W3. Climate Variability, Zooplankton Abundance and Distribution – Comparative Opportunities from the World's Oceans

Hal Batchelder (USA) and Ian Perry (CAN), Convenors

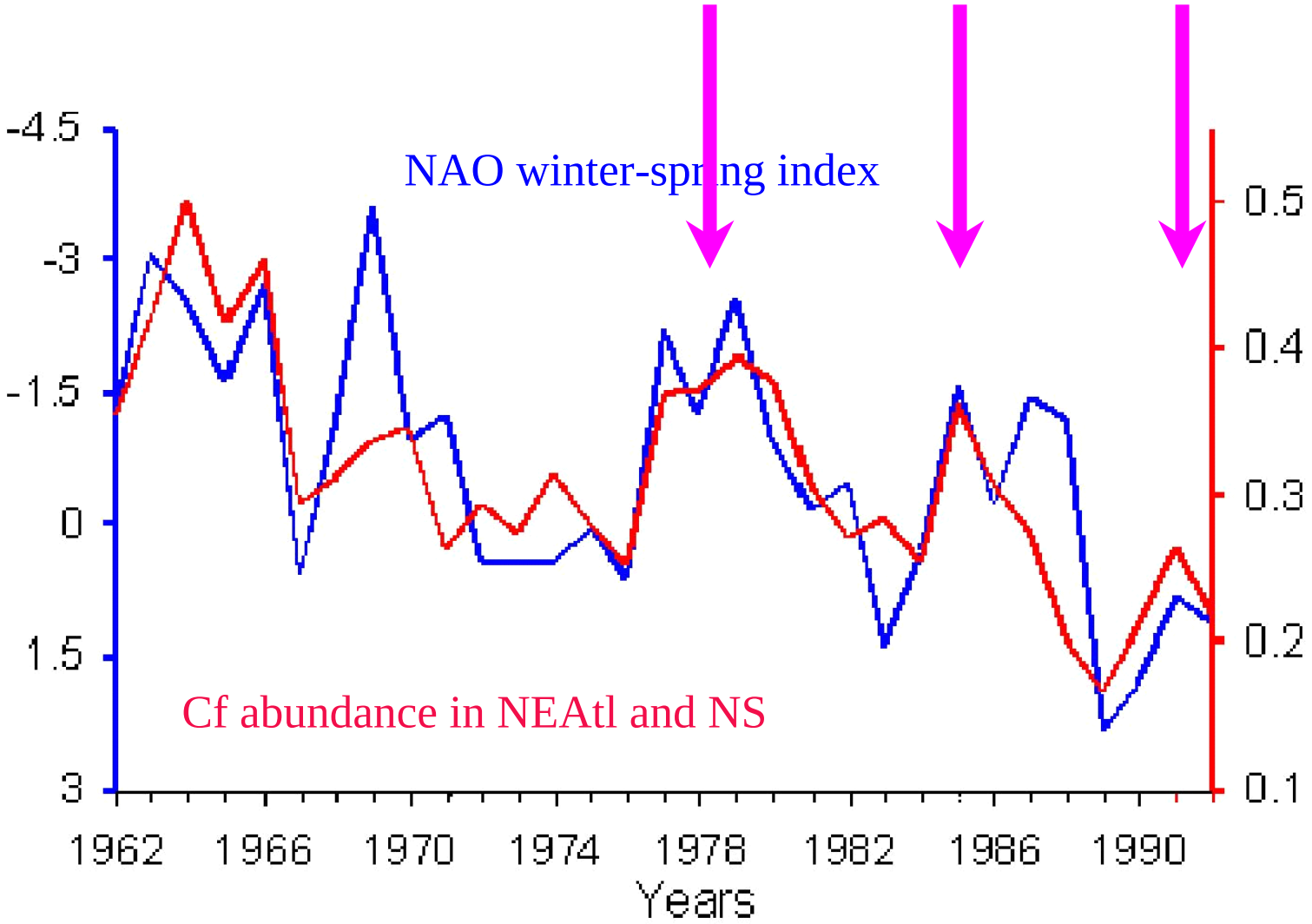
W3 Goal: Ocean comparisons of zooplankton-climate connections

