PICES report on the *Marine ecosystems of the North Pacific*: towards ecosystem reporting for the North Pacific basin

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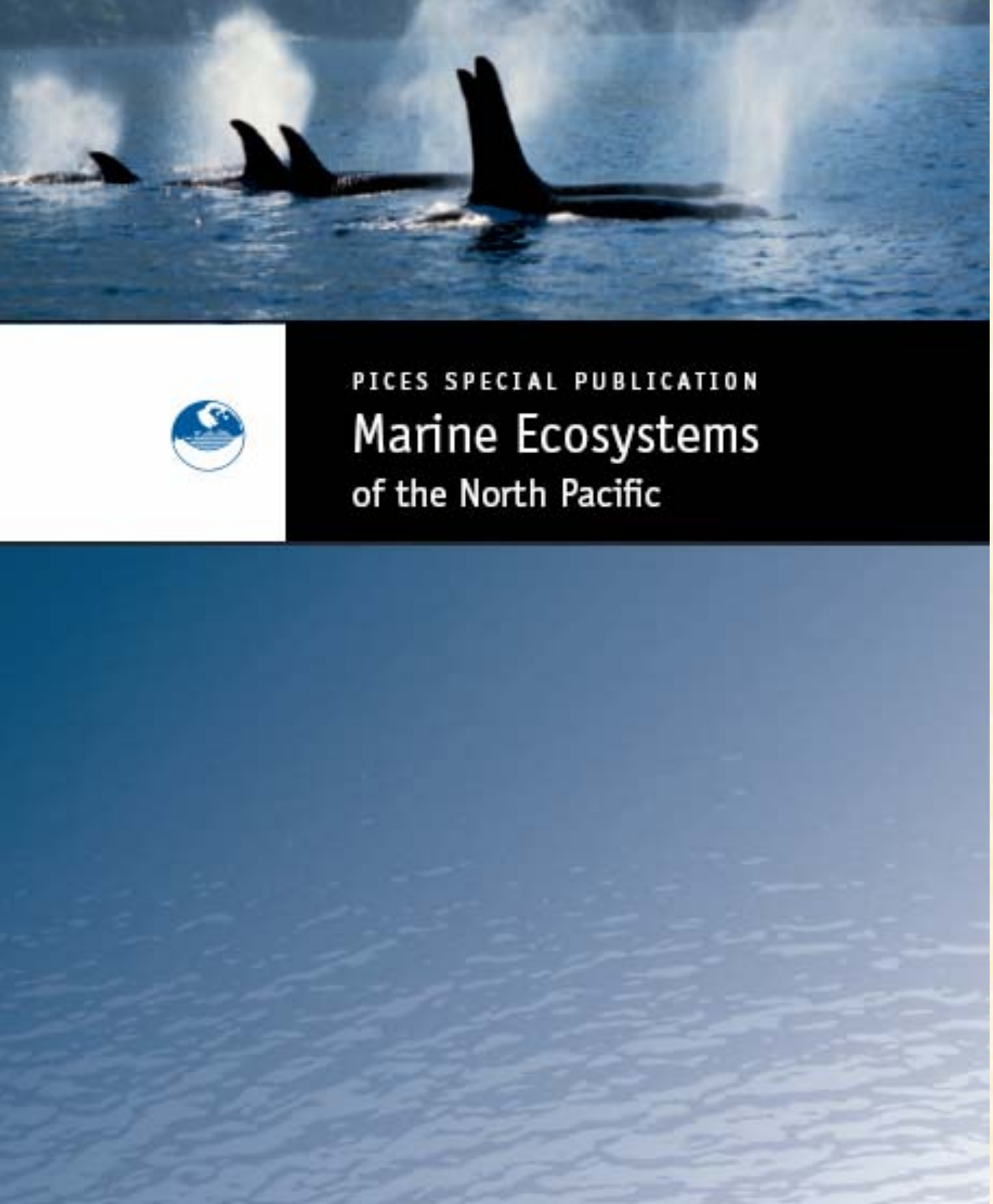

