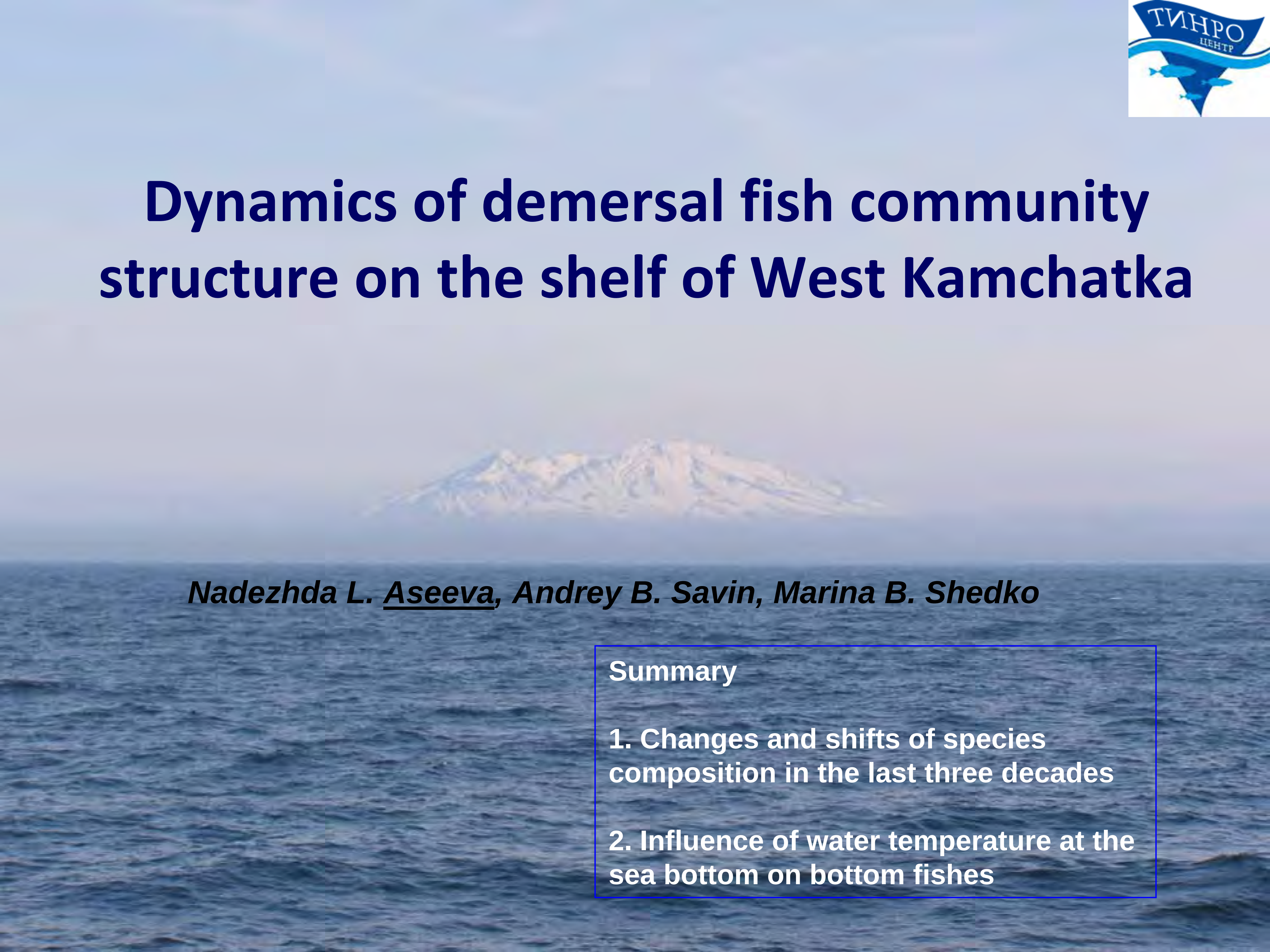


Dynamics of demersal fish community structure on the shelf of West Kamchatka

Nadezhda L. Aseeva, Andrey B. Savin, Marina B. Shedko

Summary

1. Changes and shifts of species composition in the last three decades

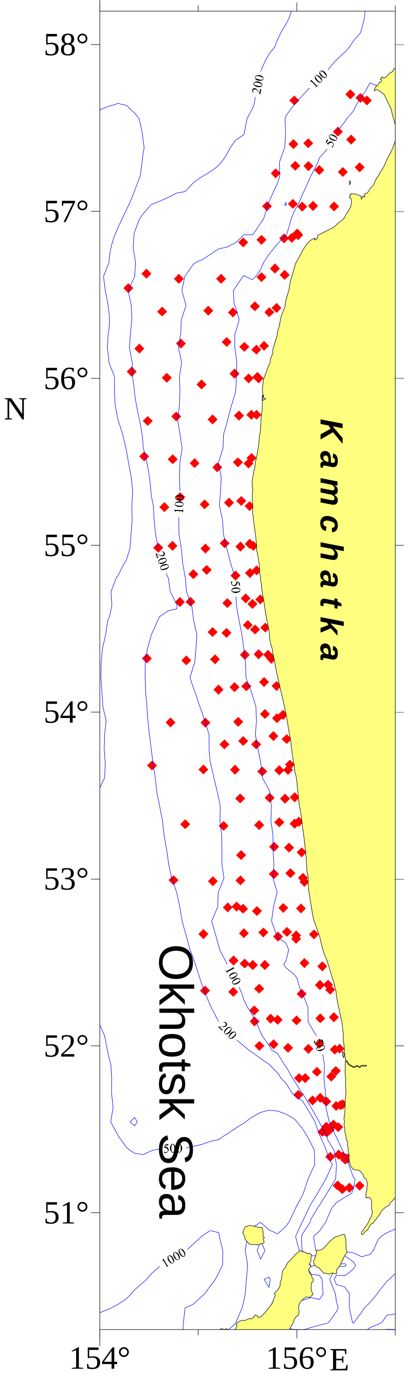
2. Influence of water temperature at the sea bottom on bottom fishes

