# PICES - Ecosystem Vulnerability, Resilience and the FUTURE science program

Hiroaki Saito

# What is PICES?

PICES: North Pacific Marine Science Organization. The name of "PICES" is an acronym of "Pacific ICES" (The Intern. Council for the Exploration of the Sea)

PICES is an intergovernmental scientific organization that was established in 1992

PICES members: Canada, Japan, China, Korea, Russia, USA

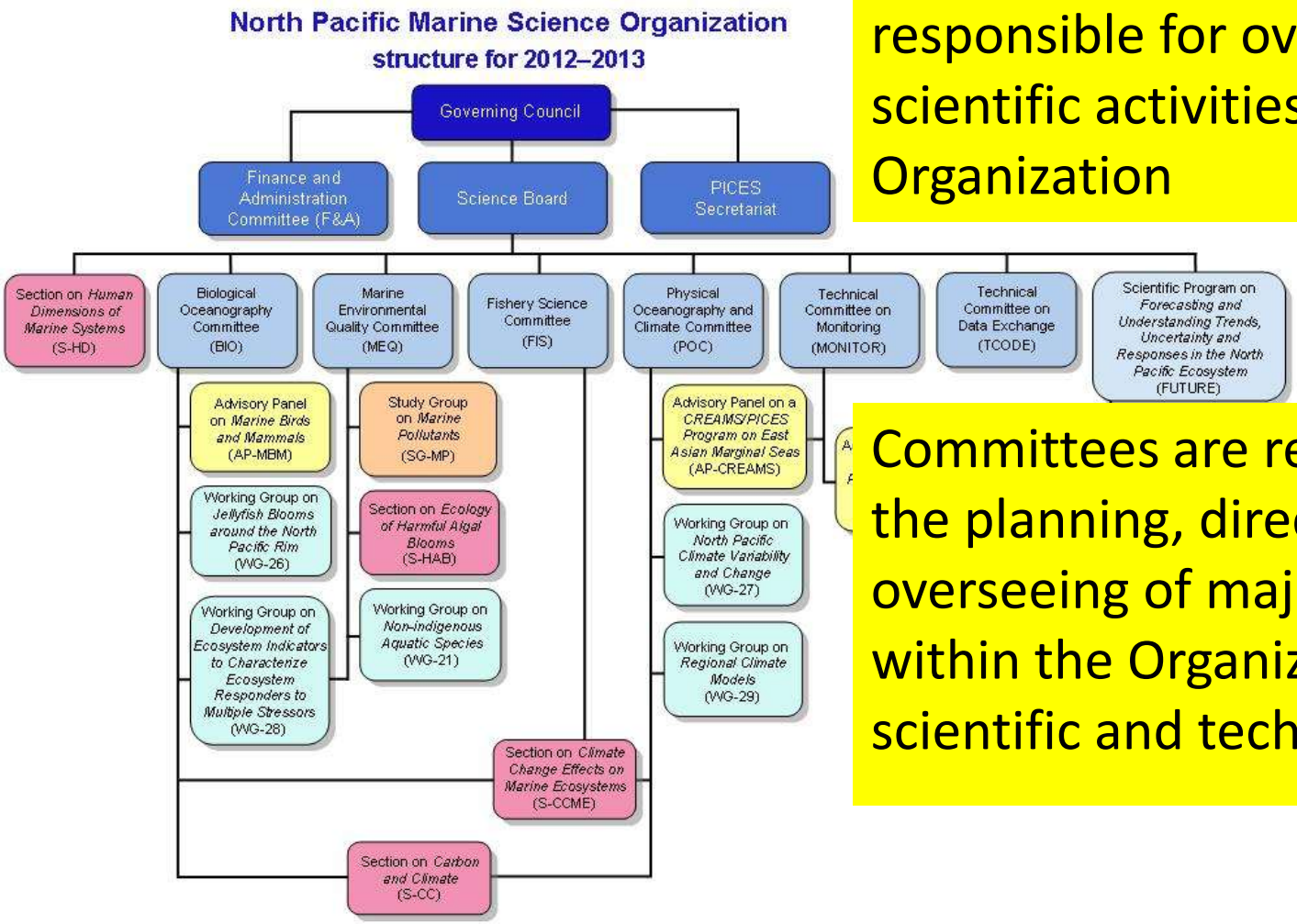
# The PICES Mission has 5 central themes:

