PICES XIV CCCC_Poster-2312
Influence of the conditions of reproduction on the survival of herring embryos in the western Bering Sea

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Current herring stock abundance in the western Bering Sea (population of Korf and Karaginski Bays) is at a low level. In this situation, among a number of factors that might influence survival of herring embryos, we distinguish two groups based on their strength of the influence, and interactions between each other. The first group includes factors of direct influence on developing herring eggs, for example periodic drying of spawned eggs caused by tides, water temperature, salinity, oxygen concentration, type of substrate, effects of waves, density of eggs in spawning grounds and predation. The influence of the second group of factors on the eggs is indirect and expressed less; these factors include the abundance of spawners, the time of spawning, the area of spawn, the tides and the ebbs.

The role of any factor in causing mortality of eggs varies during embryogenesis and is determined mostly by the type of, and the situation in, a spawning ground. The current Korf-Karaginski herring population uses mostly lagoon and coastal locked regions for spawning. Survival of embryos differs in these two spawning grounds. In lagoon type spawning grounds, the embryonic survival from spawn till emergence is 27% whereas in the coastal locked type it is only 12%.

The principal cause of egg mortality in the lagoon type spawning grounds is the combined influence of drainage, thermal shock and predation. In the locked coastal spawning grounds egg mortality is mostly a result of drainage (a tidal effect) or by wave mechanical damage, whereas predation and water temperature are not important.

PICES XIV CCCC_Poster-2394
Production of zooplankton communities in the western part of the Bering Sea in 2000s

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Trophic and production characteristics of zooplankton were analyzed for the western part of the Bering Sea. According to a series of complex macro-surveys conducted in the western part of the Bering Sea during 2001-2004, the average zooplankton biomass was 123 g m^{-2} in the upper level in summer–fall, the biomass of phyto-euryphagous zooplankton was 85-91 g m^{-2} in this period and for predatory zooplankton, it was 32-37 g m^{-2}. On the whole, the share of the predatory zooplankton in the 2000s was lower than in the 1990s. The production of phyto-euryphagous zooplankton and predatory zooplankton for this area was 228 g m^{-2} and 50 g m^{-2} respectively. Besides "real" (*i.e.* production available for fishes) production of the zooplankton calculated (~100 g m^{-2}), it was established that salmon consume no more than 4 % of the biomass of various plankton groups. However, consumption of the hyperiids equals biomass of this plankton group and is probably connected with the underestimation of hyperiid biomass. These calculations show that in the beginning of 21st century zooplankton production and feeding resources of nekton are high enough in the western part of the Bering Sea.

PICES XIV CCCC_Poster-2373
Influence of an atmospheric regime on ice cover in the Okhotsk and Bering Seas

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Year-to-year changes in ice cover in the Okhotsk and Bering Seas exhibit an interesting feature: in certain periods the coverage in the two areas vary in phase, but in other periods they are out of phase. To investigate, the years were divided into four groups: those with 1. reduced ice coverage in both seas; 2. high ice coverage in both seas; 3. reduced ice in the Sea of Okhotsk and high ice coverage in the Bering Sea; and 4. high ice coverage in the Sea of Okhotsk and reduced ice in the Bering Sea.

In the case of the first group of years, the Aleutian Low was displaced northwestward from its mean position and located near East Kamchatka, so easterly winds prevailed and the winter monsoon weakened over both seas. In the second case, the Aleutian Low was in the eastern Bering Sea, and the winds were mainly northerly (winter monsoon aggravated) over both seas. In the third case, the Aleutian Low had a southeastern position in the Gulf of Alaska, and northerly winds prevailed over the Bering Sea and easterly winds over the Sea of Okhotsk. Finally, in the fourth case, the Aleutian Low was displaced toward the southwest and was located on the oceanic side of the Commander Islands. In this case, easterly winds blew over the Bering Sea and northerly winds blew over the Sea of Okhotsk.

