PICES XIII S1-2185 Oral

Temporal variations in phytoplankton community structure and physical forcing at Station ALOHA (22.75ºN, 158ºW)

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Potential biological responses to basin-scale climate forcing in the Pacific are assessed based on temporal variations in phytoplankton community structure observed at Station ALOHA (1990-2003) and the output of a Regional Ocean Modeling System (ROMS) model. Phytoplankton populations were monitored monthly during this period using taxon-specific pigment analyses. These analyses revealed distinct temporal patterns, with highest pelagophyte abundance during the periods 1990-1993 and 1996-2003. For other key groups, such as the haptophytes and cyanobacteria, there appears to be a recent post-1996 enhancement in their biomass relative to the previous period of observation. An Ocean General Circulation Model, based on the terrain-following vertical coordinate primitive equation ROMS model, was used to simulate hydrographic dynamics at Station ALOHA. Preliminary analysis comparing the model simulation with TAO observations has shown that the model can realistically reproduce the low-frequency (seasonal-to-interannual) variability. The ROMS simulation during 1990-2003 will be first compared against the HOT physical measurements and then used to help interpret the observed changes in phytoplankton community structure at Station ALOHA.

PICES XIII S1-1994 Oral

Exploring the structure of the oceanic environment: A classification approach

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Despite a recognized need for ecosystem-based management, there is still no consensus on how to define the analytical unit – the ecosystem. We identified distinct oceanic regions in the North Pacific by applying image classification algorithms to environmental parameters output from a ROMS model. We pooled the ROMS output by Levitus seasons and into 2 periods on either side of the 1976-1977 regime shift to investigate seasonal and long-term changes in these regions. We found changes in the regions' sizes and positions before and after the regime shift that are presumably related to well-known water masses (*e.g.*, the Alaskan gyre). Seasonal effects of known atmospheric features (*e.g.*, the Aleutian Low) on the regions are also apparent. Statistical comparisons showed that the seasonal regions were more similar between regimes than from one season to the next within a regime. Prior to the regime shift there were greater differences between seasonal patterns than after, implying that the timing of seasonal transitions have been altered. These transitions warrant more attention since the reproductive success for many northern latitude species depends in part upon environmental conditions in the spring. Significant differences in chlorophyll-*a* distributions among the post-1976 regions supported our hypothesis that these regions are biologically distinct. Our approach allows temporal and spatial fluxes to be characterized at a range of scales. This flexibility in identifying ecosystem boundaries makes it a powerful tool for oceanographers to explore and test hypotheses about marine ecosystem dynamics in the move towards ecosystem-based management.

PICES XIII S1-1827 Poster

The red flying squid (*Ommastrephes bartramii*): A review of recent research and the fishery in Japan

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This poster presents a review of the biology, ecology, fisheries, and resource status of the red flying squid (*Ommastrephes bartramii*) focusing on recent literature published in Japan. *O. bartramii* is a large oceanic squid distributed in temperate and subtropical waters of the Pacific, Indian and Atlantic Oceans. The North Pacific population comprises two cohorts (autumn and winter-spring) and four stocks: 1) central stock of the autumn cohort, 2) east stock of the autumn cohort, 3) west stock of the winter-spring cohort, and 4) central-east stock of the winter-spring cohort. The population undergoes a large-scale seasonal north-south migration. Spawning grounds occur in subtropical areas where the sea surface temperature ranges 21-25°C, and feeding grounds occur in northern waters near the Subarctic Boundary. *O. bartramii* matures at 7-10 months and has an estimated one-year lifespan. In the North Pacific, adult squid generally occur at 0-40 m depth at night and at 150-350 m during the day. They prey primarily on fishes, squids and crustaceans. Predators include marine mammals and fishes. The North Pacific population of *O. bartramii* was the target of an international driftnet fishery during 1978-1992, with annual catches reaching more than 200,000 tons during the 1980s. It is now targeted by jigging boats from Japan, China, South Korea and Taiwan. Annual catches in the Japanese jigging fishery ranged from 50,000 to 80,000 tons during the mid-1990s, but have since dropped. The cause of this drop is not known. In 2000, the biomass of the autumn cohort was estimated to be about 370,000 tons. There are no recent biomass estimates of the winter-spring cohort. The review concludes with nine suggested areas for future research.