Advancing scientific knowledge
Applying scientific knowledge
Fostering partnerships
Ensuring a modern organization in support of PICES activities
Distributing PICES scientific knowledge

# Scope:

- Physical, chemical, biological, carbon cycle, fisheries
- From environmental quality to climate change, and interactions with human societies

The Science Board (SB) is an Executive Committee responsible for overseeing the scientific activities of the Organization



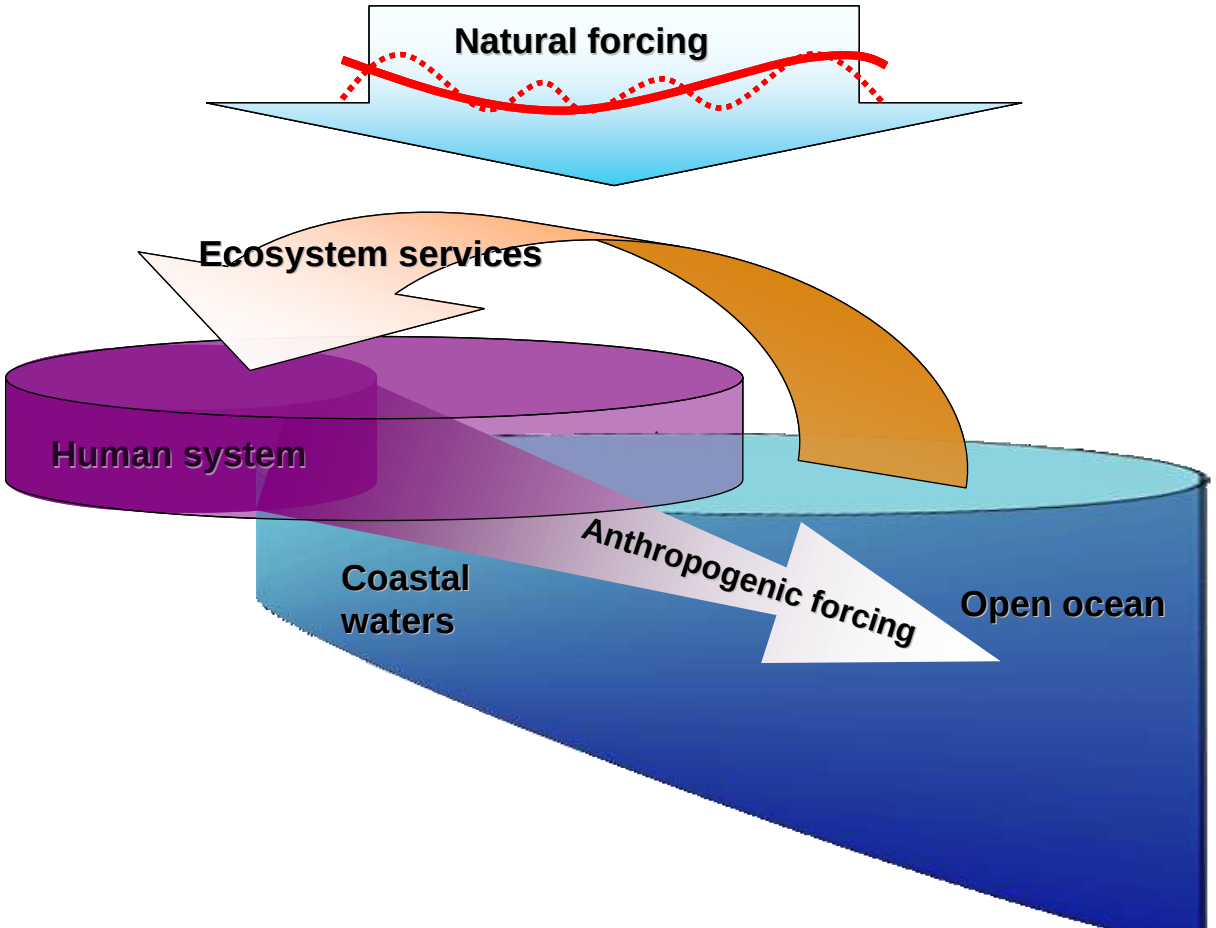

Committees are responsible for the planning, direction, and overseeing of major themes within the Organization's general scientific and technical aims.