Goal:

- to reveal principal reconstructions in the bottom fish community on the shelf of West Kamchatka

- to understand their reasons and possible mechanisms

Data

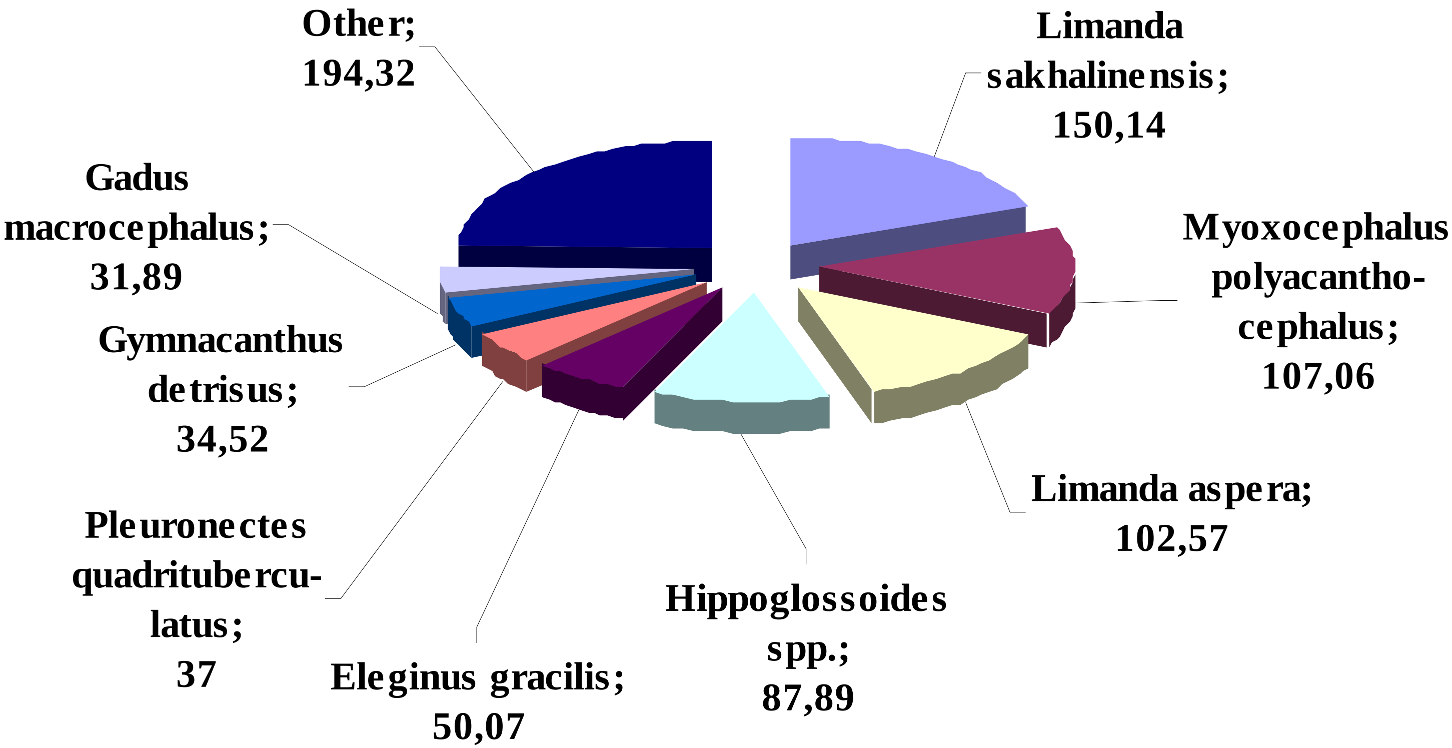


Trawl surveys of the whole shelf of West Kamchatka were conducted in summer seasons of 1982,1985,1988, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2005, 2007, 2008, 2009, 2010, 2011.