PICES XIII S1-1818 Oral

Argo as an aid to environmental monitoring and assessment – An example from the Gulf of Alaska

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The spring of 2002 saw an unusual climate anomaly develop within the waters of the Gulf of Alaska. This anomaly was characterized by rapid warming at the sea surface and an injection of a large T/S anomaly between 80 m to 150 m depth. Much has already been written about the development and origin of this anomaly, and some descriptions of its impacts have been prepared. In the northern Gulf of Alaska the anomalies resulted in a massive stabilization of the water column through the spring and fall of 2002. By February 2003 it was apparent that very little vertical mixing had taken place in the upper ocean and that this would be restricting the supply of nutrients which potentially could be damaging to the productivity of the marine ecosystem. This paper will show how the unusual climate anomalies developed and how the Argo array allows us to monitor the development and evolution of a climate anomaly in near real-time. Evidence will also be shown implying that the anomaly appears to have been associated with large scale changes in the flow of water in the northern Pacific Ocean.

PICES XIII S1-1773 Poster
Results of Russian echointegration and trawl surveys in the Donut Hole during autumn 2003

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Studies were conducted from 15 to 26 November, 2003. A total of 13 hauls within 0-310 m were made in their course; the overall length of echointegration tacklines being 1586 miles at the 0-500 m layer. The trawl survey was made using a midwater trawl (111/786) with an 86 m horizontal and 60 m vertical opening, and 110 mm mesh size in the codend. A small mesh insert (liner) 6 m long was used (20 mm mesh). The echointegration survey employed an FCV-1200L (28 khz) and a trawl sounder SI-1010. No pollock was recorded in any of the tracklines made. Near-surface concentrations of jellyfish and, possibly, of mesopelagic fishes were observed throughout the entire area. The catches included ten species of fish, as well as Commander Island squid, and medusas. Pollock was found only in one haul made at the central-eastern sector of the Donut Hole boundary within a 120-180 m layer. Smooth lumpsucker was most frequent among the fish species in catches. In total, 46 fish of this species were taken; two individuals of atka mackerel were caught in the south of the Donut Hole. At night three mesopelagic fish species were numerous in the trawl wing meshes. The catch size and composition data obtained were similar to the results of the 1998-2002 surveys made in the Central Bering Sea by vessels from Poland, China and the Republic of Korea pursuant to the terms of the Convention on Conservation and Management of Pollock Resources in the Central Bering Sea.

PICES XIII S1-2133 Oral
Links between biogeochemistry and ecosystems in marine environments

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Complex interactions between chemical factors such as concentration, distribution, and bioavailability of macronutrients and micronutrients that are required for life, and biological processes such as primary production, grazing and predation that alter the form and distribution of chemical elements in the ocean system are critical to the structure of marine ecosystems. The inputs, losses, dynamics, and chemical forms of micro- and macronutrients influence the autotrophic and heterotrophic organisms found in the ocean with subsequent non-linear impacts on metabolic rates and processes, population dynamics, and food web and community structure. The bioavailability of macro- and micronutrients required for the functioning of specific enzymes and metabolic pathways may exert considerable control on the species composition of communities of marine organisms and functional metabolic pathways. Changes in microbial and phytoplankton activity due to changes in the concentrations, types and ratios of macro- and micronutrients can alter the composition, production, and subsequent degradation of organic matter.

Through uptake, metabolic transformations, active and passive transport, extracellular complexation and recycling, biological communities exert considerable control on the oceanic abundance and distribution of macro- and micronutrients and other particle-reactive elements. Such transformations may themselves be influenced by factors internal to marine food webs, such as species composition, as well as external factors that may vary in time and space. Understanding marine biogeochemical cycles and ecosystems requires a significant increase in our understanding of the interactions between biological and geochemical processes. A series of key issues and examples will be presented.

