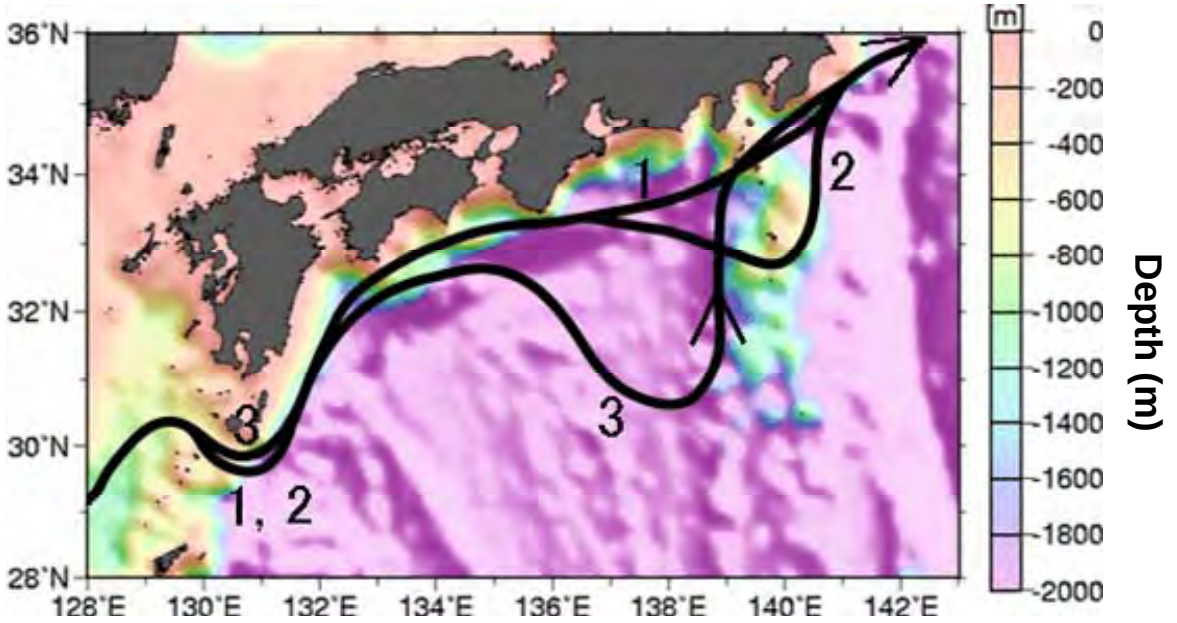
Known as low productive area

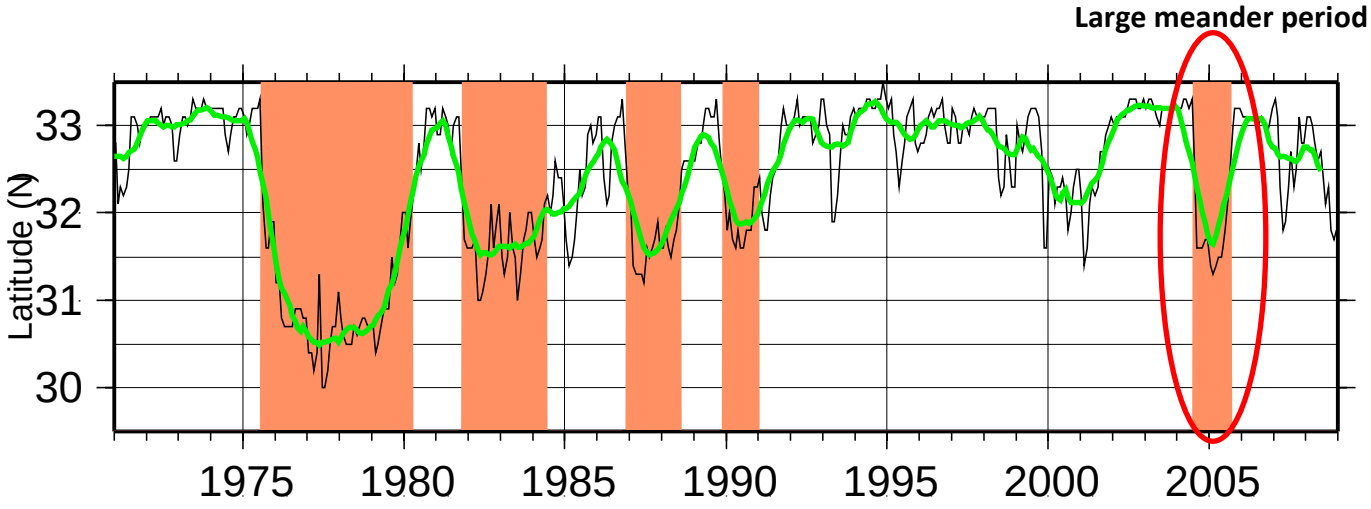
Kuroshio paradox（？）

Habitat for early life stages of abundant fishery important pelagic fishes

Field monitoring to clarify the mechanism of abundant pelagic fish production is conducted

