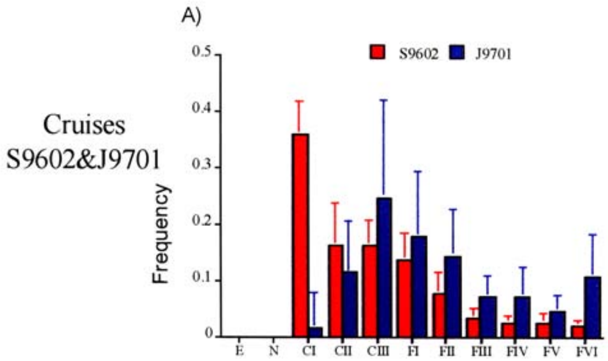

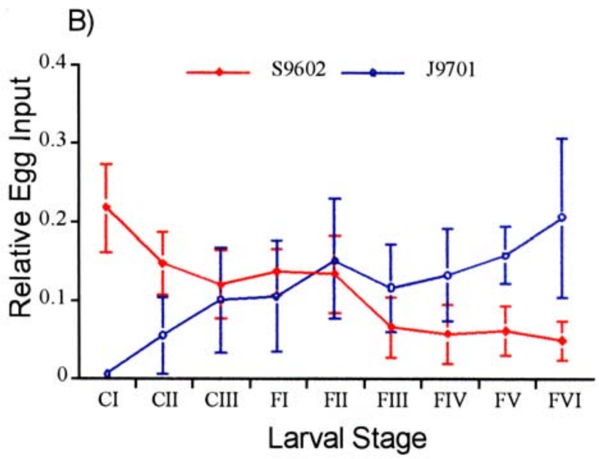

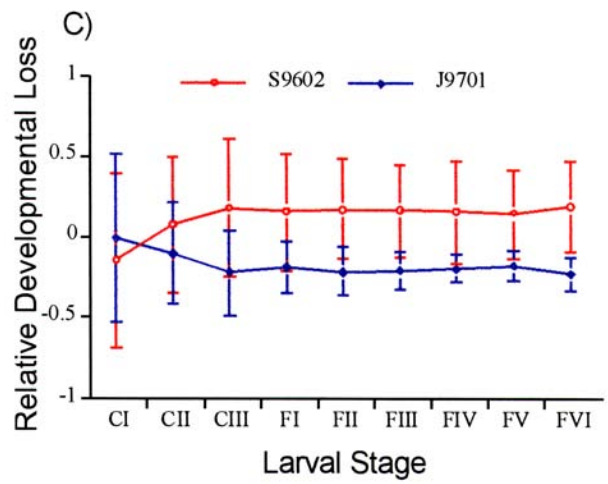

Fig. 4 Larval *Euphausia pacifica* stage-frequency distributions for the 1996 and 1007 cruises. B) Back-calculated values of relative egg input (or spawning histories). C) Back-calculated values of relative developmental loss.

An ecosystem model with zooplankton vertical migration focused on Oyashio region

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An ecosystem model with eight compartments (Fig. 1) was developed in order to describe a Northern Pacific primary and secondary production. This model was made by the request of PICES GLOBEC CCCC Program. Model equations describe the interactions of nitrate, ammonium, two phytoplankton size fractions (tentatively, these are diatom and dinoflagellate), two zooplankton size fractions (tentatively, copepod and microzooplankton), PON, and DON. Formulations for the biological processes are based primarily upon KKYS(Kawamiya et al., 1996, 1997). One dimensional physical-biological coupled model including mixed layer closure model is used to simulate time dependent features of ecosystem off Sanriku district(Fig. 2). Time series of nutrient and plankton distributions obtained from Hokkaido National Institute of Fisheries provide verification of model results. The simulated results were well reproduced the seasonal and interannual change of ecosystems there. Model simulations indicate that vertical migration of copepod is a potentially important factor in determining the trophic structure in the change of phytoplankton species during spring bloom.

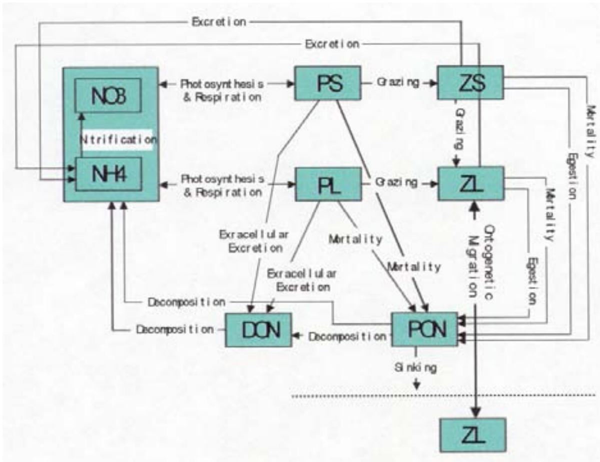

Fig. 1 Six compartment model with vertical migration of large zooplankton (ZL).