Bottom temperature were measured over the whole shelf annually since 1986

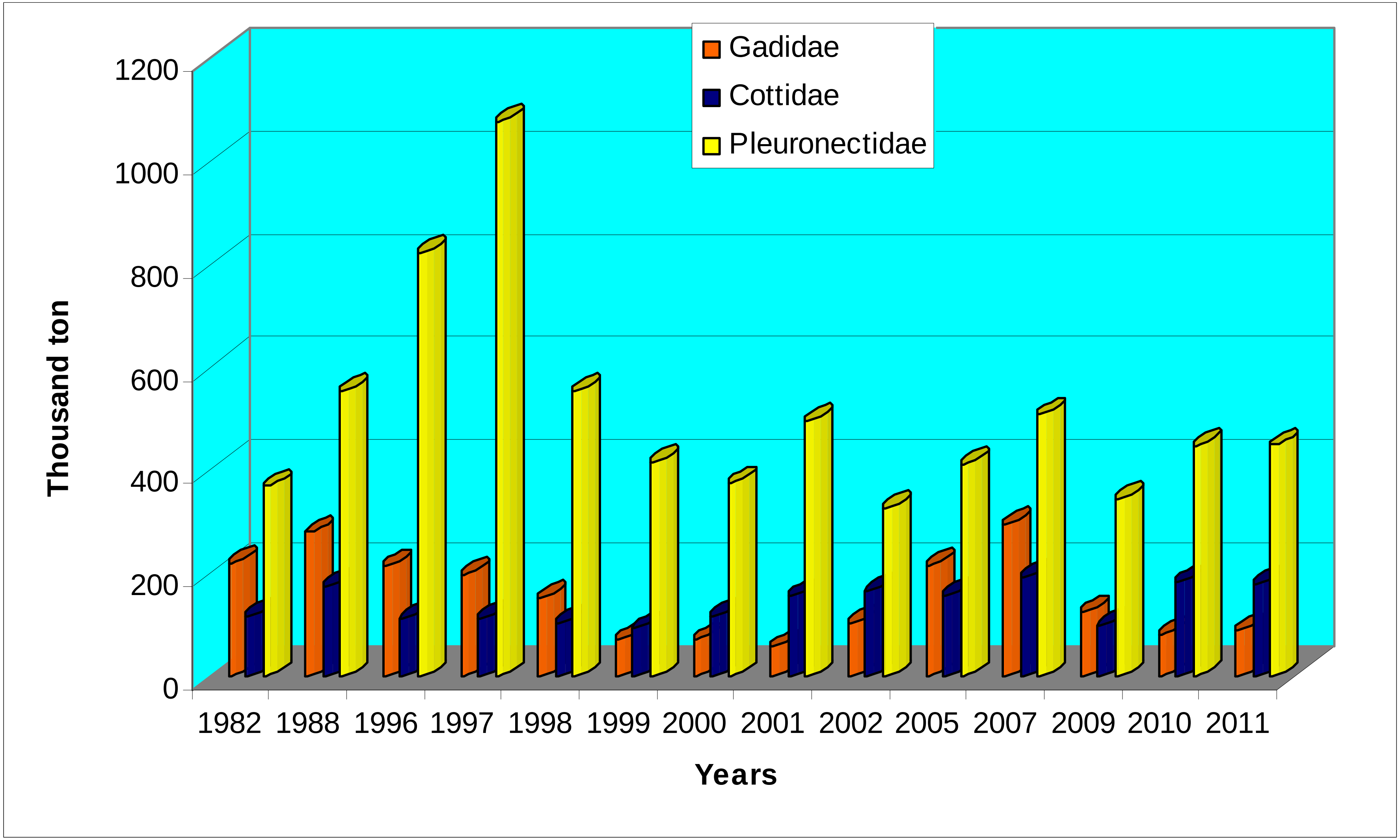
Standard scheme of the bottom trawl surveys on the shelf of West Kamchatka

Species composition of the bottom ichthyocenosis

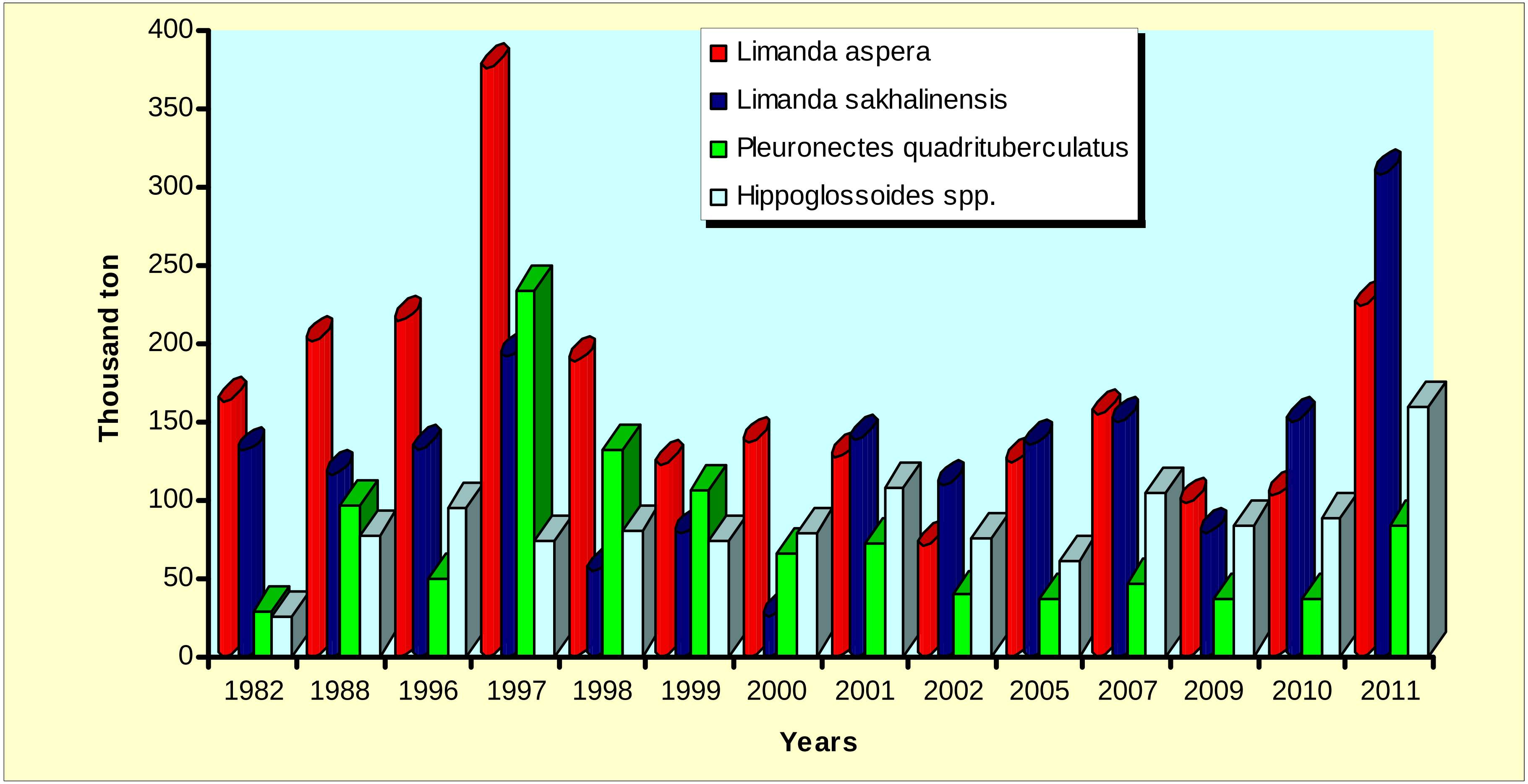


Mean species composition of the bottom ichthyocenosis on the shelf of West Kamchatka, thousand tons (without walleye pollock)