Typical patterns of the meander of Kuroshio current

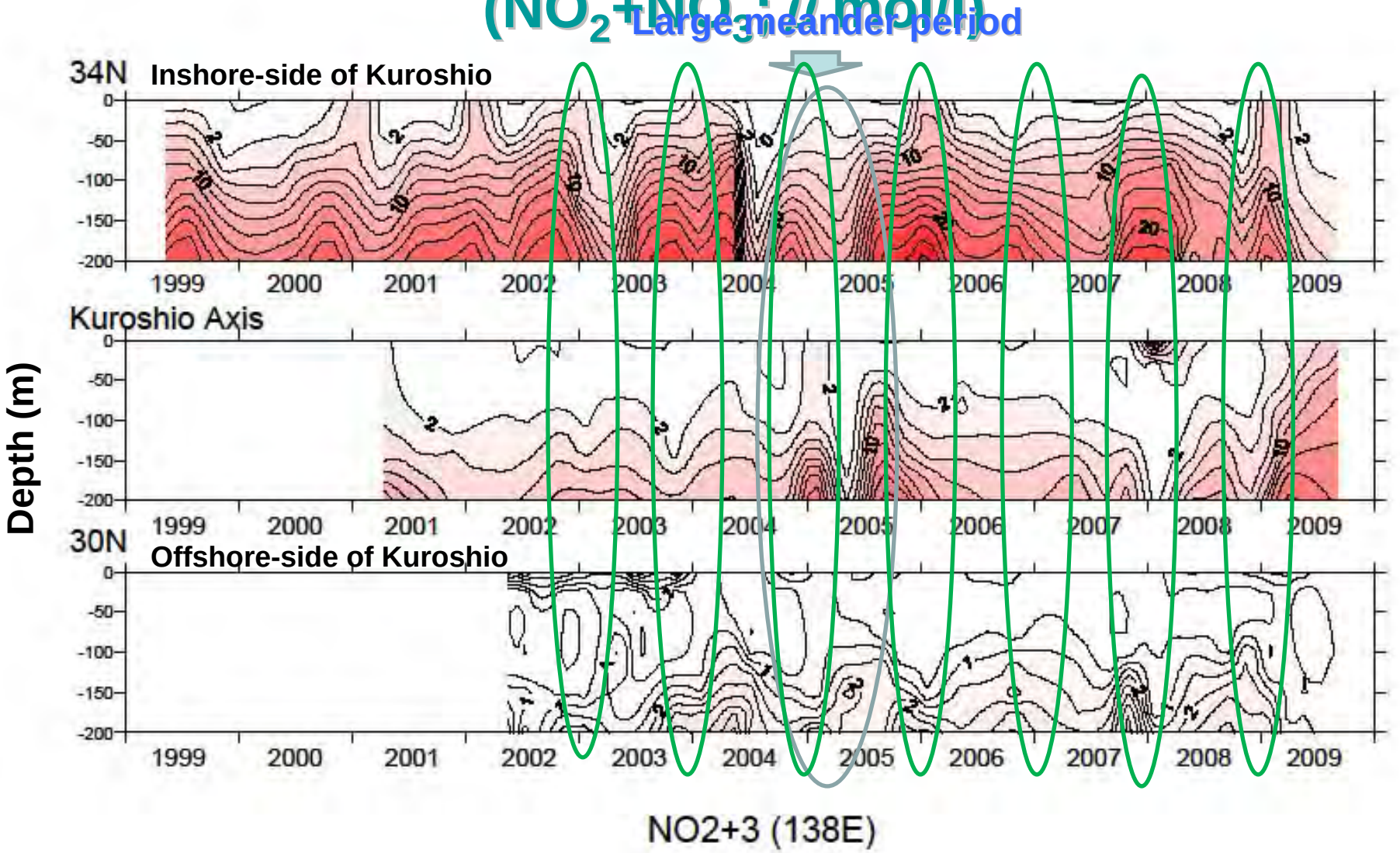




: large meander period

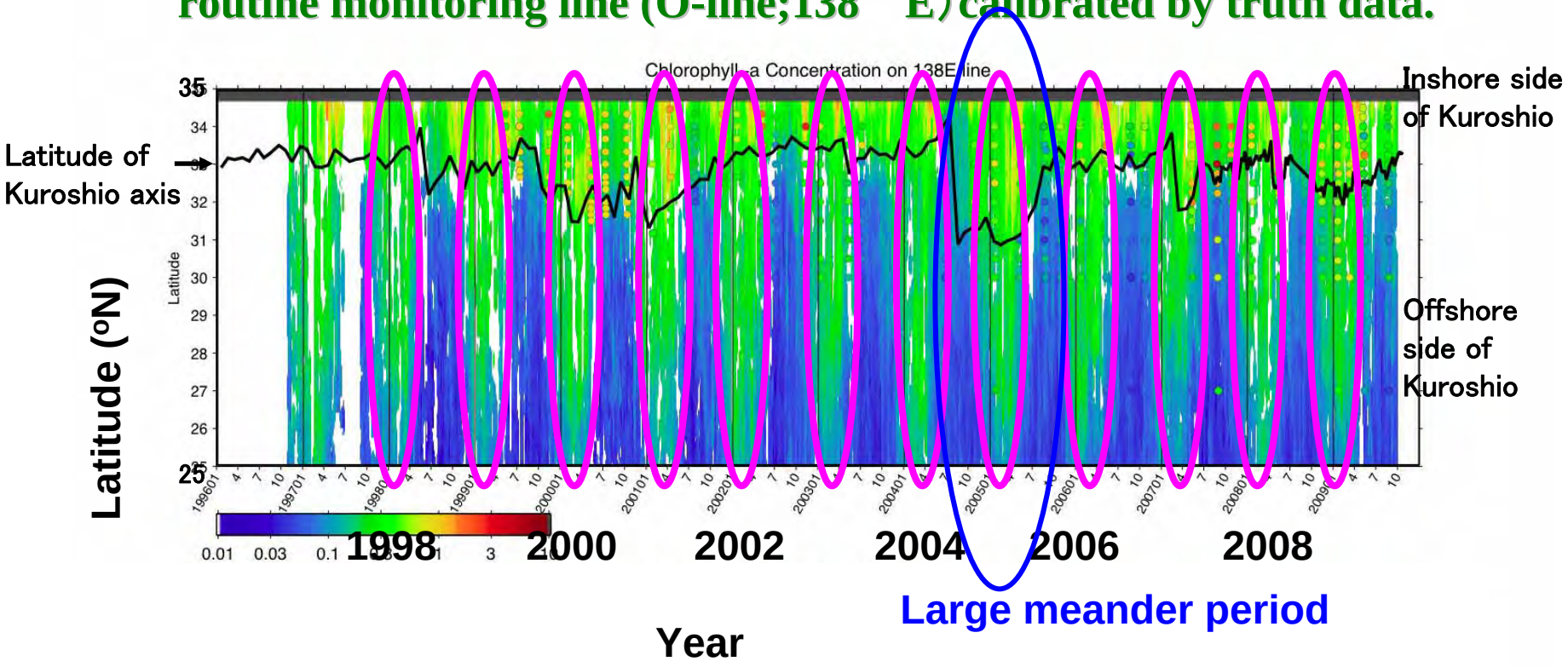
Time series of nutrient condition on the routine Kuroshio monitoring line, O-line 138°E

(NO_2+NO_3 ; μmol/l)



Corresponding to deep mixing layer during winter, high nutrient concentration has been observed.