PICES XIII S1-2018 Invited
Relation between tuna resources and atmosphere-ocean variability in the North Pacific

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It was noted in the early 1980s that some pelagic fish stocks, *e.g.* three species of sardine off Japan, California and Chile, show concurrent fluctuations with a period of several decades. Recent discussions on climate impacts on fish stock fluctuations tend to expand from small pelagic fishes to top predators. This study examines the impacts of atmosphere-ocean variability on recruitment fluctuations of tunas in the North Pacific, *i.e.* Pacific bluefin tuna (PBT), albacore (ALB), and skipjack (SKJ). PBT recruitment fluctuates with a period of around 20 years with three peaks in the middle 1950s, 1970s and 1990s. ALB recruitment shows a similar fluctuation to those of PBT, except with low recruitment in the late 1950s. SKJ recruitment has increased from the 1970s with about 20-year period fluctuations, with two peaks in the mid 1980s and in recent years. Significant correlations were noted between PBT recruitment and the Pacific Decadal Oscillation (PDO), Aleutian Low Pressure Index (ALPI) or Southern Oscillation Index (SOI); ALB recruitment and PDO; and SKJ recruitment and PDO or WP (West Pacific Index), respectively. Especially, sea surface temperature in a spawning area shows significant correlation with recruitments of the three species examined and the period of high temperature in a spawning area corresponded with high recruitments. In addition, ALB high recruitment also corresponded with low temperature in a spawning area during winter, outside the spawning seasons. Climate changes are considered to change larval survival rates in their breeding grounds through changes in food availability, growth rate and the period vulnerable to predation.

PICES XIII S1-2113 Oral
Patterns of distribution and biology of the North Pacific oceanic squid *Berryteuthis anonychus* with implications for the species life cycle

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Berryteuthis anonychus (Pearcy et Voss, 1963) is a wide-ranging squid species occurring mostly in offshore areas across the entire boreal zone of the North Pacific Ocean (NPO). Being an oceanic pelagic species, its distribution and life cycle are closely associated with oceanographic current structure. Distribution of this species is uneven, with the densest squid concentrations observed in the northeast Pacific. In the western NPO the species is less commonly encountered. High abundance of this squid in epipelagic layers of the subarctic region, and its associated importance in oceanic food webs, as well as its potential value as a commercial target for the far seas fishery, encouraged research activity into the species biology, including distribution patterns of various life stages. A large amount of data on *B. anonychus* has been obtained during the last four decades of the 20th century, mostly from Russian trawling surveys in the NPO. Having combined all data on squid distributions (spatial, vertical and temporal), and biology (mostly information on the squid size and maturity), we produced a general overview of intraspecific variability and life history characteristics. These were related to general circulation patterns and bottom topography of the NPO.

The general pattern of *B. anonychus* spatial distribution by size and maturity suggests that there exists a major putative geographic separation of the distributional range into “eastern” and “western” sections, with most ontogenetic stages, from paralarvae and early juveniles to immature and maturing adults, occurring within each area. If this in fact is the case, the “western” part of the range is geographically more restricted while the “eastern” one is expanded both latitudinally and longitudinally. In the central and eastern NPO, young squids with dorsal mantle length (DML) less than 21 mm were occasionally observed in the south of the Subarctic Current System area. Larger squids were generally distributed over a broader range of longitude and tended to be found further north. This pattern was most evident for the “eastern” group where larger squids generally occurred north- and eastward of the “paralarval area”. Squids in advanced maturity stages (III and IV) were found in the upper part of the Ridge Domain, mostly in the Gulf of Alaska, and also were occasionally present along the northern boundary of the research area that partially coincided with the southern limit of Alaskan Stream. They were also rarely present to

the west and east of the Emperor Seamounts, and far oceanward of the Kuril Chain to the north of the Subarctic Front. Prespawning or spawning *B. anonychus* have never been observed or reported, nor have egg-masses or newly-hatched individuals. Generally speaking, there was rather good correlation between distribution patterns of squid in various ontogenetic stages, and a major subdivision of the Subarctic Current System into the Western Subarctic and Alaskan gyres.

