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Oscillations of abundance in North Atlantic fishes in 1977-2010 compared to synchronous changes of commercially important species in other parts of the World Ocean due to global climatic variability

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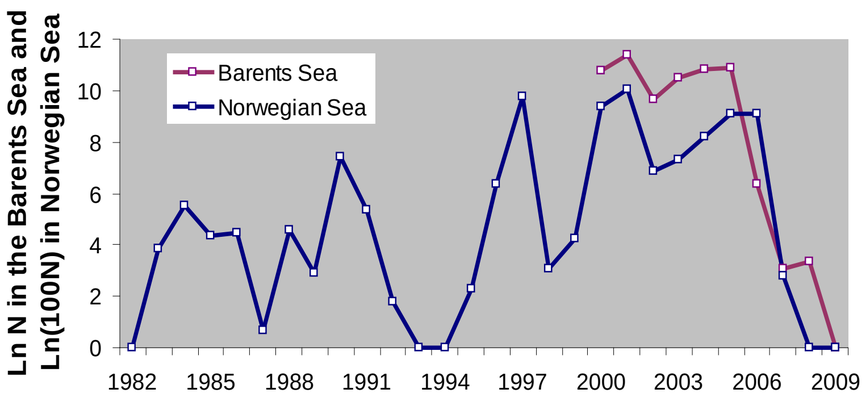
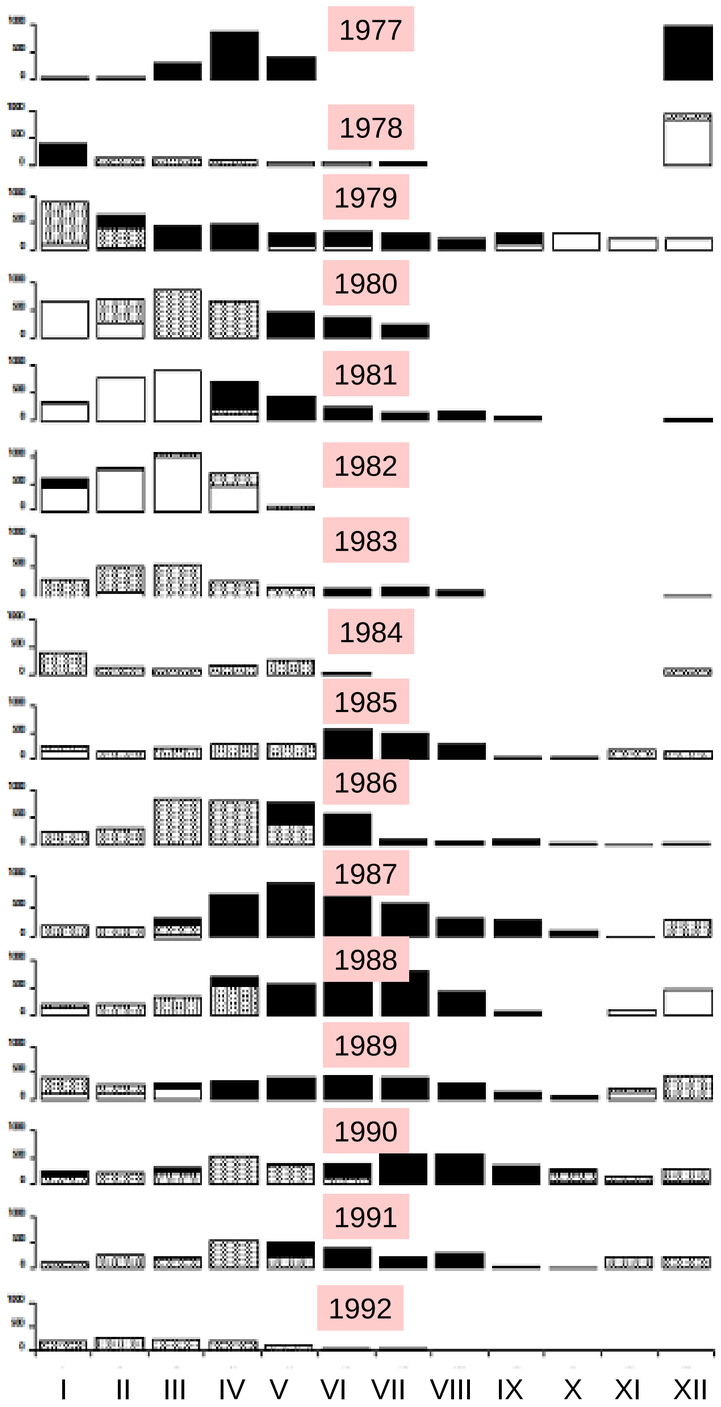
1-group indices of blue whiting from the surveys in the Nordic Seas