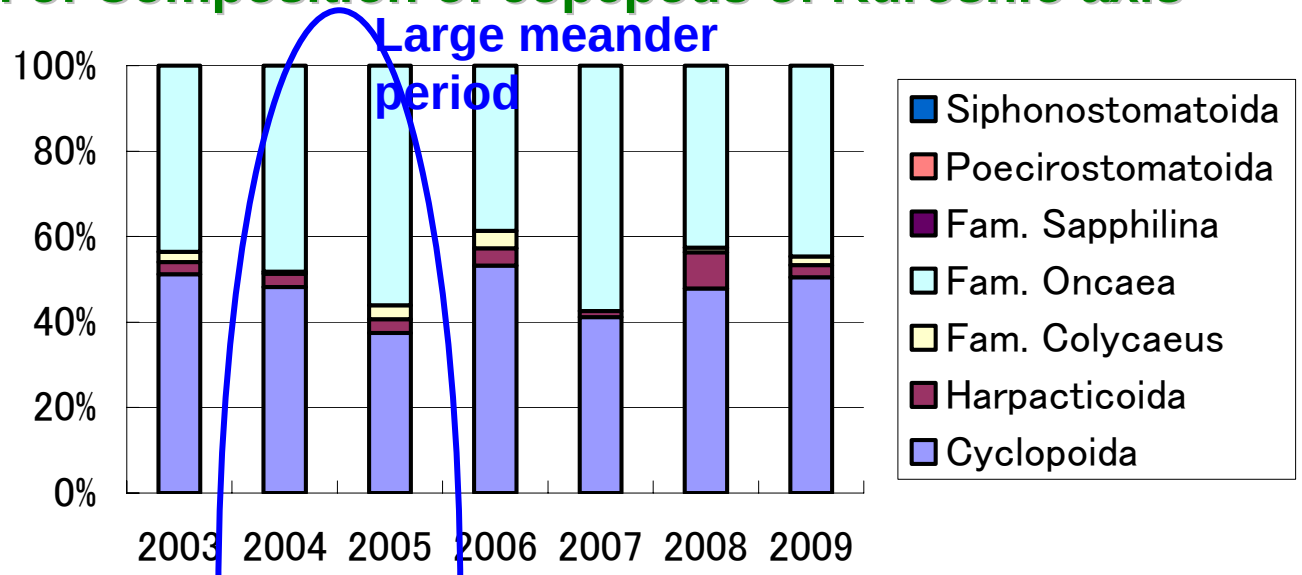
Time series variation of satellite data of Chlorophyll a concentration at Kuroshio routine monitoring line (O-line;138° E) calibrated by truth data.



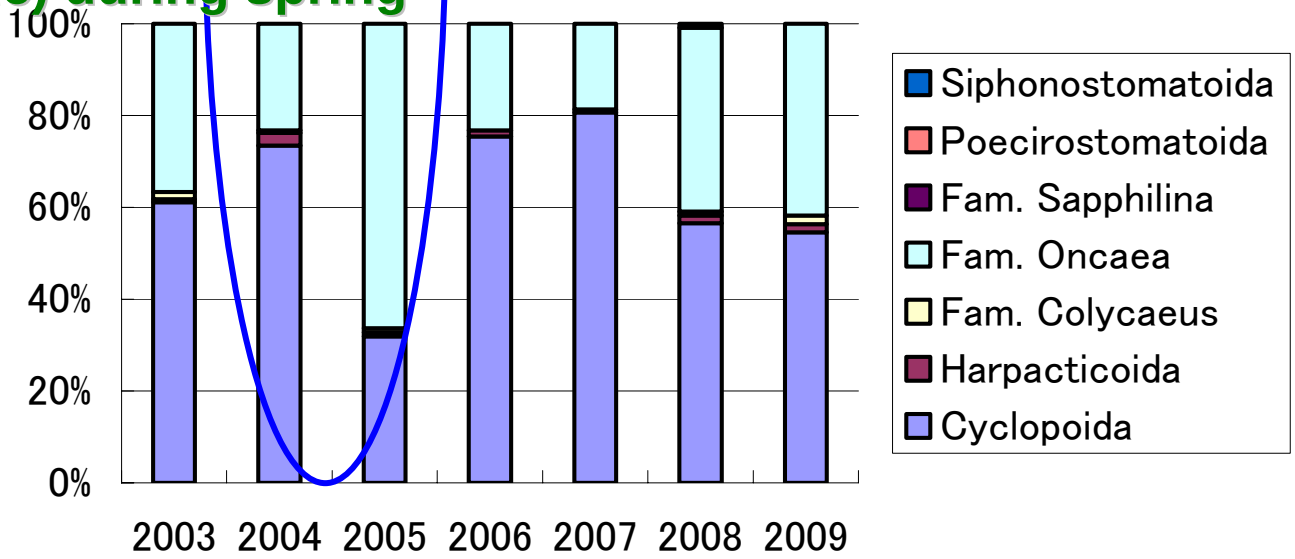
High primary production during late winter to early spring is important for biological production in Kuroshio ecosystem.

→ High chl season correspond to the spawning season of sardine and saury in this area.