# Key Tasks of FIS

- Promote and coordinate fisheries science and interdisciplinary research on biology and ecology of living resources, particularly those that are subject to harvest
- Topics include taxonomy, genetics, behavior, trophic relationships, habitat, distribution, abundance, population dynamics, and methods of stock assessment
- Focus on the relationship between human factors and climate on the fluctuation of resources

# FUTURE

## Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems



# FUTURE Vision

*To understand and forecast responses of North Pacific marine ecosystems to climate change and human activities at basin and regional scales, and to broadly communicate this scientific information to members, governments, resource managers, stakeholders and the public.*


# PICES FUTURE

**Objective 1: Understanding Critical Processes in the North Pacific**

(1) What determines an ecosystem's intrinsic resilience and vulnerability to natural and anthropogenic forcing?

(2) How do ecosystems respond to natural and anthropogenic forcing, and how might they change in the future?

(3) How do human activities affect coastal ecosystems and how are societies affected by changes in these ecosystems?

**Objective 2: Status Reports, Outlooks, Forecasts, and Engagement**

## Working Group-28 Development of Ecosystem Indicators to Characterize Ecosystem Responses to Multiple Stressors

Terms of Reference

1. **Identify and characterize the spatial (and temporal) extent of critical stressors in North Pacific ecosystems both coastal and offshore and identify locations where multiple stressors interact. Identify trends in these stressors**

WG28 may be appropriate body to carry out VME related sciences, e.g., seamount ecosystem resiliency


# PICES FUTURE

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**Objective 2: Status Reports, Outlooks, Forecasts, and Engagement**

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# Marine Ecosystems of the North Pacific Ocean 2003-2008

2010

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# Oceanic

## lead author

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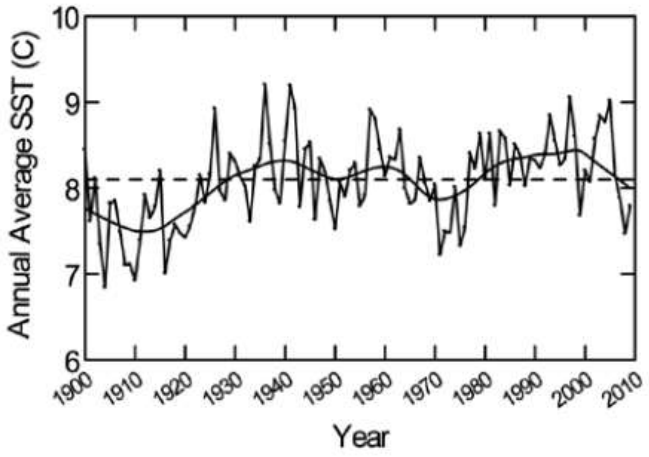
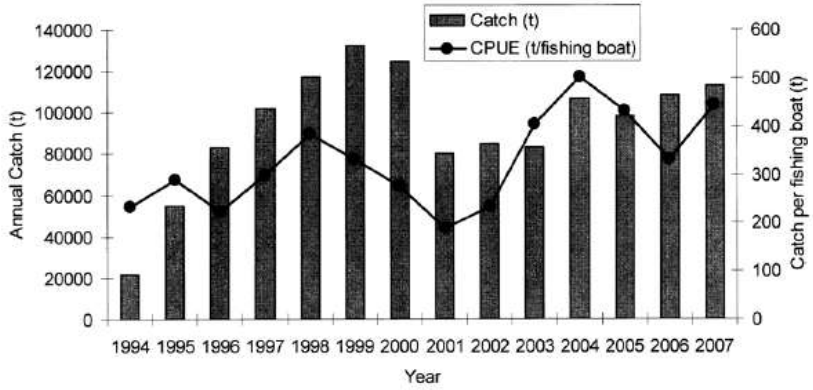
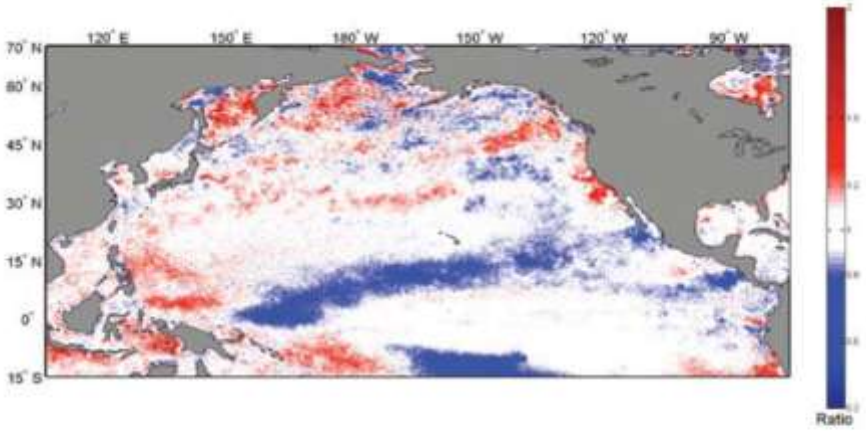
Nanaimo, B.C., Canada