From squid occurrence and distributional patterns and from a trend that suggests a northward increase in size and maturity of the squid throughout its geographic range, we suggest the following hypothetical life history. *B. anonychus* spawns most likely at great depths (of about 500 m, or even deeper) with spawning areas associated with underwater rises. After hatching, paralarvae are distributed in the highly productive upwelling zones. Growing juvenile squids appear to be dispersed by major oceanic circulatory features. Following the Western Subarctic ("western" group), and Alaskan ("eastern" group) gyres, rapidly growing young squid are transported cyclonically, and finally appear in the vicinity of their natal areas. At the onset of maturation, and during the process of maturity, squids are widely distributed in upper pelagic waters in highly productive zones, where they actively feed. By the time they are sexually mature, and ready to spawn, they are already distributed over their home areas, and finally move down to deep-water layers, where they spawn, completing their life cycle.

PICES XIII S1-2114 Poster

Population structure of the North Pacific oceanic squid *Ommastrephes bartramii* as inferred from variability in biological traits and genetic markers

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Ommastrephes bartramii (LeSueur, 1821) is an oceanic species, widely distributed in the subtropical and low temperate zones of the World Ocean, including the North Pacific Ocean (NPO). This is an offshore species that pursues strictly oceanic life cycle strategy. Combining data from different sources, including variability in biological features (size structure, maturity, distribution of individuals on different stages of ontogenetic development, genetic variability and differentiation) provides valuable information on the species life cycle and population structure.

Our research suggests that in the NPO, *O.bartramii* could be characterized by a complicated intraspecific structure that includes both spatial and temporal components. In general, there exists geographical differentiation of populations from the eastern and western parts of species distributional ranges in the NPO. This is supported by slight but significant variability in at least one polymorphic gene marker. On the other hand, successively spawned squid groups belong to different seasonal cohorts with varying biological traits, *e.g.*, time of spawning and hatch, growth rate, size at maturity. Basically from two to four cohorts are encountered by different authors. Using a restricted number of genetic markers, we did not manage to reveal any genetic differences between at least two seasonal cohorts in the northwestern Pacific Ocean (NWPO). The observed pattern of differentiation in *O.bartramii* implies that "western" and "eastern" areas of the species reproductive range in the NPO were supposedly isolated for a sufficient time to accumulate minor stable genetic differences. In the NWPO, the isolation between seasonal cohorts is either absent, or is regularly violated leading to leveling off of any possible differences. It may also imply that observed differences in size structure between seasonal cohorts in the NWPO are related to seasonal variability in growth rates of the squid, and hence in differences of size at maturity. Breaking up of any possible barrier to gene flow between inraspecific groups of *O.bartramii* could be related to specific biological features of the squid. These include functional structure of the species geographical range, reproductive cycle, ontogenetic migrations, *etc.* The following factors may also be of high importance: seasonal and annual fluctuations in stock abundance, physical and biological environmental impacts, which either separately, or in any possible combination result in temporal and (or) spatial shifts of spawning events, survival of paralarvae, migration routes, *etc.*

PICES XIII S1-2049 Invited
Zooplankton community complexity and temporal variability in the subtropical North Pacific

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Classic zooplankton sampling studies in the subtropical North Pacific revealed both the remarkable diversity of species there and the relative constancy of their rank-order abundance. They thus advanced the notion of a quintessential climax community that was internally regulated by inherent biological complexity. A decade of systematic zooplankton collections in Hawaii Ocean Time-series (HOT) Program has challenged that perspective, with clear evidence of seasonal as well as long-term temporal variability. In this presentation, we consider this new view in the context of a variable and changing physical environment.