Annual variation of Composition of copepods of Kuroshio axis during spring

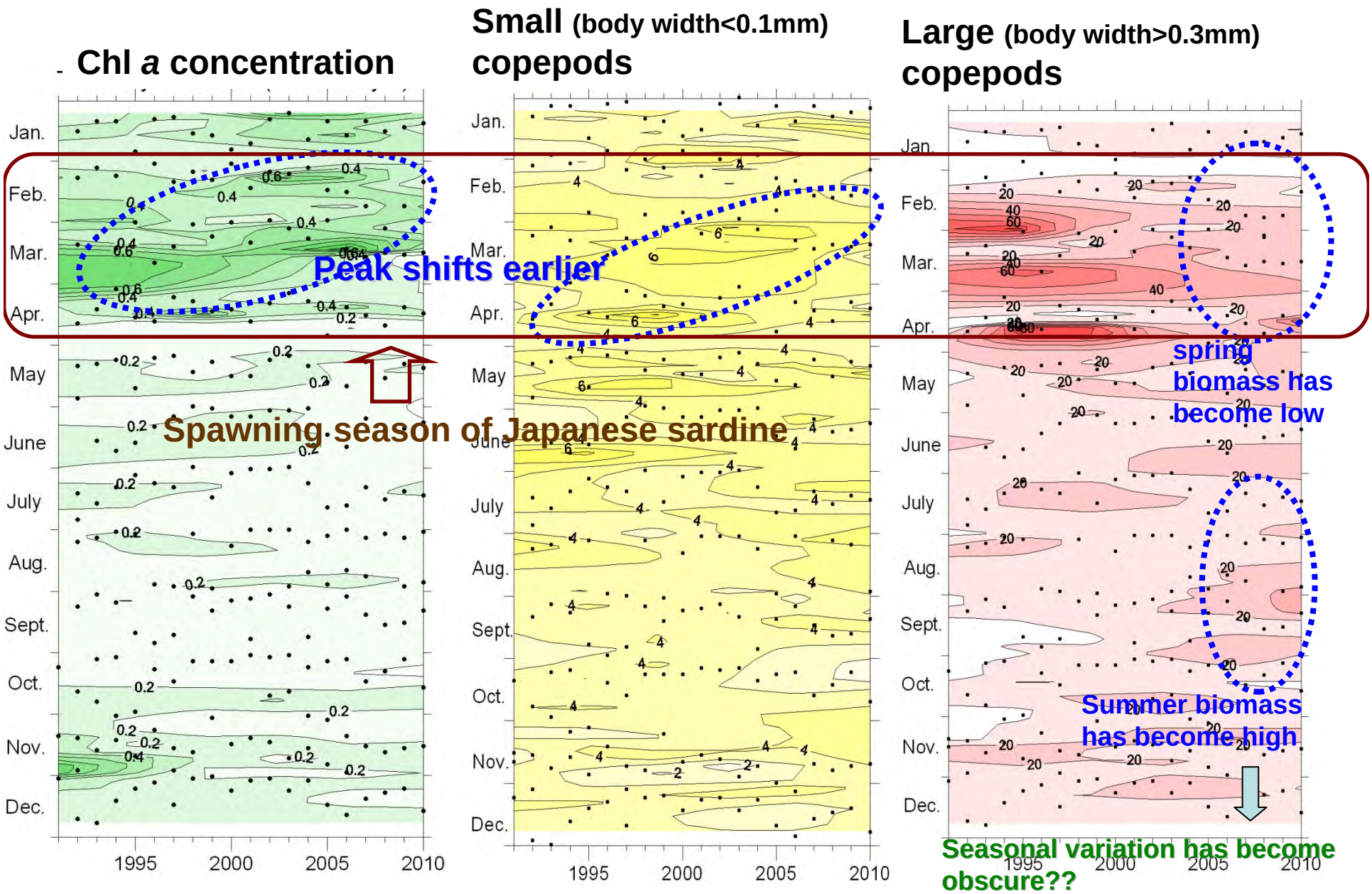


Annual variation of Composition of copepods of north of Kuroshio axis (inshore side) during spring

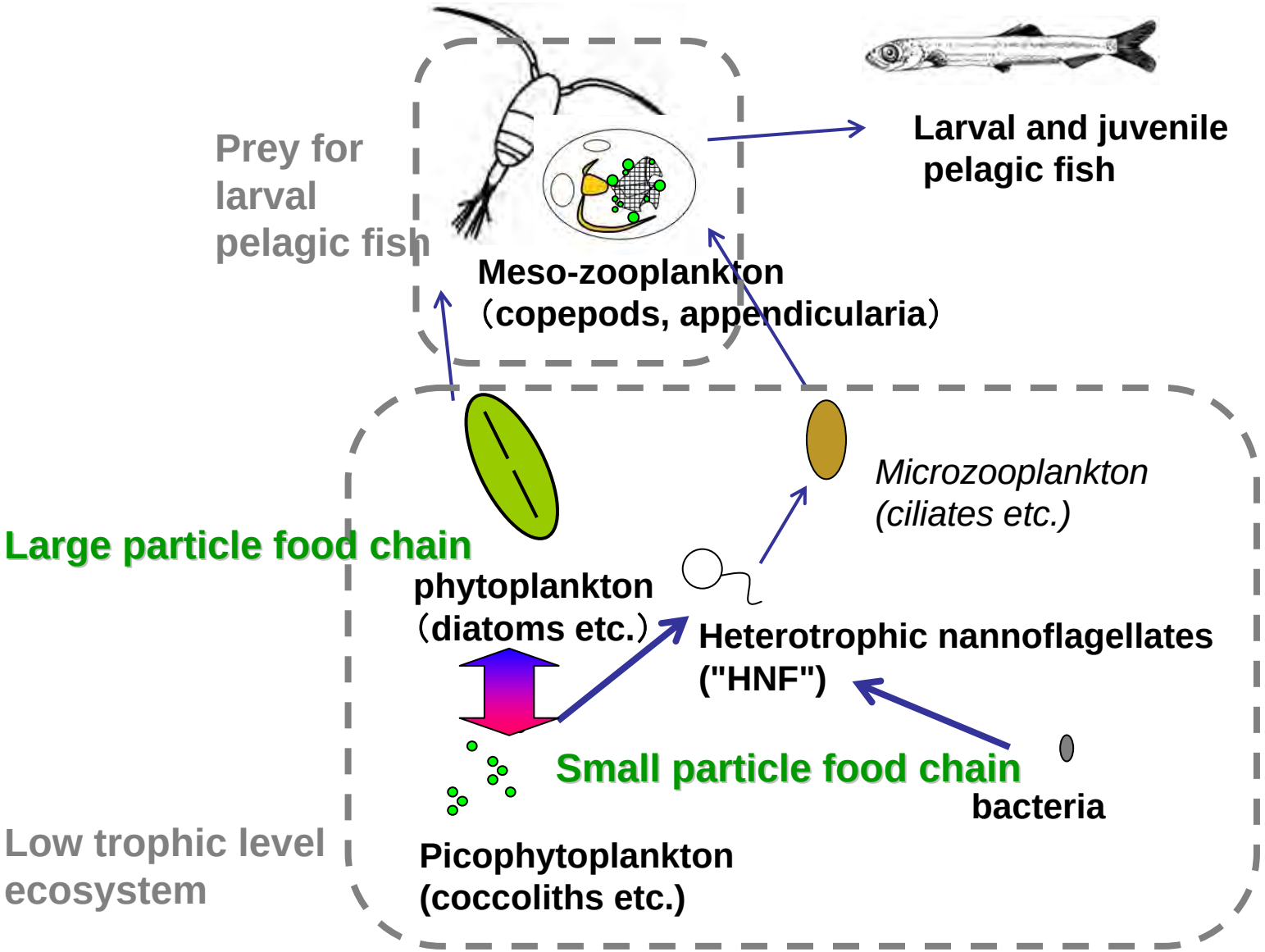


⇨ **Variation of Meander pattern of Kuroshio may cause to change the plankton ecosystem qualitatively and quantitatively.**

Annual and seasonal variations of biomass of phyto and zooplankton in Tosa bay, the spawning ground of Japanese sardine of Kuroshio area