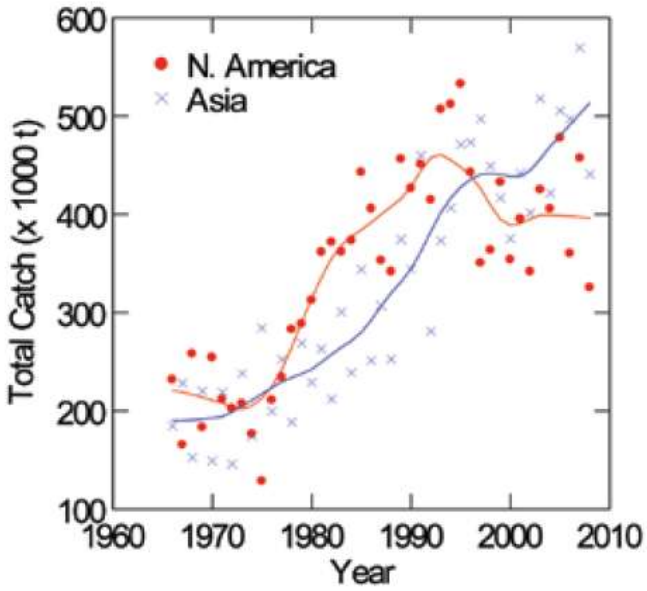

[Figure S-7] Area-weighted annual average SST in the Northeast Pacific north of 50°N and east of 160°W from 1900 to 2009 with loess smoother indicating trend. Horizontal dashed line is the mean of the time series (8.1°C). Data source is Smith et al. (2007).