PICES XIV CCCC_Poster-2326
The influence of spatial-temporal variability of shore polynias on herring stocks in the northern Sea of Okhotsk

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The character of seasonal ice-extent variability causes either favourable or adverse conditions on herring spawning grounds, migration routes, and formation of commercial target stocks. Herring is one of the most important species in the Okhotsk population inhabiting waters of the northern Sea of Okhotsk. The features of spawning migrations and success in spawning (Ayushin B.N., 1947, Tyurnin B.G., 1975, *etc.*) depend on oceanological conditions and practically all herring strong year classes of this population occurred only when favourable ice conditions were present (Melnikov I.V., 2001). The aim of this paper was to examine features of the ice regime in the Sea of Okhotsk, such as shore polynias, and to estimate their influence on the formation of herring stocks.

The data of satellite surveys for the period of ice cover erosion were used in the analysis. The times of occurrence and steady development of shore polynias were determined and their areas were calculated. Tables of occurrence times and steady development of polynias are given. The averages of their areas (March - May) for basic herring spawning and foraging areas for the period from 1978 till 2004 are given. Some regularities of times of occurrence, means of the polynia area against a background of dynamics of intraseasonal anomalies of Kats indexes are determined.

The results suggest that ice conditions in the Sea of Okhotsk impacts herring migration and spawning success and the establishment of commercial herring stocks. The presence of such connections, taking into account the intraannual peculiarities of ice processes in the main spawning grounds, makes it possible to use ice condition data in forecasts of spawning and commercial stocks of the Okhotsk herring.

PICES XIV CCCC_Poster-2348
About various impacts of modern warming in a moderate zone of the Asian continent

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We investigated several features of the dynamics of the thermal regime of the cold season, differing in their sensitivity to anthropogenic influences: monthly average temperatures of air of the coldest month of winter (January) and durations: a cold season and the period with the lowest temperatures. For our research we used 8 stations located in a moderate zone of the Asian continent mainly at 50-55°N, with the period of observation from 1917 for 2000. Our results showed a marked tendency to warming, with the most strongly pronounced warming during the last 20 years of the 20th century. Monthly average temperatures for January increased, and the duration of the cold season and its coldest period decreased. A geographic pattern of temporal warming patterns was found. Strongest early warming (during the late 1960s-early 1970s) occurred in Southeast Asia. Later, at the end of 1970s-early 1980s, warming began in the western part of Asia.

Changes differ for intensity and for territory. So, for the dynamics of average January temperatures for generally all territories, the intensity of warming increases not only with latitude, but also with direction towards the eastern part of the Asian continent. In that territory, temperature is rising about 3°C/80 years. The reduction of the duration of the cold season occurs practically synchronously in all regions and on average was 5-6

days/80 years. Changes in duration of the coldest period of winter are not so synchronous spatially, with the most intense reduction in the cold period (10 days/80 years) in the eastern part of the Asian continent.

We attempt to estimate the role of anthropogenic influence for the warming of the last decades of the 20th century by comparing thermal changes with population size in various cities. Average January temperatures and population size may be related but, for seasonal thermal processes there was no connection. It gives the basis to believe that modern warming is a consequence of the joint influence of natural and anthropogenic factors.

PICES XIV CCCC_Poster-2406
High silica concentration in the bottom water of the northernmost area of the Anadyr Gulf in fall 2000 and 2002

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The Anadyr Gulf has a two-layered structure. The surface layer is freshened due to river discharge and ice melt. Weather conditions determine the seasonal and interannual variability of hydrological and hydrochemical characteristics. The most interesting phenomenon is the existence of cold saline bottom water (σ_t > 27.0; -1.99°C <T< -1.5°C; 33.7–34.2 psu) that occupies the northernmost area (off the Cross Bay) and is associated with a submarine canyon (50-70m depth). Very high concentrations of dissolved silica in bottom water (74.4 ± 13.69 μM/kg in 2000; 56.8 ± 4.9μM/kg in 2002) were accompanied by high phosphate (> 3μM/kg), nitrate deficiency (< 25μM/kg), and low oxygen content (less than 40% in 2000 but <60% in 2002). Silica concentrations like this occur to the south on the Bering Sea shelf (σ_t = 26.95 or 197-550m). To study interannual differences of silica and other nutrients in bottom water, we compare weather conditions in both years in the Anadyr Gulf. We suppose that observed high silica concentrations might be determined by both weak water exchange between the northernmost area of the Gulf and the adjacent regions of the Bering Sea, and by the destruction of organic matter supplied from the surface layers during high photosynthesis production. Organic matter incoming below the pycnocline might remain in the bottom layer of the canyon during warm periods, isolated from other layers by strong density gradients formed during winter convection. As a consequence, nutrients have accumulated in the bottom layers. Interannual variability also might be connected with dynamic processes on the shelf (upwelling during north wind forcing).