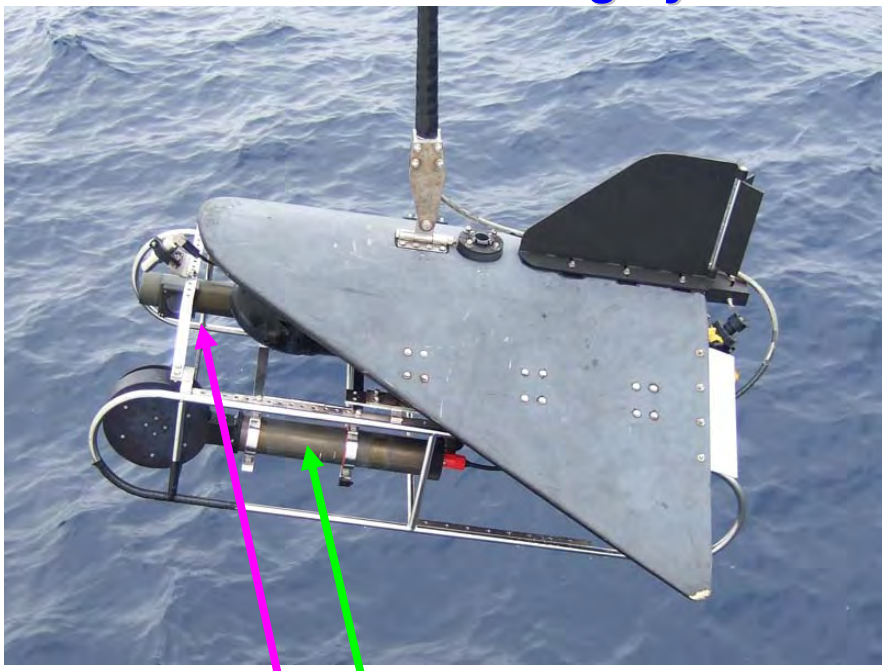


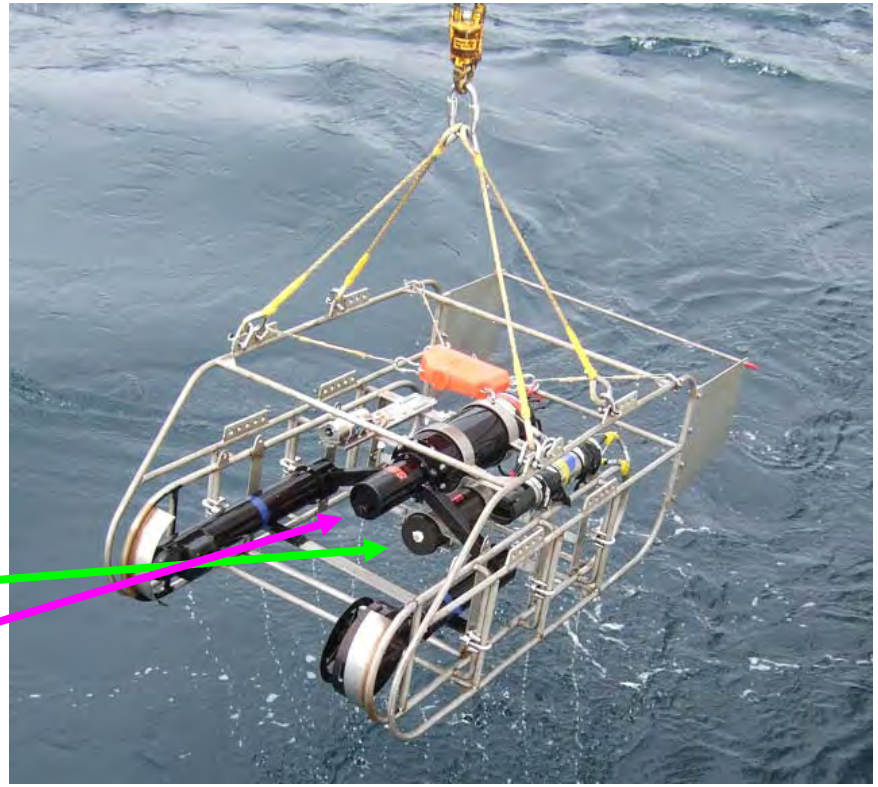
Schematic figure of trophic cascade in Kuroshio ecosystem



For analyzing the existence of small particle food web;
Video Plankton Recorder ––– to observe *in situ* suspended matters