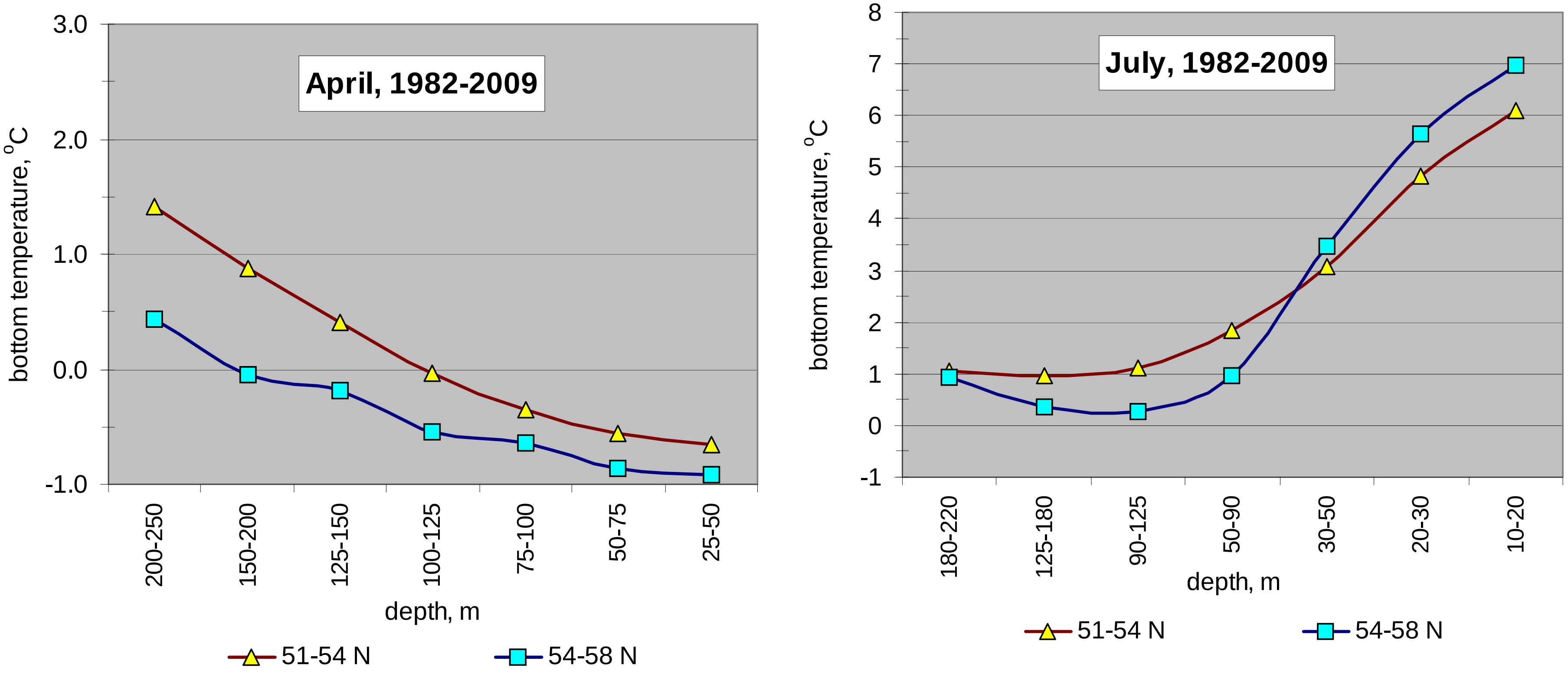
Dynamics of the mass bottom fishes biomass on the shelf of West Kamchatka, by families (thousand ton)



Dynamics of the mass flounders biomass on the shelf of West Kamchatka (thousand ton)