PICES XIV CCCC_Poster-2450
Distribution of epipelagic fishes and squids in the Northwestern Pacific during summer, 1982-2004

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Research on the community structure and dynamics over large areas of the northern North Pacific Ocean is needed to understand the present and future ecological responses to climate change. Since 1982, the T/S *Oshoro Maru* and *Hokusei Maru* of Hokkaido University have been conducting summer monitoring surveys of the oceanography and ecology of the northern North Pacific using research driftnets and hydrographic observations. In the western Pacific, this monitoring is repeated annually in June along 155°E. In the present study, we describe the distribution of epipelagic fishes and squids along this transect during the summers of 1982-2004. The southern boundary of the transition domain (the Subarctic Boundary) fluctuated between 39°N and 43°N with a period of twenty years, but the position of its northern boundary (the Subarctic Front) remained relatively constant. Chum salmon (*Oncorhynchus keta*) were concentrated mainly north of Subarctic Boundary, but also occurred south of this boundary in some years. Red flying squid (*Ommastrephes bartramii*) and Pacific pomfret (*Bramma japonica*) migrated north across the Subarctic Boundary. In the early 1990s, the abundance of both species decreased, but red flying squid has increased in abundance since the mid-1990s, and pomfret has increased in abundance since the early 2000s. Factors affecting distribution will be discussed.

PICES XIV CCCC_Poster-2537
Carbonate system in "exotic" marine environments

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At the present time, the thermodynamics of the carbonate system of seawater in the open ocean and the methods for its study are well understood. However, specific problems with theoretical descriptions and/or experimental determinations of carbonate parameters are presented for such marine environments as: 1) dumping sites of liquid CO_2 in the ocean; 2) estuarine waters; and 3) anoxic marine sediments.

The main problem in describing the carbonate system in these "exotic" areas is the absence of needed dissociation constants. It is shown that problems related with the determination of dissociation constants may be overcome using the Pitzer method (1991). Methods of determining pH and total alkalinity are discussed. Some model calculations and experimental observations are presented.

PICES XIV CCCC_Poster-2566
Features of temperature conditions in the Vostok Gulf and at the hydrometeorological station Nahodka

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The Vostok Gulf is situated in the south-east part of Peter the Great Bay of the Japan Sea. The sea biological station "Vostok" was created here in 1970. In 1991 the cultivation of marine organisms was organized in the gulf. Hydrometeorological conditions in the gulf have a significant influence on biological organisms. Atmospheric conditions and sea water surveys have been available since 1995. This ten-year record of air and water temperature is the basis of the present paper. We compare the dynamics and temperature conditions of air and water in the Vostok Gulf and at the hydrometeorological station Nahodka. The comparison of 10-day averaged temperatures of air at both stations has indicated that temperature conditions are practically identical during the warm season and insignificantly differ during cold part of the year. The characteristics of water and air temperatures in the transition season in abnormally warm and abnormally cold years is of special interest from the point of view of their influence on biota. Those are 1997 (cold) and 1998 (warm). Time and dynamics of transition from negative to positive temperatures strongly differ in these years. Ice cover exerts the greatest influence on temperature during this period. In warm 1998 the ice cover decreased during mid-February, and the intensive warming of water began after this. In cold 1997, the transition through 0˚C occurred later, and the ice decreased in early March. As a whole, the lag in the rise of water temperature from air temperature at transition through 0˚C is insignificant. However, it noticeably differs in different "thermal" years. The transition of air temperature to negative values in autumn differs considerably in warm and cold years. Undoubtedly, temperature exerts a significant influence on the biota of the Vostok Gulf.