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http://www.pices.int/publications/special_publications/NPESR/2005/npesr_2005.aspx

Objectives of the report

To describe:

1) present state of marine ecosystems of the North Pacific Ocean (Status), in the context of their recent (past 5 years) and longer variability (trends);

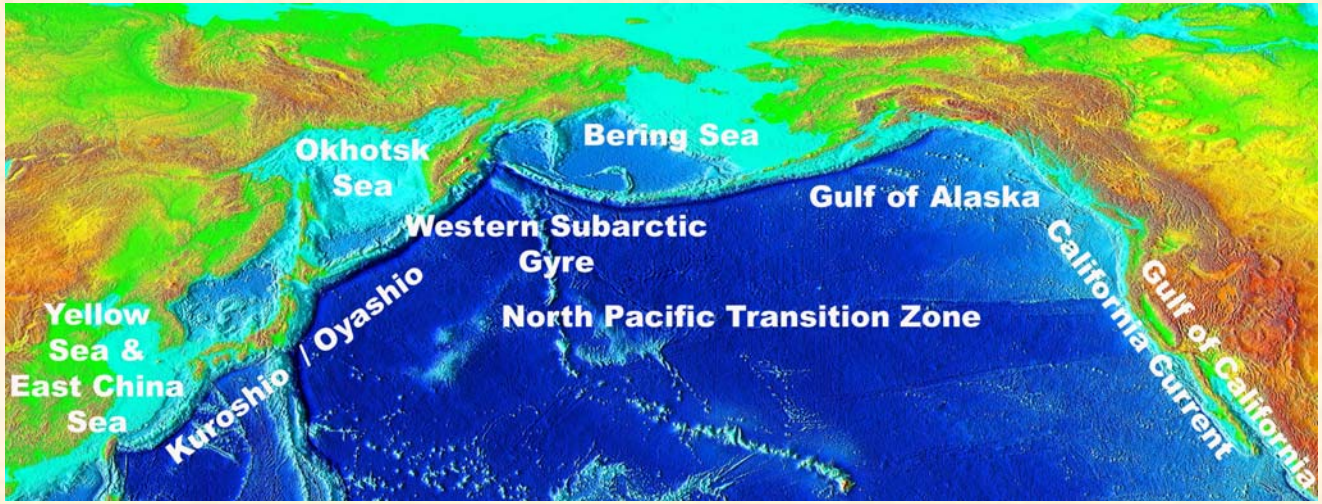
2) summarise regional assessments into a broad basin-wide synthesis;

3) identify critical factors causing changes in these ecosystems;

4) identify key questions and critical data gaps inhibiting understanding of these marine ecosystems.

Note: was not explicitly designed to provide advice for ecosystem-based management; no explicit Objectives

Chapters



- Synthesis
- Ocean/climate
- Yellow & East China seas
- Japan/East Sea
- Okhotsk Sea
- Oyashio/Kuroshio
- Western Subarctic Gyre
- Bering Sea
- Gulf of Alaska
- California Current
- Gulf of California
- North Pacific Transition Zone
- Fisheries Commissions (IATTC, IPHC, NPAFC)

Chapter structure

- Background (setting)
- Climate
- Hydrography
- Nutrients
- Plankton
  - Phytoplankton (chlorophyll)
  - Zooplankton
- Fish/invertebrates
- Seabirds
- Marine mammals
- Issues
- Critical factors causing change

Chapter structure

Emphasis was on the “most recent” data/information

- i.e. conditions over the past 5 years (if available), put into the context of the existing time series

Readership was assumed to be interested marine scientists, and possibly the interested public/NGO’s

Approach to producing each chapter

- where possible, information was drawn from existing ocean status reports (e.g. Canada) and ecosystem summaries (e.g. California Current, Bering Sea)
- where such reports were not available, regional workshops were convened with local experts to present and synthesize recent information
- individual “countries” were invited to convene local experts to develop the various Chapter sections