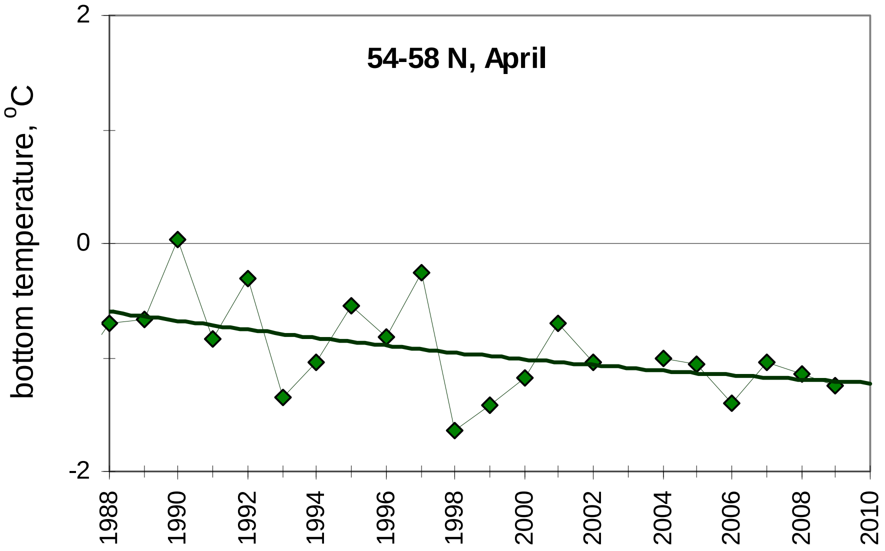


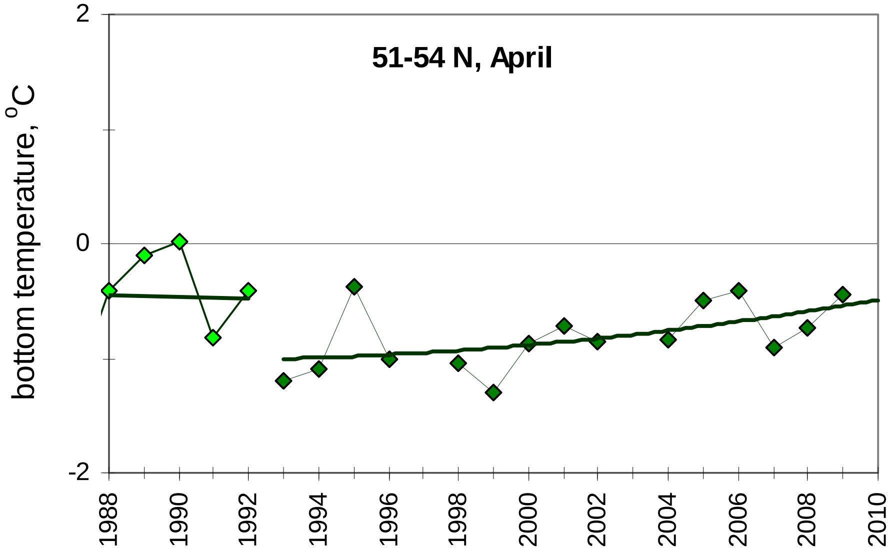
Vertical distribution of water temperature in spring and summer



Mean profiles of water temperature at the sea bottom in certain areas of West Kamchatka shelf

Year-to-year changes of water temperature at the sea bottom





In the northern part of the shelf, a permanent tendency to lowering is observed in the last two decades, with several extremely cold years.

In the southern part of the shelf, the downward shift in 1992-1993 was replaced by slowly heightening of the bottom temperature.

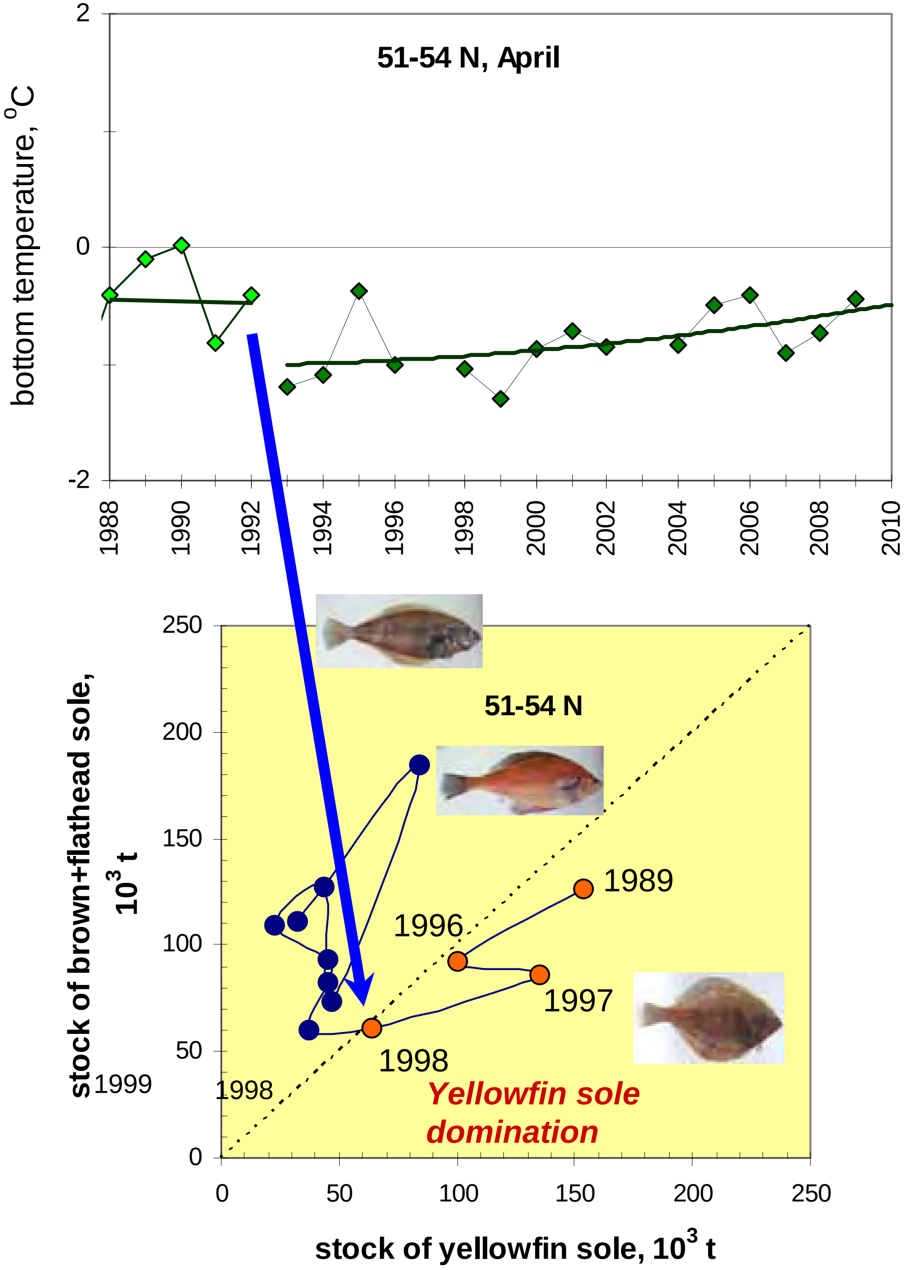
Year-to-year change of the bottom temperature at the depth 25-75 m on the shelf of West Kamchatka northward and southward from 54°N in April