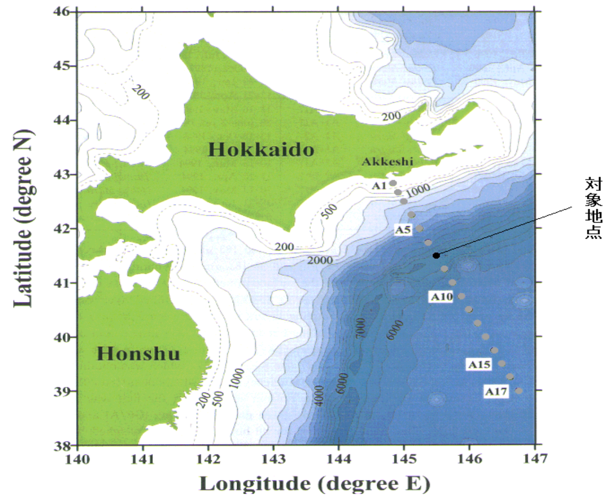

Fig. 2 Applied point of the model (One-D model).

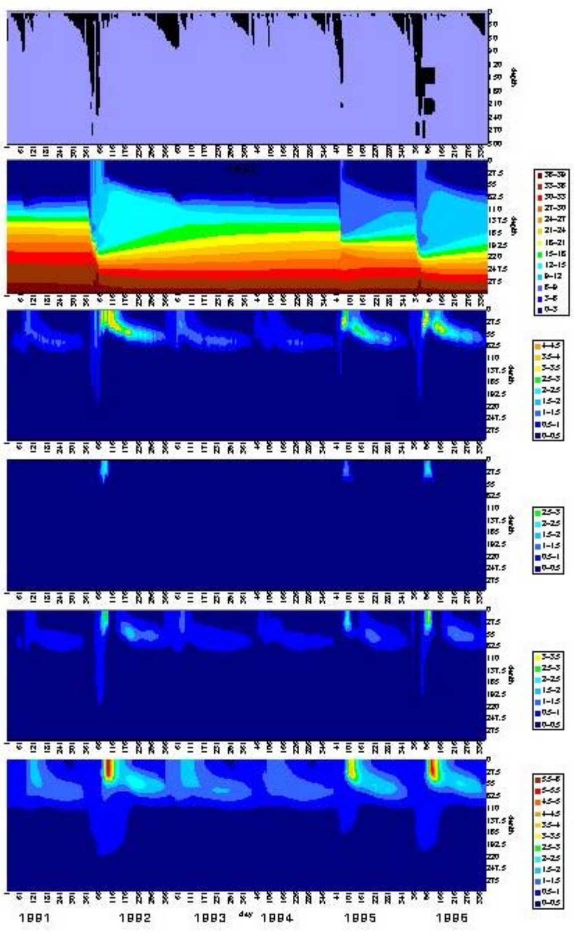

Fig. 3 Calculated results without vertical migration of ZL.

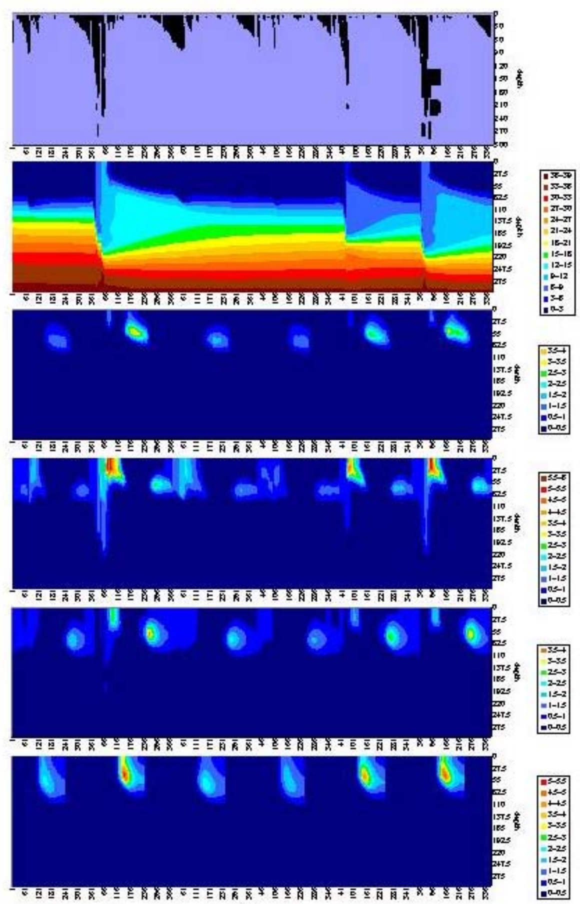

Fig. 4 Calculated results with vertical migration of ZL.

Figure 3 shows in case without vertical migration of copepod. This only shows the spring bloom of small zooplankton (ZS) which causes consequent large zooplankton increase. However as shown in Figure 4, in case with vertical migration of copepods (ZL), in spring large phytoplankton (PL) makes first bloom because small phytoplankton (PS) cannot increase by grazing pressure of small zooplankton and after large zooplankton (ZL) migrate to shallower region small zooplankton decrease by grazing of large one which causes increase of small phytoplankton bloom following large one.

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