PICES XIII S1-2079 Oral
Dynamics of plankton and nekton communities in the Western Subtropical Gyre

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The Western Subtropical Gyre is characterized as a low productivity region with low plankton biomass, but also has schools of large predators. The mechanism of this phenomenon is not clear. According to our investigations, the biomass of phytoplankton increases from subarctic to subtropical waters by about 100 times. In contrast, the biomass of small- and mid-sized zooplankton double from sub-tropical to subarctic waters. Large-sized zooplankton are 10 times more plentiful in subarctic than subtropical waters

What are the main causes of the increase in the productivity of subtropical waters? First is the drift of inshore species into open waters with the Kuroshio current. Juveniles of sardine, anchovy, mackerel, Japanese flying squid are main foods of skipjack and albacore tuna. Second is ontogenetic accumulation of forage species into the upper layers. For example, *Euphausia pacifica* form surface spawning schools, and larva of some myctophids and bathylagids concentrate into the surface 1-meter layer. These species are among the main foods of skipjack, dolphin, frigate mackerel *etc.* Third is transport of organic substances from subarctic into subtropical waters by predators. Most large fishes and squids migrate only once into subtropical waters and die just after spawning. Their organic substances may be used by bacterioplankton and gelatinous zooplankton. Forth is accumulation of plankton and micronekton around seamounts and into other dynamic zones. These regions are feeding areas for albacore tuna. It is interesting that most high abundance predators that inhabit subtropical waters have life spans of no more than 1 year. These species concentrate into the northwestern periphery of the Subtropical gyre. Longer-lived fishes are spread more widely into the central part of the gyre and do not form large accumulations; that is why longlines are the best fishery gear for them. Thus, inshore-offshore and north-south transport of organic substances are the basic methods of enrichment of the low productivity Subtropical Gyre.

PICES XIII S1-2150 Invited
The forcing of the Pacific Decadal Oscillation

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The Pacific Decadal Oscillation (PDO) is the leading mode of variability of sea surface temperature in the North Pacific. It is a widely used index for Pacific Decadal variability, North American and East Asian climate, the North Pacific ecosystem, and modulations of tropical Pacific to North American teleconnections. We show that North Pacific SST and the PDO can be accurately reconstructed from a first-order, auto-regressive model forced by El

Nino, intrinsic variability of the Aleutian Low, and ocean thermocline depth and zonal advection anomalies in the Kuroshio Extension. The latter result from the slow adjustment of the ocean gyres to changes of the wind stress, and are estimated from the history of the Pacific wind stress and Rossby wave dynamics. The leading mode of the reconstructed SST anomalies capture the time evolution and spatial pattern of the PDO. The resulting evolution equation of the PDO shows that it too is dependent only its own history, and the forcing indices - the coupling of the PDO to other modes of North Pacific SST variability is small. The contribution of the different forcing mechanisms is frequency dependent. At annual and shorter time-scales the Aleutian Low dominates, at interannual time-scales teleconnections from the tropics and intrinsic variations of the Aleutian Low are of equal importance. The influence of gyre anomalies in the Kuroshio Extension is on par with the other two forcing at decadal time scales.

PICES XIII S1-2096 Oral
When did the 1976 regime shift occur?

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Many physical and biological time series from the North Pacific display a relatively sharp change in about 1976, which has been deemed a climate 'regime shift'. This has led to an oversimplification that the entire North Pacific environment and ecosystem shifted suddenly and simultaneously following the 1976-77 winter. However, many studies have reported changes 'in about 1976' that more accurately should be portrayed as being initiated years earlier. Thus the doctrine of a global 1976 regime shift was established. We characterize the evolution of a number of North Pacific physical and biological variables leading up to 1976, and provide evidence that there has been significantly more variable temporal behavior than has been supposed. For example, ocean temperatures below the upper mixed layer and in the northern extremes of the North Pacific began warming around 1970 and do not show a clear shift in 1976. Likewise, many fishery time series suggest population shifts near 1970. One interpretation of a regime shift is an evolving phenomenon whose signals 'propagate' into different regions, depths, and fields having different response times, depending in part on the process that is directly supplying the climate signal. We define changes in North Pacific climate and ecosystem structure during the 1960s-70s, classified spatially and by variable type, provide examples, and suggest mechanisms that may be responsible for a more gradual climate change in the interior ocean followed by a near-surface acceleration. We apply these ideas to more recent climate 'shifts' attributed to 1989 and 1998.