Towing system with TV camera and CTD

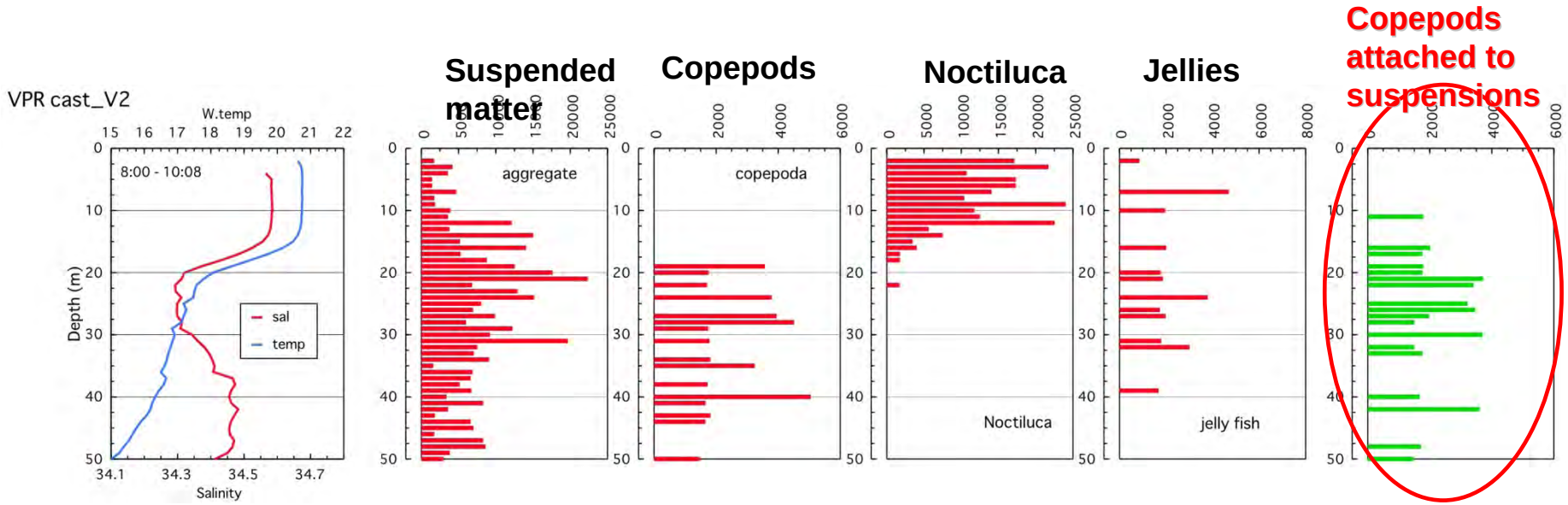


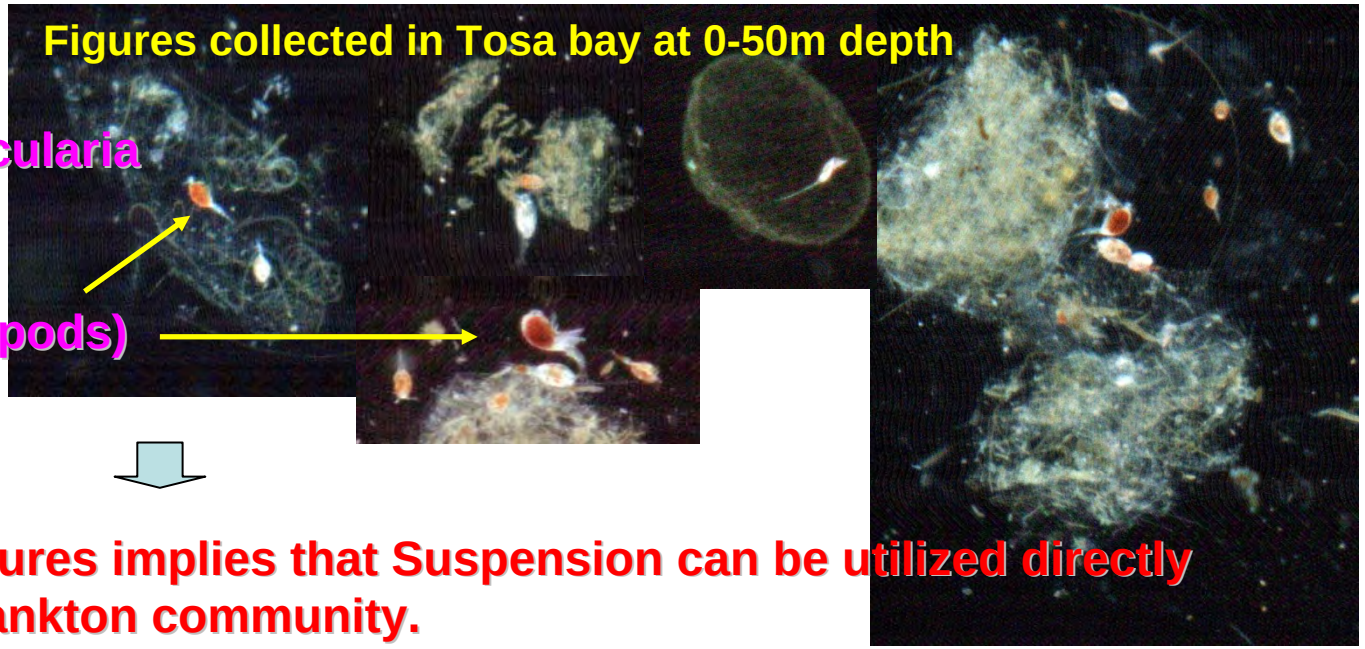


CTD

TV camera

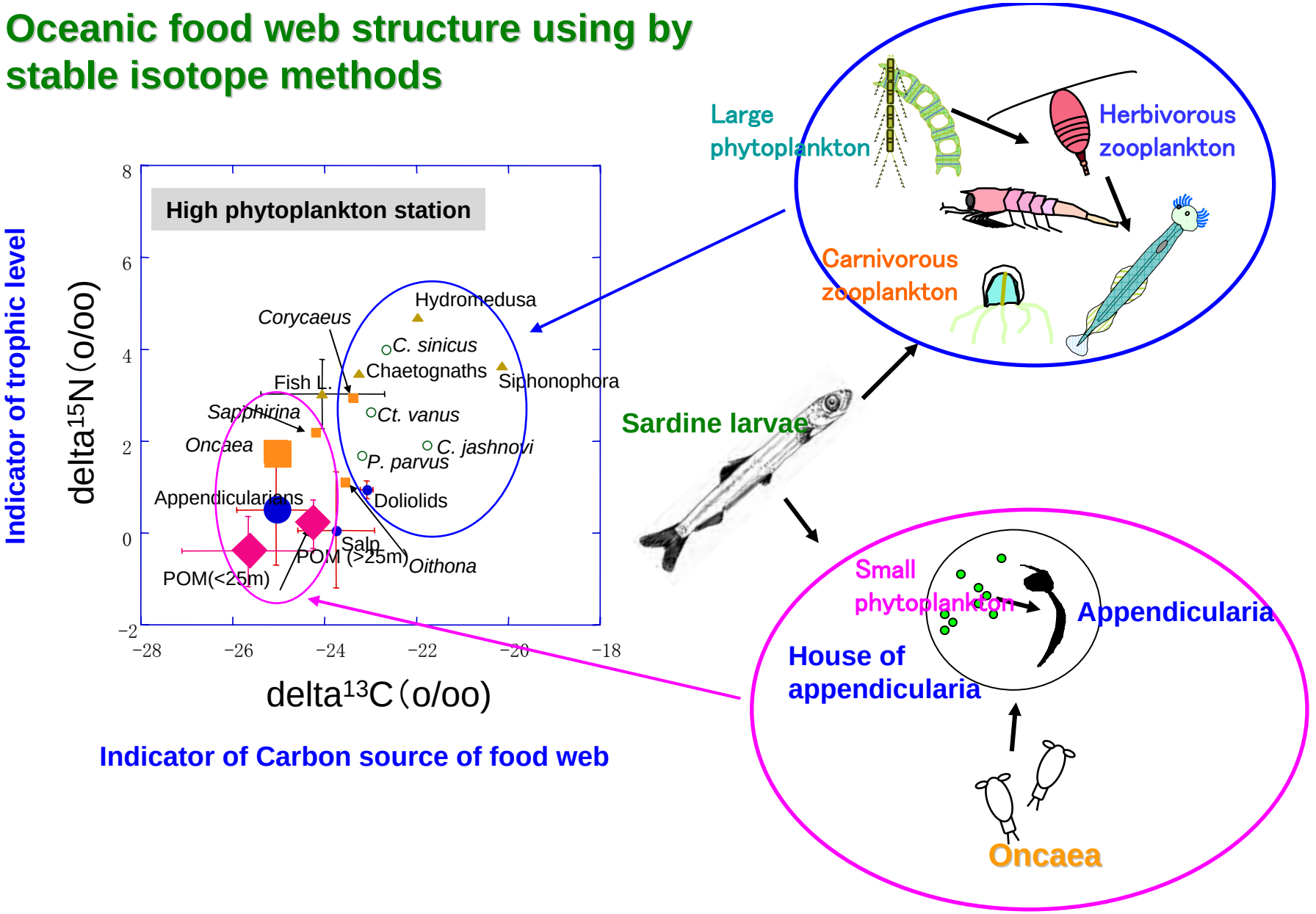
Vertical distribution of Plankton and suspension observed by VPR





These figures implies that Suspension can be utilized directly by zooplankton community.

Oceanic food web structure using by stable isotope methods



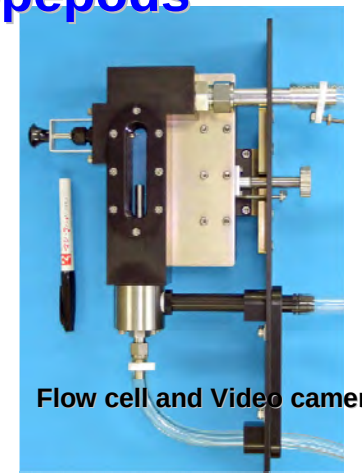
Different paths of biological transportation of zooplankton food web has been suggested by stable isotope.

Bench-top Video Plankton Sampler (B-VPR)

There are large accumulated plankton samples collected around Japan for long times. But most of them are not analyzed yet because it needs lots of time and effort.

→Quick and automatic analysis are needed.