Approach to producing each chapter

Existing reports:

- California Current
- Eastern Bering Sea

Workshops:

- CREAMS/PICES (Japan/East Sea) - Seoul National University (August 2002) .
- Okhotsk Sea – TINRO Center (June 2003).
- Yellow/East China seas – PICES XII (October 2003) (delayed by SARS)

“National” reports:

- Eastern Subarctic Gyre (Alaska)
- Oyashio/Kuroshio; Western Subarctic Gyre (Japan)
- Gulf of California (Mexico)
- Tuna, Pacific halibut, salmon (Fishery Organisations)

Lead Authors

- Steven Bograd (California Current)
- Elena Dulepova / Vladimir Radchenko (Okhotsk Sea)
- Yukimasa Ishida (Oyashio/Kuroshio and W. Subarctic Gyre)
- Pat Livingston (Bering Sea)
- Salvador Lluch-Cota (Gulf of California)
- Franz Mueter (Gulf of Alaska)
- Ian Perry (Synthesis and Working Group Chair)
- Mike Seki (Transition Zone)
- Sinjae Yoo (Yellow/ East China seas)
- Fisheries Commissions (salmon, tuna, halibut)

+ Skip McKinnell (Japan/East Sea) and Editor

For this workshop's consideration

- production of next report "should" be easier now that a first version exists
- next report could be:
  - a major re-write/update (most data in existing report from 2002 and earlier), or
  - online updates to specific sections of the existing report
- Recommendations to NPRB/PICES for enhancements, new analyses, synthetic indices?

Some of the significant data gaps

Unevenness of regional coverage of some chapter components

- e.g. **chemical oceanography** (especially nutrients) lacking or minimal in most chapters
- **benthos** lacking or minimal in most chapters
- **harmful algal blooms** (PICES HAB Section)

Do these represent

- actual lack of data, or
- lack of awareness of data ?

Fill data gaps by convening workshops of disciplinary experts (e.g. on nutrients) ?

Some of the significant weaknesses

- contaminants
- ecosystem-level salmon status and trends
- Inter-tidal / sub-tidal ecosystems
- “human dimensions” (e.g. fishing effort, etc.)
- large, basin-scale physical oceanography / circulation analyses (in particular with Argo data)
- weak in contributions by some nations
- development and presentation of common and synthetic ‘ecosystem indicators’

Some chapters include indicator-type analyses

All chapters have some level of abundance and/or biomass measures for fish

Several chapters have some level of abundance and/or biomass information for highest and lowest trophic levels

Only a few chapters include synthetic information,

e.g. Eastern Bering Sea; Gulf of Alaska

- information on species diversity, recruitment

Eastern Bering Sea

Chapter Highlights

- oceanographic & ecosystem dynamics dominated by sea ice
- shifts in abundance of fish & invertebrates over past 20 yrs, although groundfish populations appear to have stabilised whereas some crab stocks remain at low levels
- concerns about declines of (some) Steller sea lion and northern fur seal populations, and unusual distributions of endangered whales
- significant issues: sea ice & climate warming, unusual phyto- and zooplankton blooms, interactions of fishing with bottom habitats, marine mammal population declines and unusual distributions