PICES XIII S1-2165 Invited
Processes and patterns at oceanic "hot spots" in the subtropical North Pacific

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The pelagic oceanic environment in the subtropical North Pacific is often perceived as being homogeneous, offering few visual cues to maintain spatial orientation. However, while spatial heterogeneity is effectively restricted to vertical gradients of light, temperature, and abundance of organisms, regions of strong and complex horizontal oceanographic variability abound throughout the open ocean ecosystem in the form of large-scale frontal systems and mesoscale dynamic features where productivity is enhanced and/or trophic transfer facilitated. These include such phenomena as basin-scale physical (*e.g.*, Subtropical Front) and biological (*e.g.*, Transition Zone Chlorophyll Front) fronts, and meso-scale frontal meanders and eddies. In addition, abrupt topography in the form of seamounts are common features in the pelagic subtropics that can have a profound influence on adjacent open ocean food webs in a variety of ways, particularly so for those that rise within the upper few hundred meters of the surface. Accompanying these oceanographic and topographic areas of enhancement are often concentrations of migratory nekton species and collectively has commonly become referred to as oceanic "hot spots". A combination of *in situ* and remotely sensed observations at these special areas provide insight to understanding the processes and patterns that functionally underlay these "hot spots" and are presented here. These oceanographic and topographic features are fouind to often give rise to localized regions of higher productivity leading to aggregation and development of a

forage base while physical gradients and structure provide cues for predators to locate prey or more directly, aggregate or concentrate food items.

PICES XIII S1-1878 Poster
Ichthyoplankton of the equatorial frontal zone east of Galapagos Islands

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During her 34th cruise, Russian *R/V* "Akademik Kurchatov" performed a short transect crossing the equatorial frontal zone, east of Galapagos islands (87-88° W). This study analyzes stratified samples collected with two types of plankton nets (Juday type) and covering the upper 200 m of the water column. The sample period coincided with austral winter, when the equatorial front is weakly developed. The ichthyoplankton collection included 53-55 species from 25-26 families. Family Myctophidae was the most species rich, with larvae of 14-15 species recorded. Less diverse families were Gonostomatidae and Nomeidae (4 species). Other families were represented by 1-2 species. Larvae of *Vinciguerria lucetia* and *Auxis rochei* numerically dominated the ichthyoplankton. The larvae of these two species, as well as early stages of *Diogenichthys laternatus*, *Nannobrachium* sp. (Myctophidae) and *Psenes sio* (Nomeidae) comprised more than 60 % of the total ichthyoplankton collected and occurred in more than 20% of samples. Eggs of 17-19 fish species were also recorded in ichthyoplankton, including *B. nigrigenys*, *Maurolicus* sp., *Vinciguerria lucetia*, *Stomias* sp., Myctophidae gen. sp., *Oxyporhamphus micropterus*, *Exocoetus sp.*, *Cheilopogon* sp., *Trachipterus cf. fukuzaki*, *Psenes sio*, *Auxis rochei*, *Cubiceps pauciradiatus*. In general, ichthyoplankton composition was rather typical for the eastern tropical Pacific and was principally composed of larvae of epipelagic and mesopelagic species. Small numbers of larvae of coastal species (Serranidae, Gobiidae) were probably dispersed from the nearby Galapagos Islands.

PICES XIII S1-1877 Poster
Species composition and abundance of mesopelagic fish assemblage on the periphery of the North Atlantic subtropical gyre