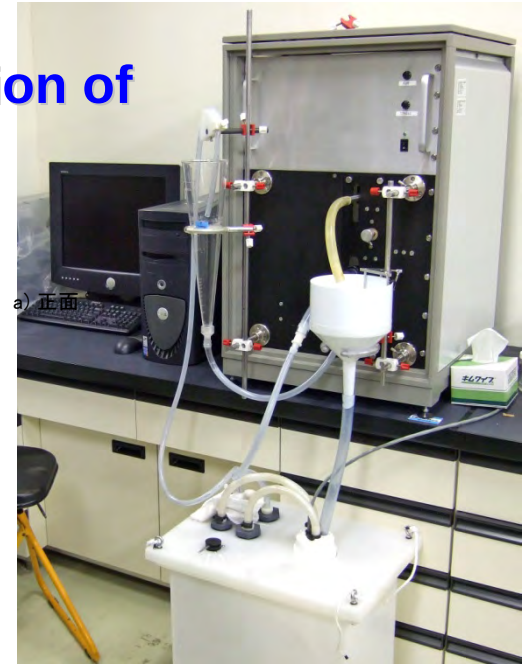
B-VPR →analysis on abundance and size composition of copepods



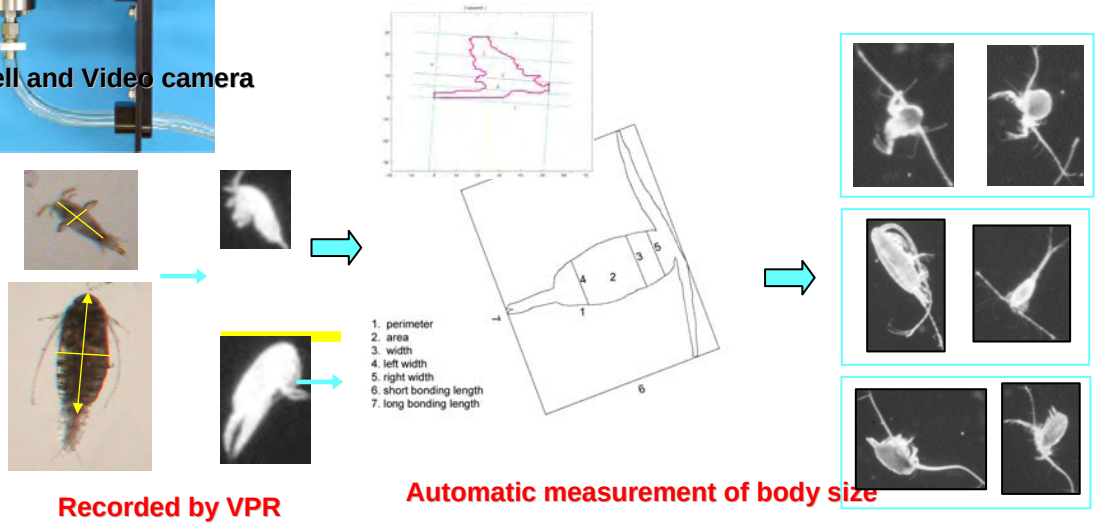
Flow cell and Video camera

Resolution: 0.01 mm/pixel
（Prosome length>0.4mm）

Ability: 15-30 min / bottle



a) 正面

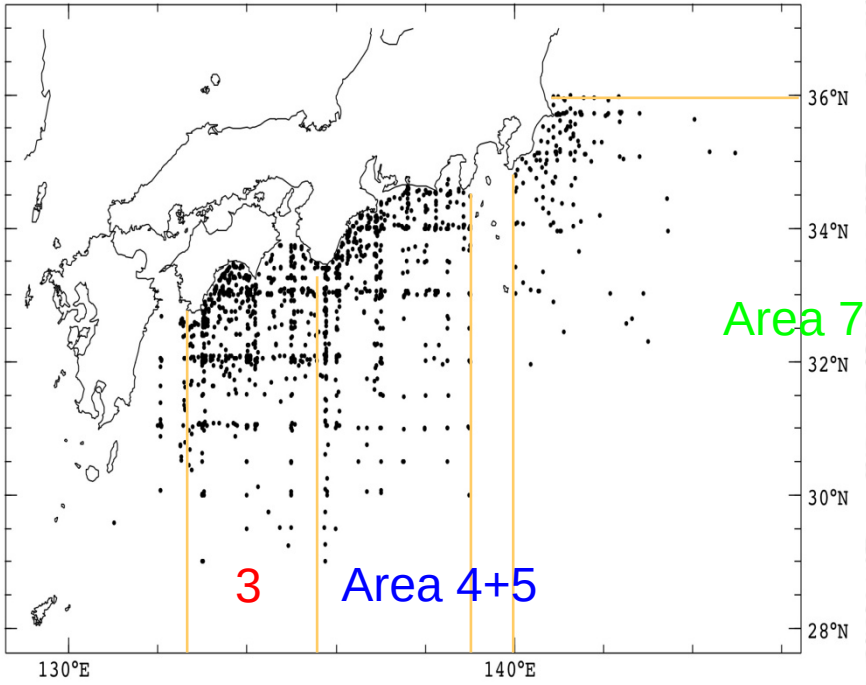


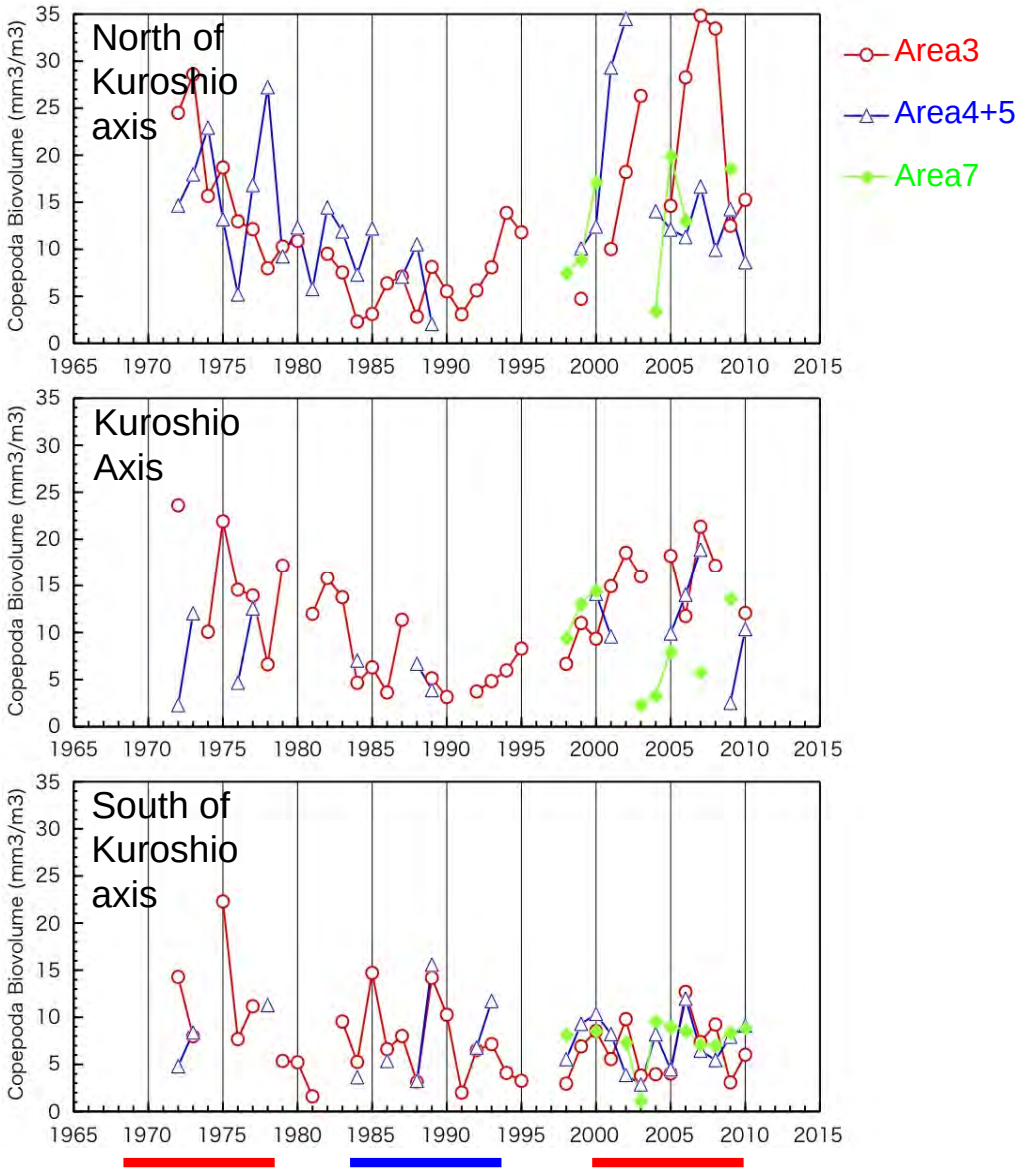
Recorded by VPR

Automatic measurement of body size

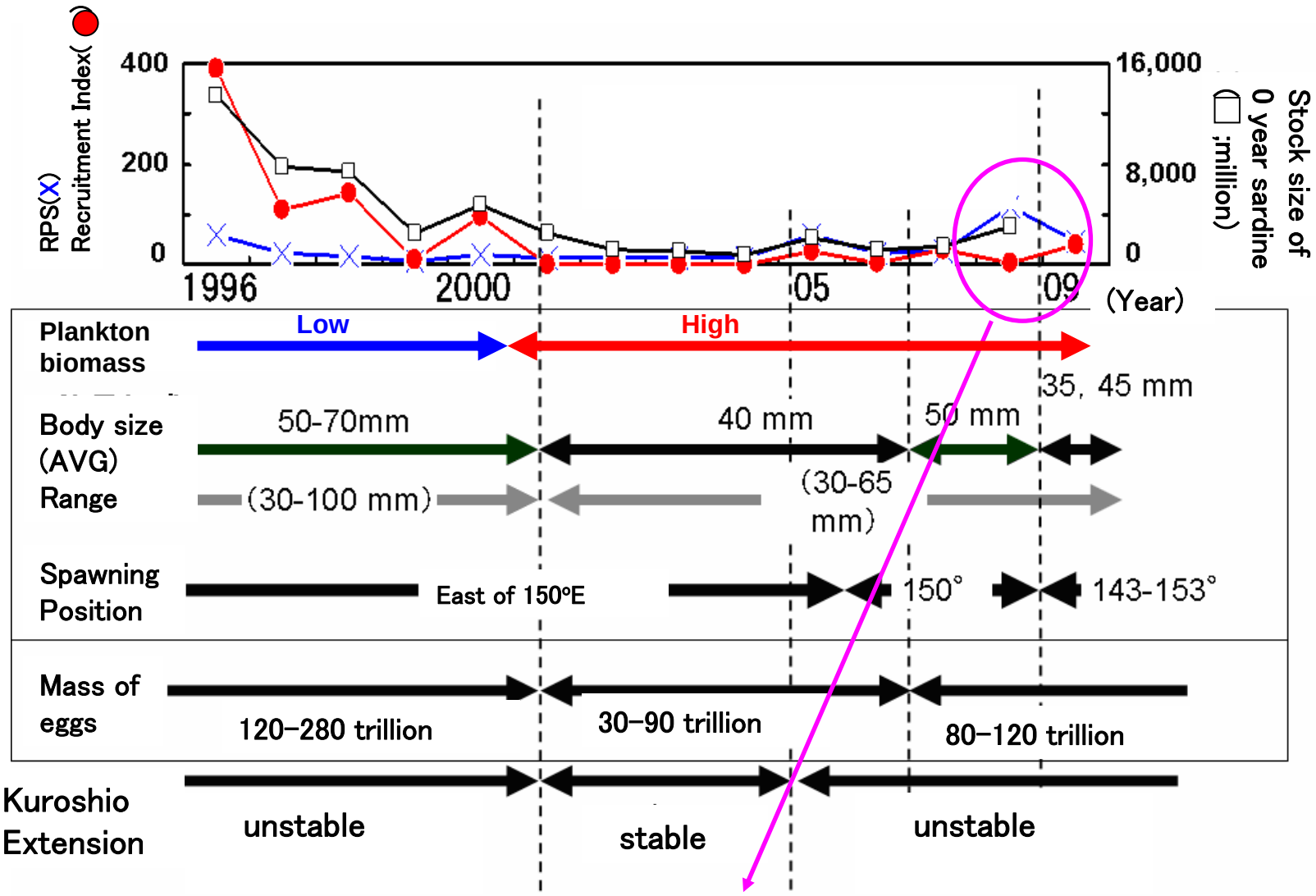
At present, ca.2000 formalin preserved bottles collected since 1960 has been analyzed.

Result of annual variation of winter biomass of copepods in Kuroshio area using B-VPR





Annual variation of sardine recruitment and larval body size



After long period of bad recruitment of sardine, the recruitment status becomes better since 2008 --- the good recruitment regime is beginning??

Conclusions

- Recently, peak season of copepod bloom has tended to become earlier, and seasonal variation of large copepod biomass has become unclear.
- The timing of change of ecosystem may be related to not only the climate change but the change of meander pattern of Kuroshio.
- The biological production by small phytoplankton may be important for larval fish production via appendicularia.
- Long term continuous monitoring on plankton community is very important to analyze the mechanisms of the stock variation of fishery important species (e.g. sardine, anchovy). Bench-top Video Plankton Recorder system will become useful gear to analyze large quantity of preserved plankton samples.