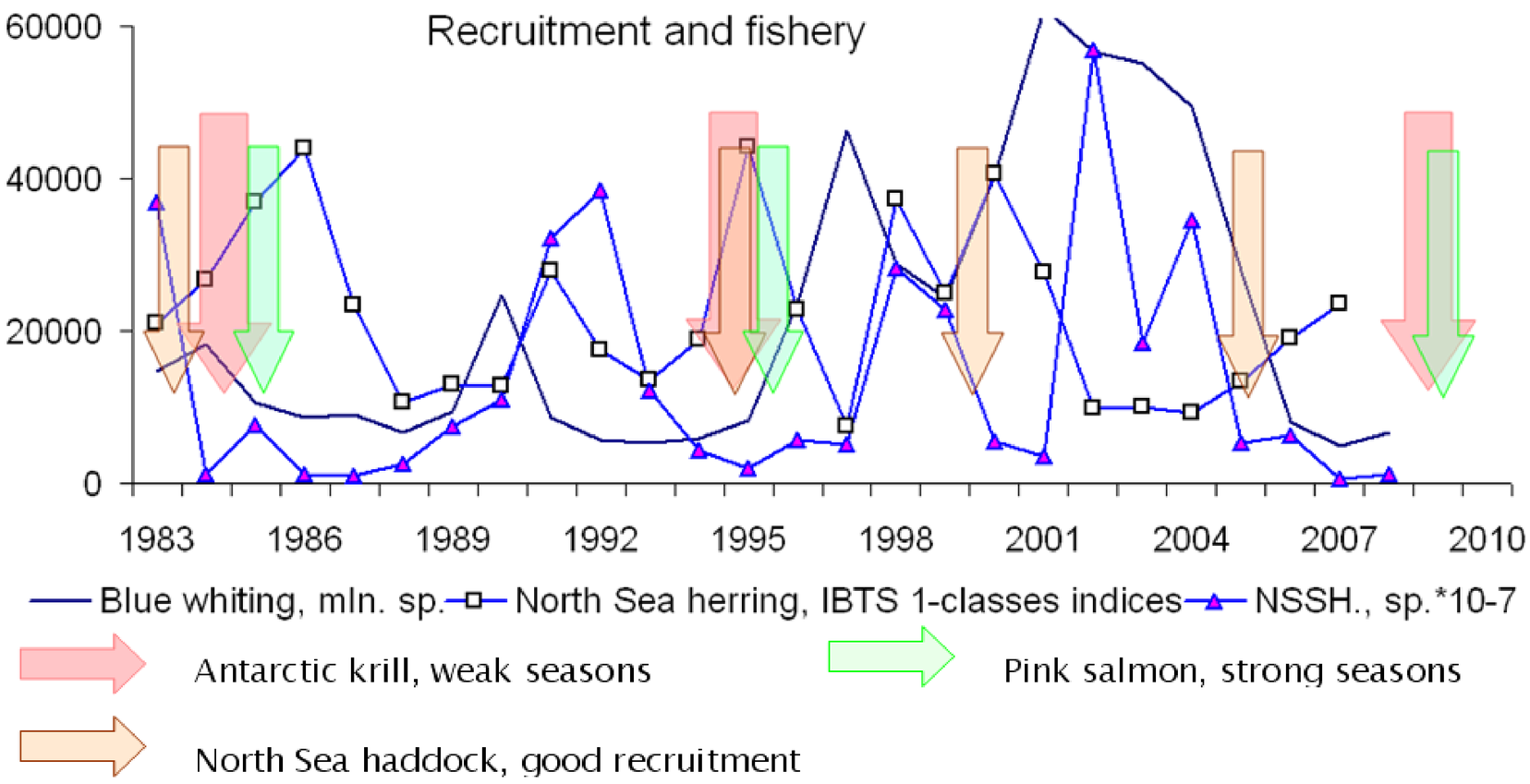
The oceanic fisheries require forecast provisions expressed mainly in terms of distribution, movements, quantities and size composition. In its turn, such forecasting requires sampling, collecting and analyzing of certain data. As usual, the more data collected, the more precise the forecast should be. There are situations, however, when traditional informative provisions predict development of the fishery more or less close to average ones, and reality turns to be hard: Norwegian spring-spawning herring in the 1960-s, north-west-African sardine in 1997, etc. Relatively simple way to avoid those difficulties one may found in the existed links of biomasses or recruitments among the different stocks. Some of them are good, some are insufficiently monitored. That mutual relations might be based on the scrutinized assessments in one of the stocks while in other one the catches only are available and other attitude is required. The 2009 yielded several evens of extreme magnitude in series of important World Fisheries: zero recruitment of blue whiting, zero presence of Antarctic krill in subarea 48.3, extremely low biomass of Chilean Jack Mackerel in the eastern part of its range (Penney, 2010), very high biomass of pink salmon in North Pacific. It is clear, that global events represent just points of the global net, the whole interrelation of which are not conceived yet. This is an attempt to trace possible synchronous changes in different stocks with the task of future predictions.

Forecasting for stocks development in Northeast Atlantic is supported with assessment surveys. Advance time and reliability of the indices obtained are not very high. However, presence of prominent fluctuations and directions' trends are conceived properly, as the results of different surveys coincide (left). When general stocks' dynamics are obvious, those may be compared. The comparison will allow to forecast phenomena which cannot be modeled. Those may be forecasted by reaction of other, even poorer investigated species when time shifts in correlations revealed do exist. In such cases data on very distant stocks may be useful.