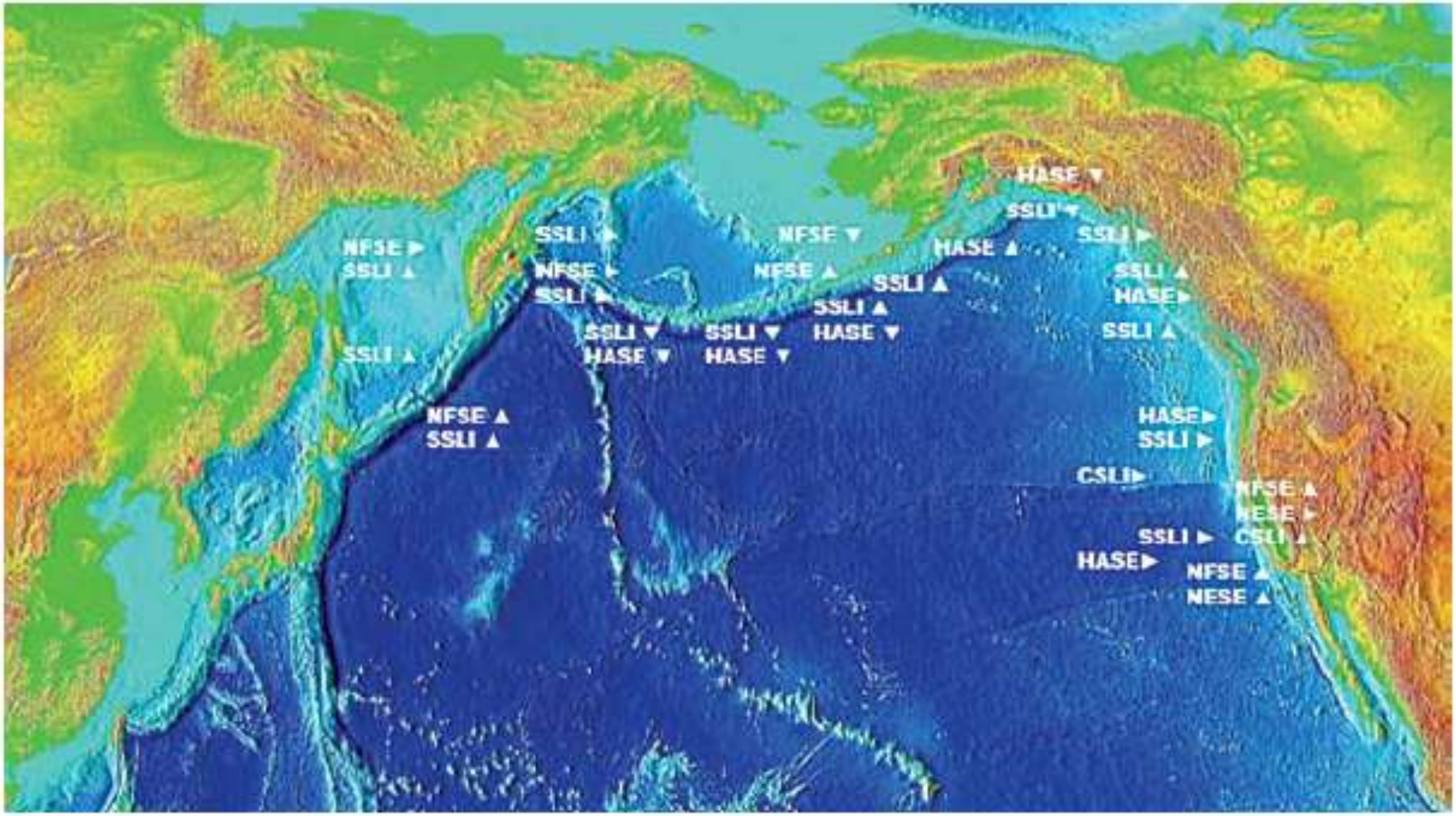

[Figure OC-40] Total annual catch of neon flying squid (*Ommastrephes bartrami*) caught by the Chinese squid-jigging fleet in the North Pacific, 1995–2007, and average CPUE in the area 150–165°E, 38–46°N for the same period.