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Subtropical gyres, found in all major oceans, represent unique marine ecosystems, hosting highly diverse pelagic communities with rather stable species composition and biomass. In October 1999, Russian *R/V* sampled deep sea pelagic biota southwest of Azores archipelago, near the northern periphery of the North Atlantic subtropical gyre (36°14' N, 33°57' W). The deployment of six non-closing Isaaks- Kidd midwater trawls, covering various depth strata, resulted in the collection of 2354 fish specimens representing 66 species from 20 families. With the exclusion of extremely abundant bristlemouths (Cyclothone spp.), mainly caught below 200 m, the most abundant species in the collection was *Notolychnus valdivae*, followed by *Vinciguerria attenuata*, *Argyropelecus hemigymnus*, *Chauliodus danae*, *Lampanyctus* sp., *Diogenichthys atlanicus*. The majority of species collected were represented by just few specimens. The entire fish collection was composed almost exclusively of mesopelagic species, with only few typical representatives of bathypelagic fauna – *e.g. Eurypharynx pelecanoides*, *Lynophryne* sp. The only non deep-sea representative in the collection were juvenile specimens of *Anguilla anguilla*, almost invariable caught with each tow. Myctophids were by far the most diverse, comprising nearly half (30 species from 15 genera) of the entire species diversity. Of these, *Notolychnus valdivae* formed one third of all lanternfish specimens collected. Other dominant myctophids were *Lampanyctus* sp. (9.6% of all myctophids), *Diogenichthys atlanticus* (9.0), *Lampanyctus photonotus* (6.3), Benthosema *suborbitale* (5.2). Less diverse families in the area sampled were Melanostomiidae (5 species), Gonostomaidae (4), Phosichthyidae (4), Sternoptychidae (4).

PICES XIII S1-1833 Oral

Possible ecological interactions between small pelagic and mesopelagic fishes in the Kuroshio-Oyashio Transition Zone and Kuroshio Extension in spring

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We examined horizontal and vertical distributions and feeding habits of juveniles of Japanese sardine (*Sardinops melanostictus*), Japanese anchovy (*Engraulis japonicus*), mackerels (*Scomber* spp.), adults of a gempylid (*Nealotus tripes*), juveniles and adults of dominant myctophid fishes (*Ceratoscopelus warmingii*, *Symbolophorus californiensis*, *Notoscopelus* spp. (mostly *N. resplendens*), and *Myctophum asperum*) in the Kuroshio-Oyashio Transition Zone and Kuroshio Extension in spring obtained by a nighttime midwater trawl survey during 1995-2004. Geographic distributions of these commercial small-pelagics and mesopelagics generally overlapped throughout the study area and period. Consecutive sampling in close proximity in 1995 revealed vertical segregation of major distributions between small pelagics and mesopelagics. In the upper 20 m layer, Japanese anchovy comprised 88% of the total wet weight followed by *C. warmingii* (3%) and *S. californiensis* (3%). Myctophids in the upper 20 m layer were dominated by juveniles relative to adults when compared to deeper layers. Euphausiids and myctophids were the most important prey for adult black snake mackerel, suggesting a prey shift from anchovy larvae at the juvenile stage. Major diets of juveniles of small pelagics and juveniles and adults of myctophids were copepods with a slight to moderate overlap of species composition in the stomach contents. Given the prevalence of mesopelagic fishes in the study area, which is the key area for reproductive success of Japanese sardine and anchovy, early growth and survival of commercial species may be largely affected by mesopelagic fishes through competition in addition to bottom-up and top-down effects.

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Long-term climate change in the Yellow Sea and East China Sea

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The Yellow Sea and East China Sea (YE) are marginal seas of North Pacific (NP) Ocean. The first and second EOF modes of sea surface air temperature (SSAT) in the NP show a north-south oscillation in the western side of the ocean, which is correlated with the Kuroshio and Oyashio systems. However, the climate system in the YE is affected mainly by the southern part of the oscillation though half of the seas are located farther north. The EOF of SSAT in the YE seas shows a spatially synchronous variation. The temporal pattern of the first mode of the EOF correlates with air temperature and sea surface temperature (SST) in Qingdao. In decadal scale, an obvious low frequency variation shows a negative temperature anomaly period from 1956 to 1987. After then, a positive anomaly is dominant and reaches its maximum around 1998. Then it looks like to restart a negative process. A long-term warming trend of SST in the past 40 years is clear with the rate of 0.09°C/decade, comparable with the global averaged SST increase of 0.1°C/decade. The temperature increase in coastal areas is much higher than that in offshore areas. The correlation of long-term variation of SSAT and SST in the YE with either ENSO or PDO is unexpectedly poor, with correlation coefficients of about 0.15. Therefore, long-term climate change in the YE must be a locally dominant and complicated system, as it is strongly affected by the processes in Northwest Pacific Subtropical High system, Equatorial Current system, Asian Monsoon system and the land climate system.