Situations with krill fishery, as a whole, are rather predictable (below, left: Litvinov, in press; Litvinov et al., 2003): spatial and temporal variability of the air transfer influences significantly krill fishing effort patterns in Atlantic Sector of Antarctic, affecting krill availability, ice and weather conditions. Analysis of the krill fishery in period of its peak activity in 1977-1992 revealed, that fishing effort in the frames of the quasi-4-year cycles was highest in the Subarea where southern meridional transfers were highest as well. The phenomenon was observed in Subareas 48.1 (1981-1982) and 48.2 (1983-1986) under conditions of increased westward component of the zonal air exchange and in Subarea 48.3 (1987-1988) of decreased westward component. There are situations, however, when krill is nearly absent from 48.3 (South Georgia Isl.): 1984, 1994 and 2009. The proposed mechanism of the event is described in details by Sushin and Shulgovsky (1999): it is demonstrated, that absence of krill in 1983/84 season was caused exclusively by unfavorable environmental conditions (insufficient water flow from southern areas). Later on, in spring-summer of 1984/1985 season the same situation may be caused by absence of krill in the eastern part of the Scotia Sea regardless of oceanological conditions. Reliable predictor of the event, which complicates significantly the fishery, is not determined yet. Hill et al. (2009) noted indications that this occurred during a weak La Niña phase and a positive phase of Southern Annular Mode anomalies, which cannot be considered as reliable single predictor as well.



Distribution of fishing effort in krill (days of fishing) by subareas in 1977-1992. Black – South Georgia, grey – South Orkneys, white – South Shetland islands



It is to be noted, that one of the most abundant generations of pink salmon in the last 25 years was fished in 2009, very abundant generations as occurred in 1983 (peak of fishery - 1985) and 1993 (peak - 1995). So, there is clear temporal analogy between lack of krill in subarea 48.3 and most abundant generations of pink salmon, with contrary synchronous extremums.

The lacks of krill in subarea 48.3, which are hard burden for fishery and crucial event for wild populations, have certain similarity with abundance dynamics of North Atlantic Fishes. Long periods of weak recruitment in Norwegian spring-spawning herring occur just after lack of krill in subarea 48.3; vice versa, no such lacks were observed in the years of the strong blue whiting recruitment. The years of the decreased recruitment of the herring are succeeded by years of increased abundance of North Sea haddock. In its turn, appearance of abundant generations of haddock precedes to increase in 1-classes indices of herring in North Sea surveys assessments.

The close temporal coincidences of extremums (which may be opposite in signs) in such different ecologically and geographically species as Antarctic krill, Pacific pink salmon, blue whiting and herring witness certain regularity of these analogies and existence of the global mechanism running complicated interrelations between Ocean and Atmosphere, which determine such events.

The similarity is well-seen in intermediate extremums as well, which may be opposite in sign but close chronologically.

The direct predictor of the lack of krill in subarea 48.3 is its absence in the stomachs of icefish and penguins (Hill et al., 2009), but this predictor does work for the short period only. The following factors allow to prolong the forecasting period

- weak La Niña phase and a positive phase of Southern Annular Mode anomalies;
- favorable conditions for krill fishery in subarea 48.2 during two and more years under the maximum of southern transfer (Litvinov et al., 2003);
- start of fishery for the most abundant pink salmon generation;
- low level of recruitment of blue whiting and Norwegian spring-spawn herring.

In its turn, long-period database on krill fishery is sufficient support for forecasting of stocks dynamics in North Hemisphere fishes.

References

ICES CM 2009/ACOM:03 Report of the Herring Assessment Working Group for the Area South of 62 N;

ICES CM 2009/ACOM:10. Report of the Working Group on the Assessment of Demersal Stocks in the North Sea and Skagerrak - Combined Spring and Autumn (WGNSSK);

ICES CM 2009/ACOM:12 . Report of the Working Group on Widely Distributed Stocks (WGWIDE);

Litvinov F., in press, Fishery for Antarctic krill in USSR and Russia: experience and future possibilities. // In: "Russian fishery in far oceanic regions: history, present and и prospects". VNIRO, Moscow.

Litvinov F., V. Sushin, G. Chernega and O. Berezhinsky. 2003. The Soviet krill fishery in the Atlantic sector of the Antarctic from 1977 to 1991: fishing effort distribution and interannual patterns.// *CCAMLR Science*, Vol. 10: 1–13

Penny A.., 2010. Observations and Proposals Regarding SPRFMO Jack Mackerel Stock Assessments. International Consultations on the Establishment of the SPRFMO. Assessment Simulation Task Team 6-9 April 2010

Sushin, V., Shulgovsky K. 1999. Krill distribution in the western Atlantic sector of the Southern Ocean during 1983/84, 1984/85 and 1987/88 based on the results of Soviet mesoscale surveys conducted using Issaks-Kidd midwater trawl.// *CCAMLR Science*, 6: 59-70.