Water temperature influence on the yellowfin sole abundance

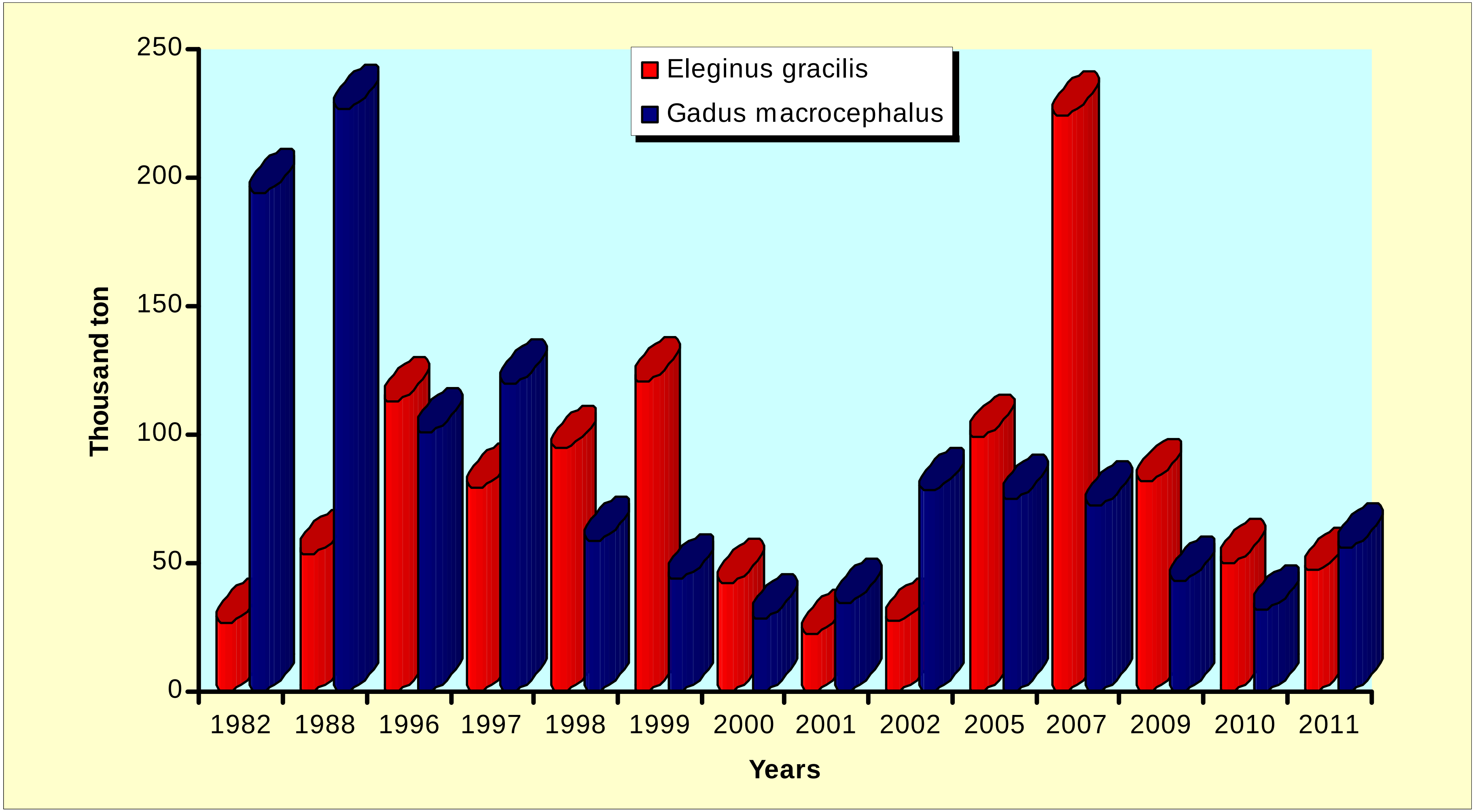
The temperature shift to cooling occurred in 6-7 years before the change of the bottom community structure. This time corresponds to the age of the highest biomass for flounders.

The decreasing of the yellowfin sole stock in the late 1990s was possibly caused by worsening the conditions for its reproduction in 1992-1993. This species spawns in spring in the upper layer, where low temperature was unfavorable for its larvae survival.