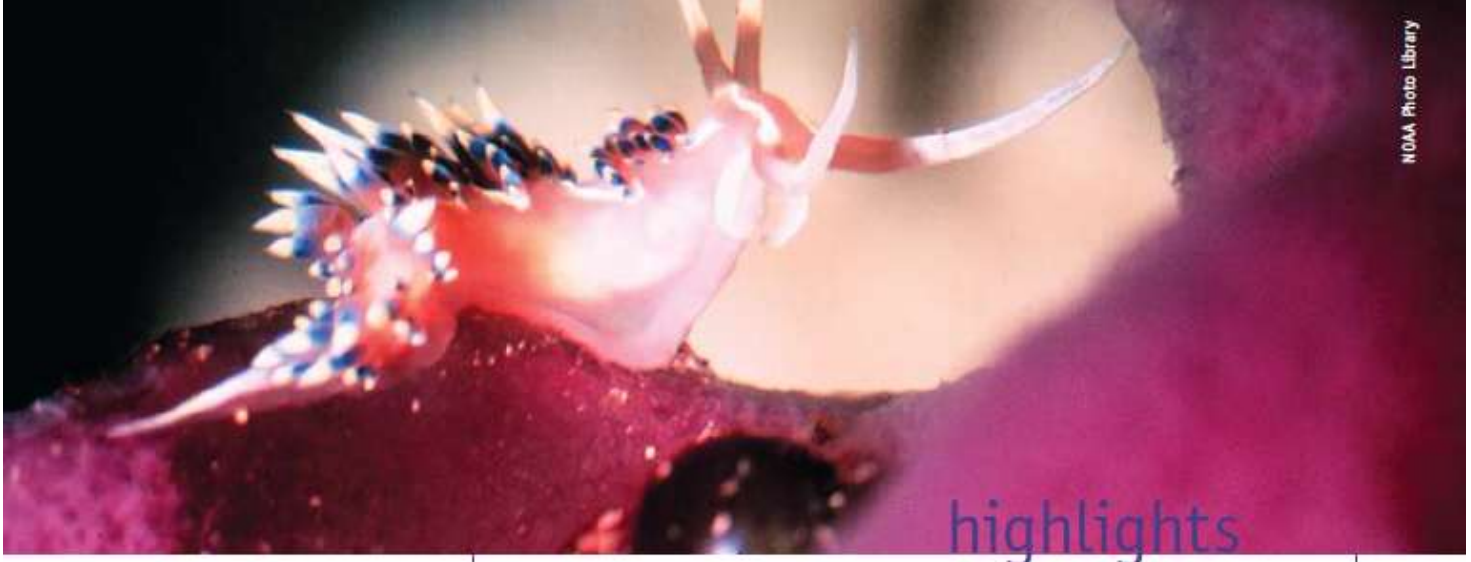

[Figure S-20] Ratio of mean chlorophyll between 1998-2002 (denominator) and 2003-2007 periods. White color indicates minimal chang between the two periods (ratios = 0.9-1.1).




[Figure S-26] Trends in total commercial catch (× 1000 t) of Pacific salmon, by continent. The combined total was as high or higher during the focus period than at any other time in the historical record. Loess trend lines indicate the general trends in each region (Data source: NPAFC, see Irvine et al. 2009).




[Figure S-34] Abundance trends for pinnipeds in the North Pacific Ocean. Trends are indicated by ▲ (upward), ▶ (without trend), and ▼ (downward). Species codes are: CSLI=California sea lion, HASE= harbour seal, NESE=northern elephant seal, NFSE=northern fur seal, and SSLI=Steller sea lion. Information sources for trends can be found in Tables S-3, S-4.