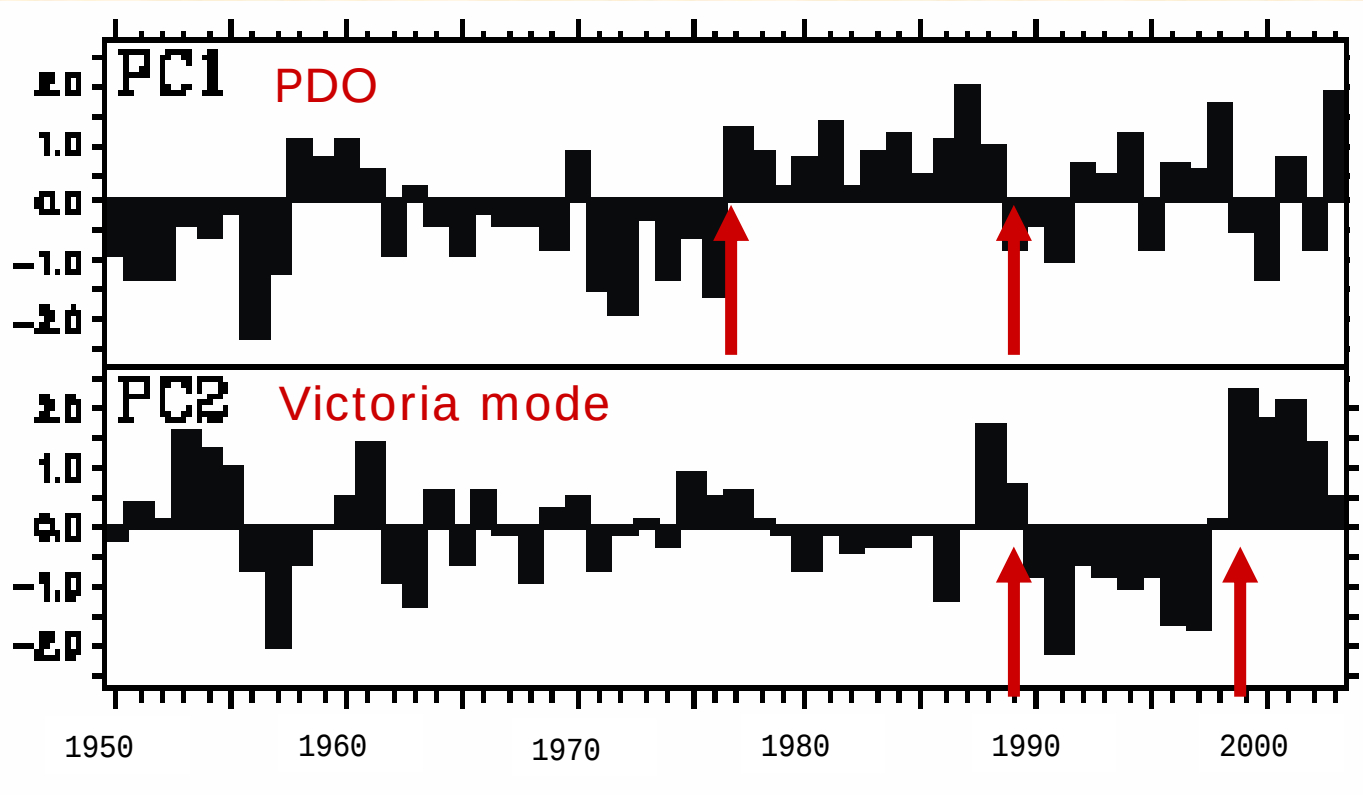
Basin-scale synthesis

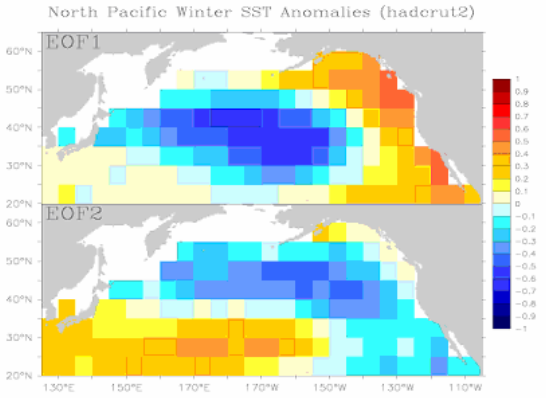
Synthesis section attempted to provide a basin-scale comparison and integration of Regional-scale information