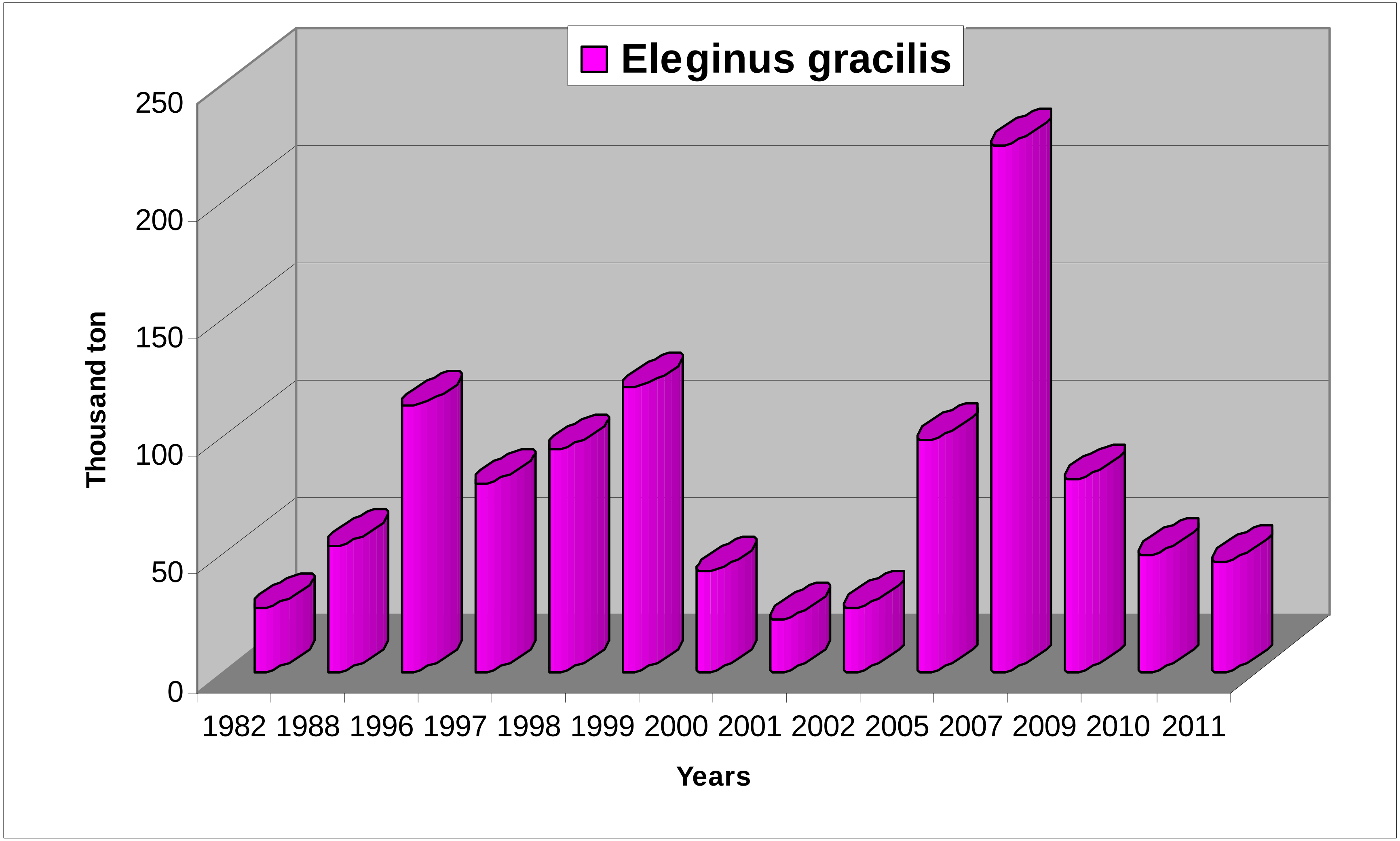
Other sole species had no any prominent changes of their stocks because they spawn in the deeper layer with relatively stable conditions.



Dynamics of the pacific cod and saffron cod biomass on the shelf of West Kamchatka (thousand ton)



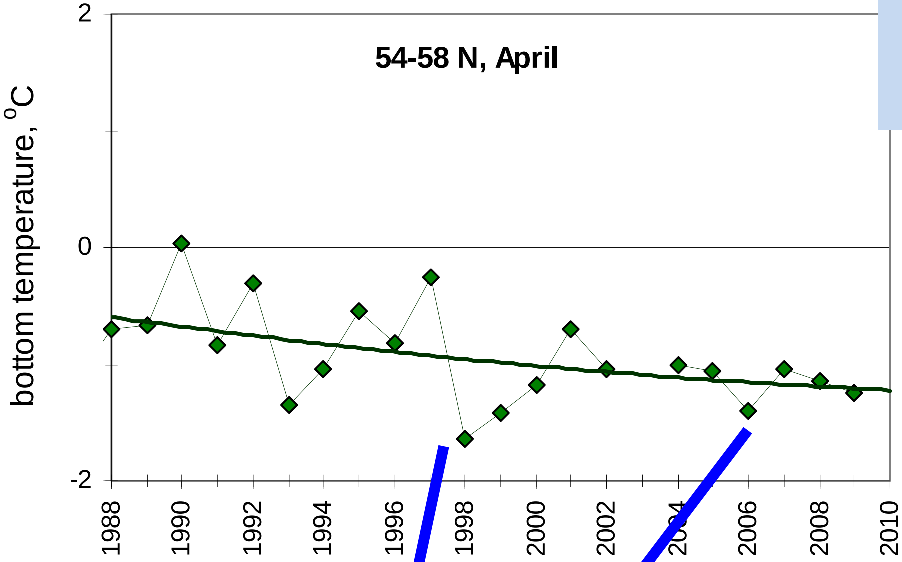
Dynamics of the saffron cod biomass on the shelf of West Kamchatka (thousand ton)



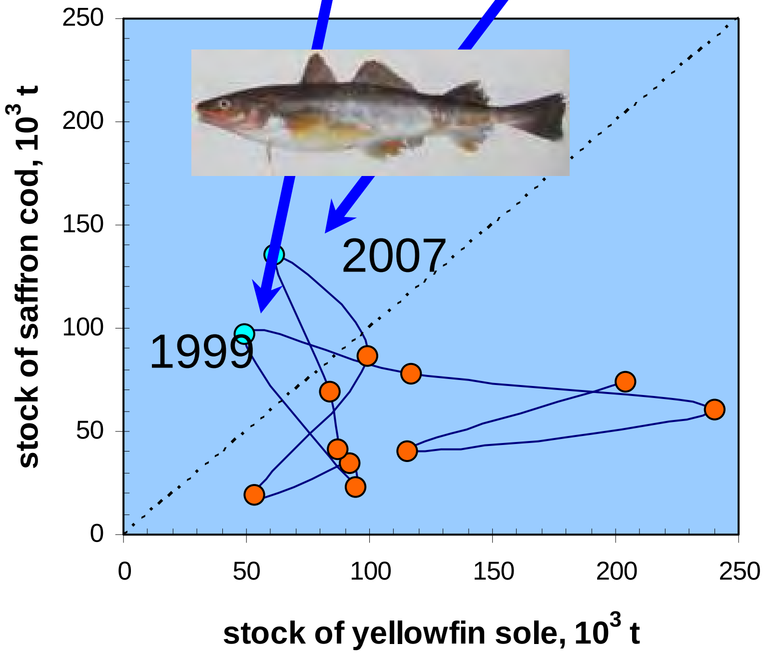
Water temperature influence on the saffron cod abundance

Both cases of the high abundance of saffron cod happened in the next years after the temperature minimums.