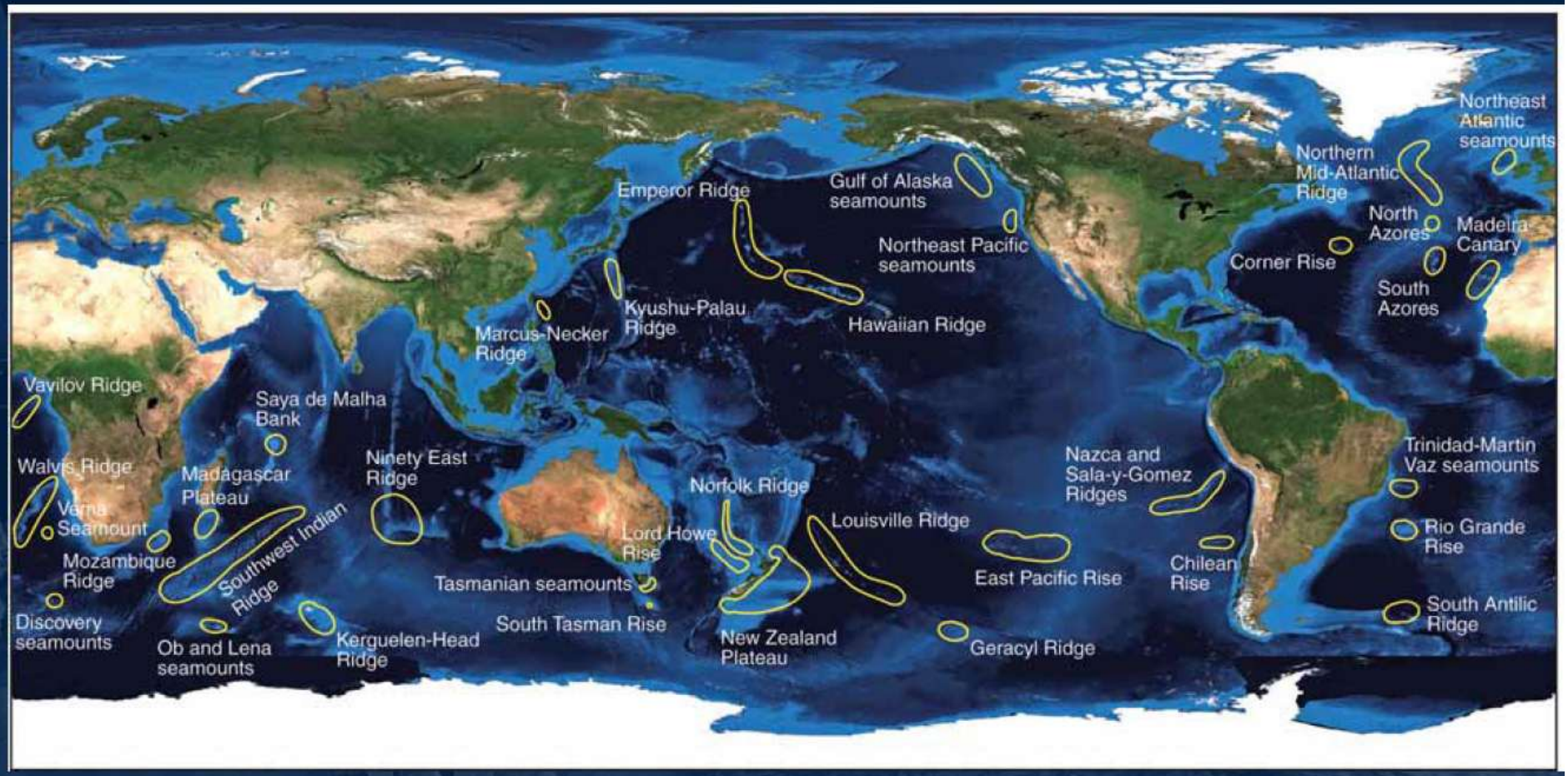



# highlights

- Data on fish and squid stocks are neither abundant nor comprehensive for the open ocean. Catches of neon flying squid in the western Pacific were relatively high in the focus period. The most abundant species of Pacific salmon (sockeye, pink, chum) rear in the Subarctic region. Total catches of sockeye salmon were average or above average, chum catches were average and pink salmon catches were above average in the western North Pacific and below average in the eastern North Pacific. Some western stocks of chum salmon appeared to be decreasing in size. North Pacific albacore tuna stocks were relatively high during the focus period, but predictions are for them to decline by 2015 if fishing pressure is not reduced. Most data for the central North Pacific fisheries (tuna/billfish) showed declining catches during the focus period when compared with previous data.

- Seabird diversity and abundance increased in the eastern North Pacific, at least up to 2006 but this could reflect a change in distribution. Changes in seabird community structure and relative abundance on Line P may be related to changes in the underlying mesozooplankton community. The reproductive success

# Global seamount trawling




From Clark et al, 2007

# 2010 Sendai Workshop on "*Networking across Global Marine Hotspots*"

*by Gretta Pecl, Stewart Frusher, Warwick Sauer and Alistair Hobday*

Vol. 487: 177–183, 2013
doi: 10.3354/meps10477

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Published July 30

*Contribution to the Theme Section 'Biophysical coupling of marine hotspots'*

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INTRODUCTION

## Scales and mechanisms of marine hotspot formation

Elliott L. Hazen[1,2,*], Robert M. Suryan[3], Jarrod A. Santora[4,5], Steven J. Bograd[1], Yutaka Watanuki[6], Rory P. Wilson[7]

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# Marine Ecosystems of the North Pacific Ocean 2003-2008

2010

# 6.0 Fishes and Invertebrates
## 6.1 Northeast Pacific

The fish fauna of the oceanic northeastern Pacific consists of a mix of temperate and subarctic species, resulting in a gradient in species composition along the shelf from the east to the west (Mueter and Norcross 2002). At least 383 species belonging to 84 families of marine and anadromous fishes have been reported from the Alaska continental shelf, slope, and offshore areas (Mecklenburg et al. 2002). The majority of fish biomass and commercial exploitation occurs on the continental shelf and slope in relatively nearshore areas. Few studies have been conducted to investigate long-term temporal patterns in fish abundance in the northeastern Oceanic Region. The central part of the Alaska Gyre provides the principal feeding habitat for many species, particularly salmon, throughout the year (Brodeur et al. 1999). South of the Alaska Gyre, the NPTZ once supported large-scale squid (Ommastrephes bartrami) driftnet fisheries until a moratorium prohibiting use of this gear was established by the United Nations General Assembly in 1992 (PICES 2004). Midwater trawling over seamounts in 1981 found low quantities of non-commercially valuable species of squid, bathypelagic fishes, and immature salmon (Hughes 1981).