Basin-scale synthesis

Large-scale climate and ocean conditions

- e.g. identification of importance of 2nd mode of PDO ("Victoria Pattern")





Basin-scale synthesis

Little basin-wide synthesis of lower trophic level information

However, SCOR WG 125 on

Global Comparisons of Zooplankton Time Series

Co-Chairs: David Mackas (Canada) and Hans Verheye (South Africa)

Examining
1. Synchronies in timing of major fluctuations,
2. Correlation structure for modes of zooplankton variability
3. Amplitude of variability and comparison to the amplitude of population fluctuations of predator species
4. Likely causal mechanisms and consequences for the zooplankton variability, based on spatial and temporal coherence with environmental and fishery time series.

Basin-scale synthesis

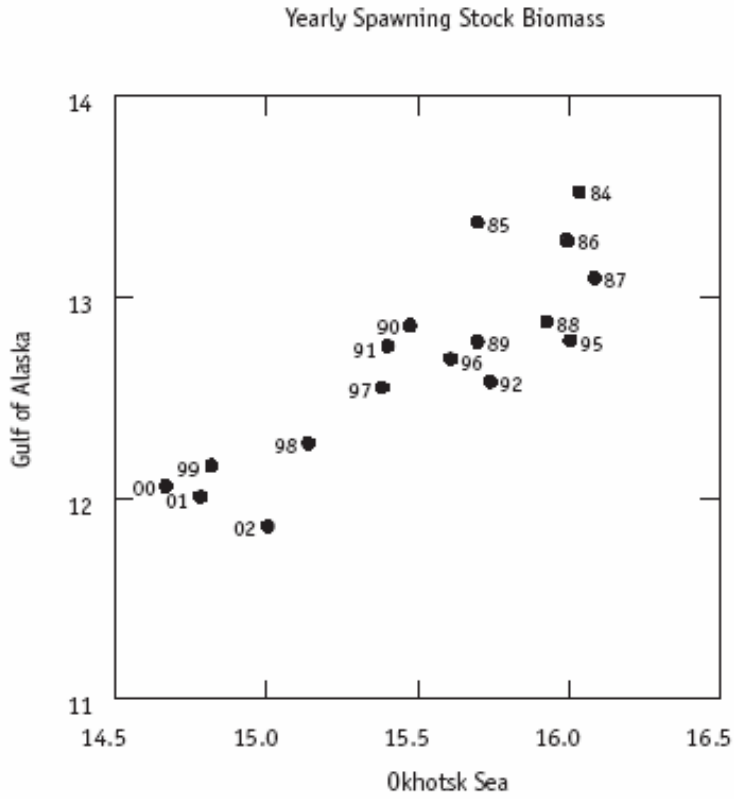
Comparisons of trends of “middle trophic level” species within oceanic ‘habitats’:

Subarctic coastal systems

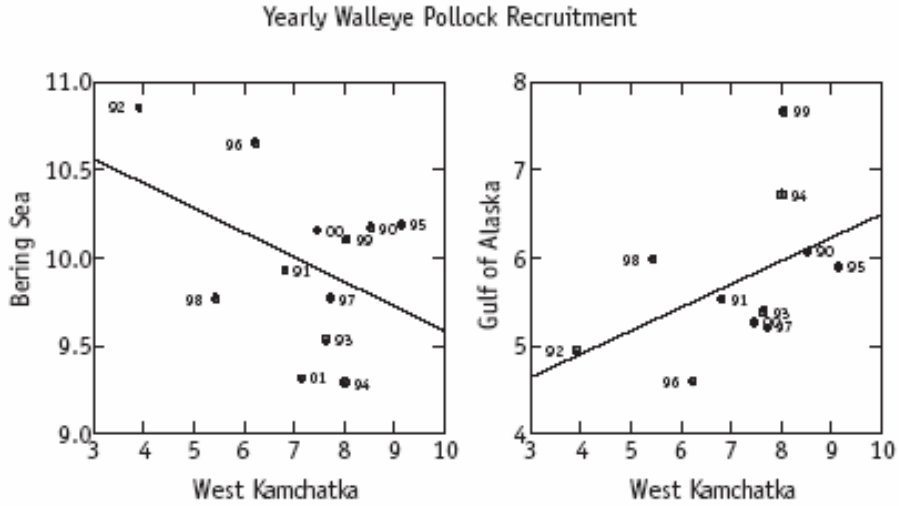
- e.g. walleye pollock; flatfishes

Basin-scale synthesis

Subarctic coastal systems



[Figure 12] Spawning stock biomass (females) in the western part of coastal Gulf of Alaska versus spawning stock biomass in the Okhotsk Sea, transformed to log (million t) scale.

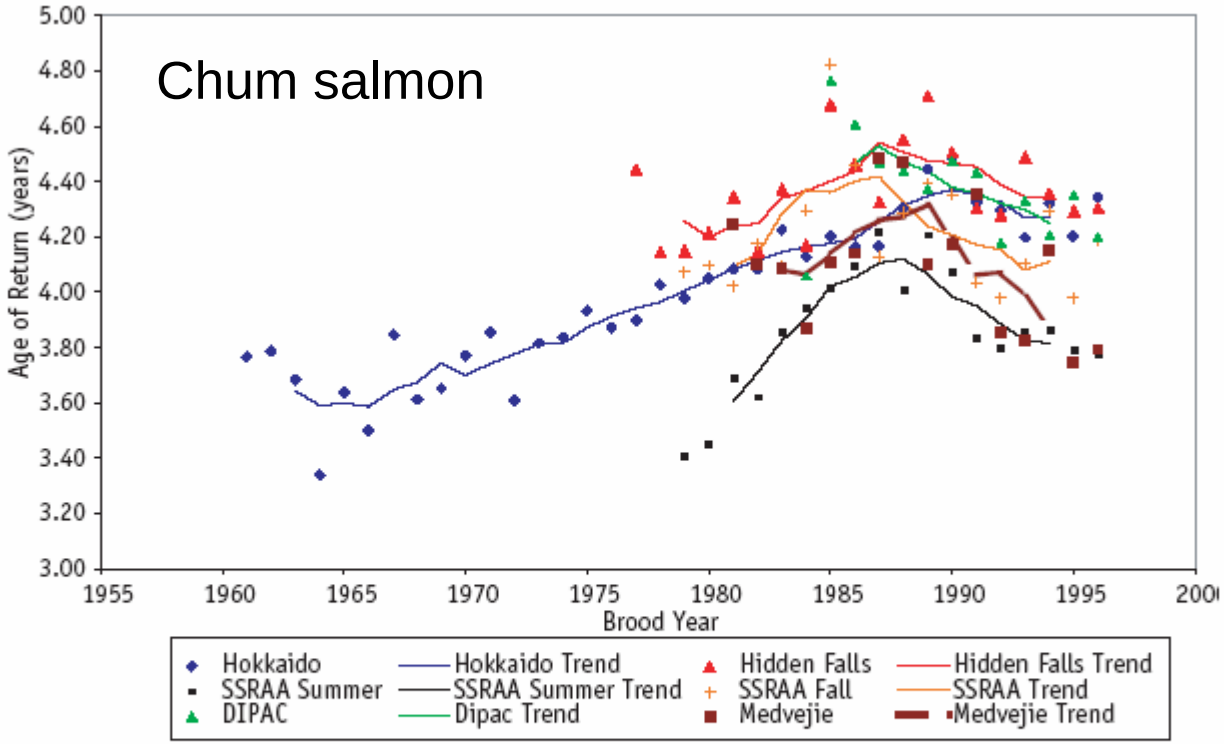


[Figure 14] Correlations between walleye pollock recruitment on the western Kamchatka shelf versus: (left panel) eastern Bering Sea and (right panel) Gulf of Alaska since the 1990 year-class.