Age of the saffron cod in trawl catches is predominantly 1+. So, its abundant generations were born in the coldest winters. This dependence is known for the Japan Sea, as well, where it is accounted for later spawning that provides the larvae hatchering in better feeding conditions during spring bloom of zooplankton. Possibly, this mechanism works here, too.

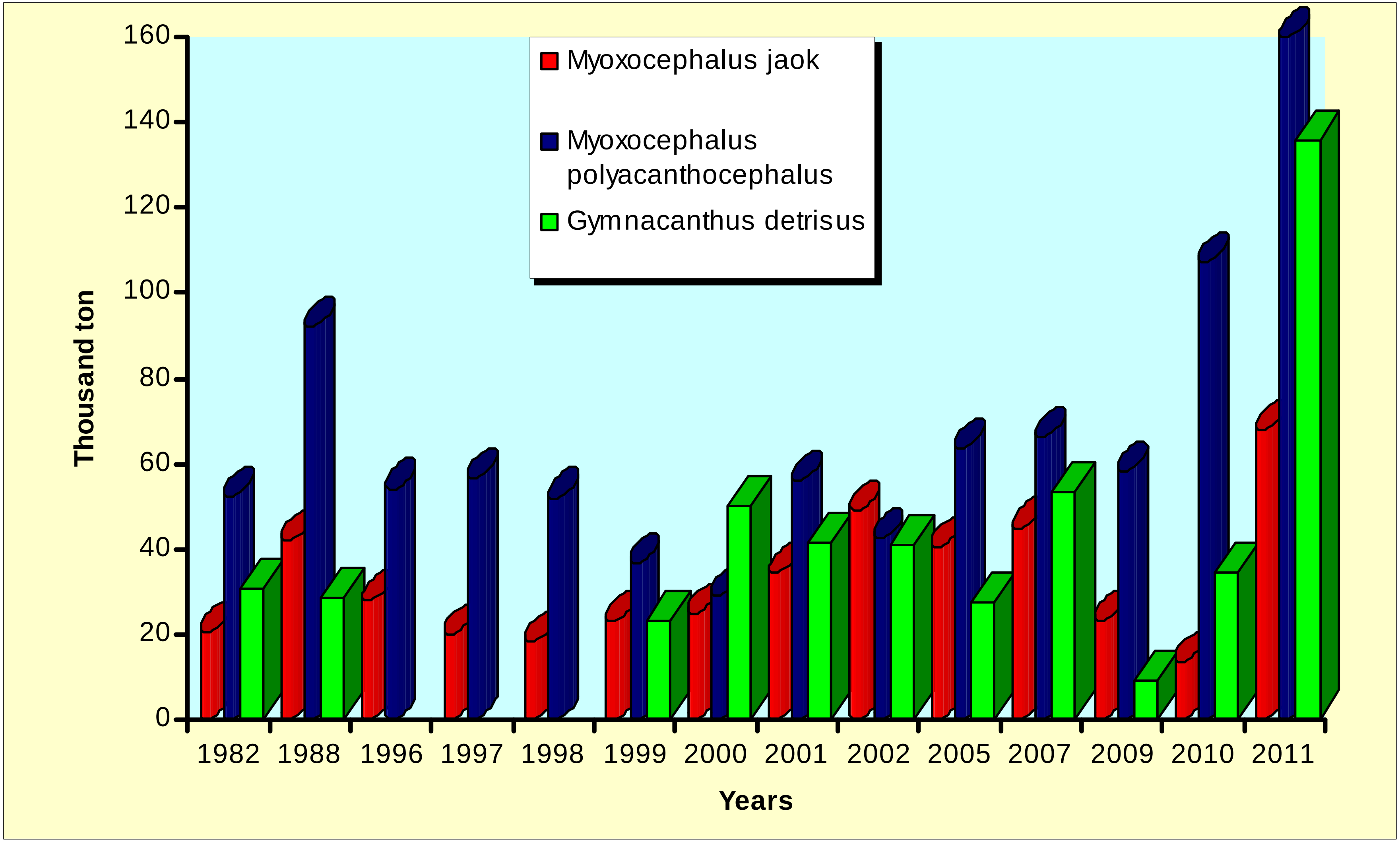


Year-to-year change of the bottom temperature at the depth 25-75 m on the shelf of West Kamchatka in April



Year-to-year dynamics of the ratio between yellowfin sole and saffron cod in the northern shelf of West Kamchatka

Dynamics of the sculpins biomass on the shelf of West Kamchatka (thousand ton)



Conclusions

We found a general similarity of the changes in total biomass of the main families of the bottom fishes, as flounders, gadids, and sculpins. All of them decrease their stocks in the late 1990s and recovered in the last decade.

Among flounders, the yellowfin sole only had significant fluctuations of its biomass, but so far as it was the dominant species, its fluctuations caused reconstruction of the whole ichthyocenosis: its species structure changed from monodominant to polydominant one in the late 1990s. Shift of water temperature to cooling in the early 1990s was obviously unfavorable for yellowfin sole, as a spring-spawning species, though it became apparent in its stock with the lag about 6-7 years.

Fluctuations of the saffron cod abundance were also considerable but had another patterns – high peaks of abundance in certain years, which were formed after the abnormally cold winters. Thus, conditions of cold winter are favorable for reproduction for saffron cod, as a winter-spawning species.

Fluctuations of sculpins are not understood yet. Severe conditions in the late 1990s caused replacement of large-sized sculpins, as the two species of Myoxocephalus, by small-sized ones, as Gymnocanthus, but we have no any idea on the mechanism of these changes.