Little is known about demersal species that inhabit the deeper parts of the continental slope and oceanic region. Due to the extreme depths in this region, there are few commercial fisheries and limited opportunities for fisheries research. **Seamounts in the Gulf of Alaska represent one of the few areas in the oceanic region where exploitation of demersal fish species has occurred.** Hughes (1981) first conducted exploratory fishing on Gulf of Alaska seamounts in 1979 using trawls and pots. Sablefish, (Anaplopoma fimbria) was the most common finfish found but rattails (family Macrouridae) were also caught. Other commercially important species encountered were several species of king crab (family Lithodidae) and tanner crab (Chionoecetes tanneri). Subsequent longline surveys conducted by Maloney (2004) on eight seamounts in the Gulf of Alaska from 1999-2002 produced high numbers of sablefish, giant grenadier (Albatrossia pectoralis), and Pacific grenadier (Coryphaenoides acrolepis). Tagging studies have verified that sablefish migrate among the continental shelf, slope region and seamounts but the route is unknown (Maloney 2004).

In 2005, the U.S. North Pacific Fisheries Management Council named 16 seamounts within the U.S. Exclusive Economic Zone off Alaska to be Alaska Seamount Habitat Protection Areas. These marine protected areas are now closed to all bottom contact fishing gear. **Since the cessation of high seas driftnet fisheries and closure of seamounts to bottom contact fishing gear very little commercial exploitation has occurred. No time series information of abundance exists for fish species in this area.** The best information likely comes from giant grenadier abundance estimates.

North Pacific Status Report and past PICES presentations mentioned unique characteristics of the ecosystems in highseas and  at seamount regions. But, limited information prevents from further understanding on the ecosystem dynamics and the status of resources. This limitation is also serious problem to identify VME or wise use of biological resources from vulnerable ecosystems.

One of uniqueness of PICES is that having long history of interdisciplinary sciences from climate to ecosystem and to society. Interdisciplinary approach is essential to understanding the present situation of marine ecosystem and to forecast the future,  and to consider the sustainable use of marine resources from VME under changing climate of the Anthropocene.

PICES scientists are interested in VME, related to ecosystem resilience, and also sustainable use of ecosystem services, which are key issues under increasing anthropogenic forcing, and also key issues in PICES FUTURE programme.

# PICES Collaborations

Some Scientific Topic Areas

- Climate Change
- Ecosystem Assessment
- Biological Invasions
- Ocean Acidification
- Marine Spatial Planning
- **VME**

**HOW?**
**Joint Working Groups**
**Joint Workshops and Symposia**
**Joint Theme Sessions**

Some Operational Areas

- Training/Capacity Building
- Knowledge Exchange/Communication

**HOW?**
**Summer Schools**
**Workshops**
**PICES Press**


Symposium Scope

Drastic ecosystem changes have been observed in recent decades in both open and coastal systems. These changes are believed to have occurred in response to climate change and increasing anthropogenic pressures. “What is the future of the North Pacific given current and expected pressures?” This is the question addressed by the PICES Integrated Science Program, FUTURE (Forecasting and Understanding Trends, Uncertainty and Responses of North Pacific Marine Ecosystems). FUTURE will synthesize and disseminate knowledge provided by national and multi-national research programs. Under the overarching question, FUTURE attempts to answer three Key Scientific Questions related to: a) ecosystem resilience and vulnerability; b) ecosystems response to natural and anthropogenic forcing; and c) future ecosystem change. The Program also addresses poorly understood, yet important, issues of interactions between human societies and coastal ecosystems, such as the effects human activities have on the provision of ecosystem services. In addition to the scientific understanding of mechanisms of ecosystem change, FUTURE aims to engage human societies by providing useful products on ecosystem change. Inaugurated in 2009, FUTURE will enter its mid-life in 2014, making it an appropriate time to evaluate what has been achieved and what remains to be addressed. Based on information assessed at this symposium, FUTURE may redirect its course in order to achieve its final goalsFUTURE will enter its mid-life in 2014, making it an appropriate time to evaluate what has been achieved and