PICES XIV CCCC_Poster-2278
Pelagic food web structure in the northern California Current system

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Ecosystems are complex adaptive systems characterized by the diversity and individuality of components, localized interactions (competition, predation, reproduction) and autonomous processes that change the structure of the system over time. As such, they are difficult to analyze, and predictions of the dynamics of individual

components have limited reliability. Our focus is to better understand the ecosystem processes that affect production and survival of juvenile salmonids. A first step in understanding these processes is to develop as full a description of the trophic structure of the system as possible. From that foundation, we can develop dynamic models based on functional groups or guilds at whatever level of complexity is needed to address a particular question. Here, we present an analysis of the trophic structure of the Northern California Current shelf pelagic zone (latitudes 40°N to 48°N), based on recent observations of diets of pelagic fishes during U.S. GLOBEC studies and other related research, combined with literature reports of diets for other organisms (such as zooplankton and top predators). We apply cluster analysis of predator and prey relationships, combined with life-history information to suggest functional groups for dynamic analysis. We also consider variation in food web structure both among years and across latitudes.

PICES XIV CCCC_Poster-2403
Possible food resource partitioning by small epipelagic fishes and myctophids in the Kuroshio-Oyashio Transition Zone - A preliminary study

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We examined stomach contents of juveniles of Japanese sardine (*Sardinops melanostictus*), anchovy (*Engraulis japonicus*), mackerels (*Scomber japonicus* and *S. australasicus*), and juveniles and adults of seven myctophid fishes (*Ceratoscopelus warmingii*, *Diaphus perspicillatus*, *Myctophum asperum*, *M. nitidulum*, *Notoscopelus japonicus*, *N. resplendens* and *Symbolophorus californiensis*), which were simultaneously collected by four nighttime trawl tows in the surface (< 30m) of the Transition Zone in May 2002. Also, mesozooplankton were collected by a NORPAC net either from 150m or 40m depth to the sea surface. Copepods in 317 stomachs of these fishes and NORPAC net samples were identified to species or genera, counted and their prosome lengths were measured. Dry weight for each prey in the stomachs was estimated from length-weight relationships. An index of relative importance (IRI) of prey item i was calculated using frequency of occurrence (Fi), percentage in number (Ni) and weight (Wi): IRIi = (Ni + Wi)Fi. In terms of IRI, the most important copepod prey differed by predators: *Paracalanus parvus* (sardine), *Corycaeus affinis* (anchovy), *Neocalanus cristatus* (mackerels), *Pleuromamma piseki* (*C. warmingii*, *D. perspicillatus*, *M. nitidulum* and *S. californiensis*), *P. xiphias* (*N. resplendens*), *Eucalanus californicus* (*M. asperum* and *N. japonicus*). Comparison of two NORPAC net samples taken from different depths in proximity indicated that *Paracalanus* and *Corycaeus* are more abundant in near surface (< 40m) in contrast to *Eucalaus* and *Pleuromamma*. These results suggest "resource partitioning" is occurring not only between epipelagic fishes and myctophids (the former mainly feed on epipelagic copepods and the latter on wide-ranging or deeper ones), but also within epipelagic fishes and myctophids.

PICES XIV CCCC_Poster-2214
Abundance, dynamics and trophic status of jellyfish (Cnidaria) in the epipelagic zone of the Okhotsk Sea

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We examined the biomass, distribution, feeding habits and trophic level of jellyfish based on data from surveys of the epipelagic zone of the northern part of the Okhotsk Sea conducted in fall, winter and spring 1998-2005. In fall 1998-2003, the total biomass of jellyfish varied greatly from 0.7 to 3.0 mmt. In the beginning of winter 2002, it was high (0.7 mmt) and was by one-two orders of magnitude lower in spring 2004. Scyphomedusae dominated the jellyfish biomass. The percentage of hydromedusae was higher in spring than in fall. Two species, *Cyanea capillata* and *Chrysaora melanaster,* alternated as the dominant species by biomass in all years. Perhaps, changes of domination are determined by different impacts of oceanological factors on the survival of these scyphistomae species. In spring 2004, most of the diets (59-100% in terms of biomass) of medusae was comprised of planktonic crustaceans. Eggs of walleye pollock and larvae of fish were important prey items of jellyfish, especially of hydromedusae (up to 36%). We used stable-isotope ratios of carbon and nitrogen analysis to determine the trophic level (TL) of the most common species of medusae. In spring 2004, the

average TL of hydromedusae was equal to capelin and herring. The average TL of scyphomedusae was lower and similar to amphipods. Consequently, jellyfish are important predators and competitors of fish in Okhotsk Sea.