Walleye pollock

- only the Eastern Bering Sea appears to have maintained ‘stable’ biomass 1985-2000

Basin-scale synthesis Central Oceanic Gyres

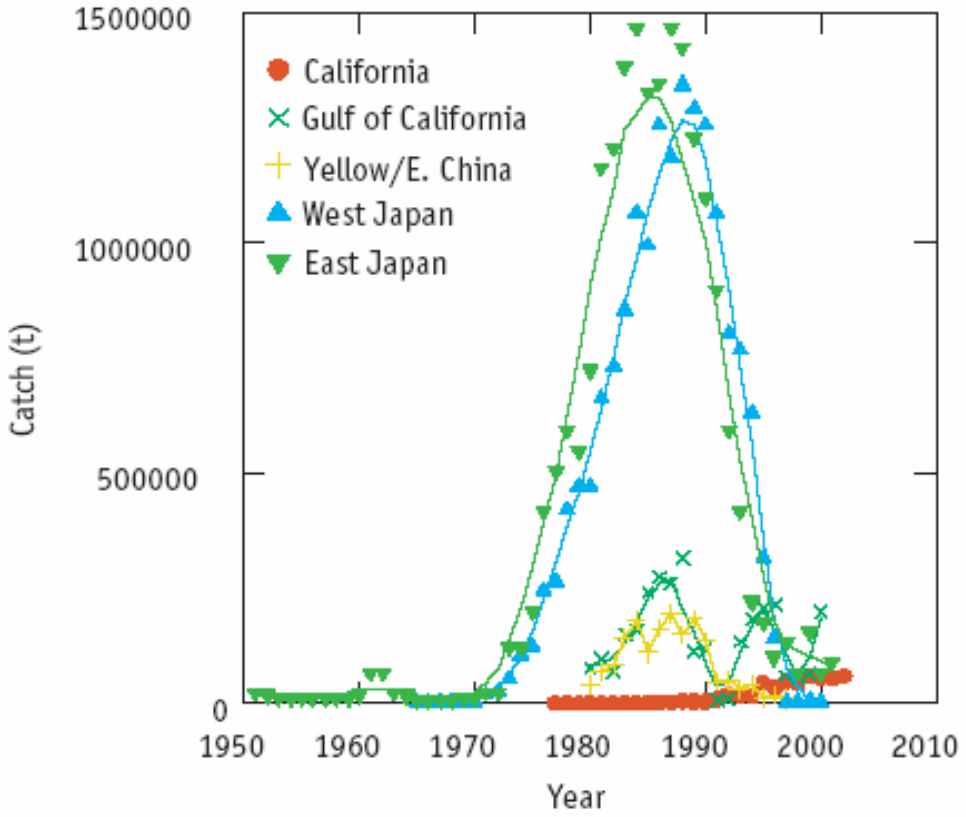


[Figure 155] Trends in age at return (by brood year) for various hatchery runs of chum salmon.

- age-at-return increased for Hokkaido, Portland Canal, SE Alaska hatchery chum salmon coincident with increased abundance of N. Pacific salmon

Basin-scale synthesis

Temperate coastal & oceanic systems



[Figure 20] Pacific sardine catch trends by region around the North Pacific.

Pacific sardine trends across the Pacific

Main Points

1) PICES North Pacific Marine Ecosystems Report (2004) was a pilot. It will evolve with its next iteration. An important task is to define its audience more clearly, e.g. decision makers and general public, or ocean management specialists and scientists. Also needs to consider best formats to present the information;

2) How to fill the significant data gaps? Should PICES conduct its own analyses and develop indicators? Which indicators to use? Connect with NPRB Workshop conclusions?;

3) Significant information and understanding can be gained by using large-scale, basin-wide comparisons. Consider developing indices based on selected species/functional species groups or key features which can be compared among regions.