- available data sets
- opportunities for comparative projects
- foster larger-scale geographic comparisons

ICESCIEM
International Council for the Exploration of the Sea
Conseil International pour l'Exploration de la Mer

PICES
North Pacific Marine Science Organization

GLOBEC



From B. Planque, 1995 Thesis

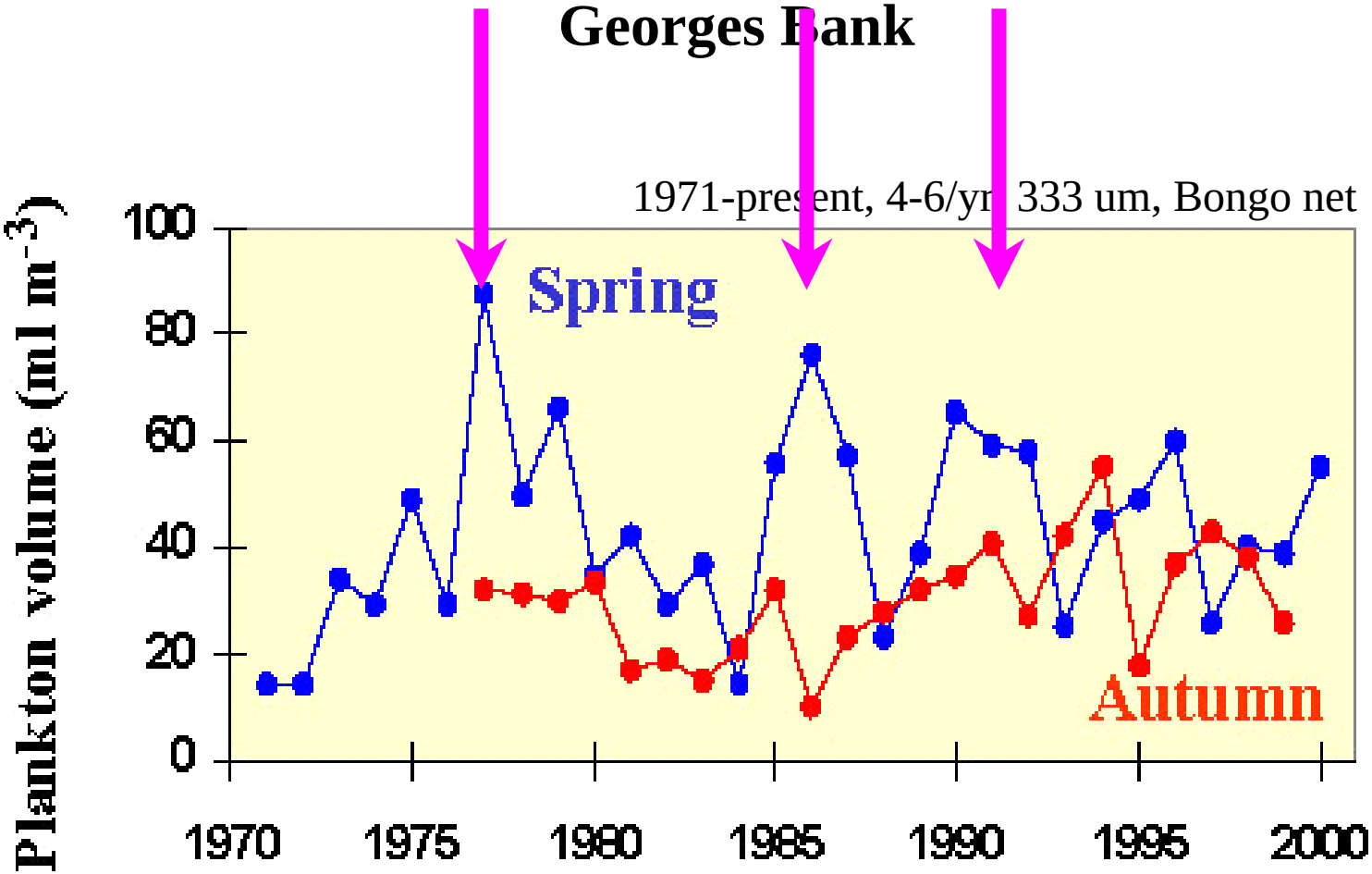
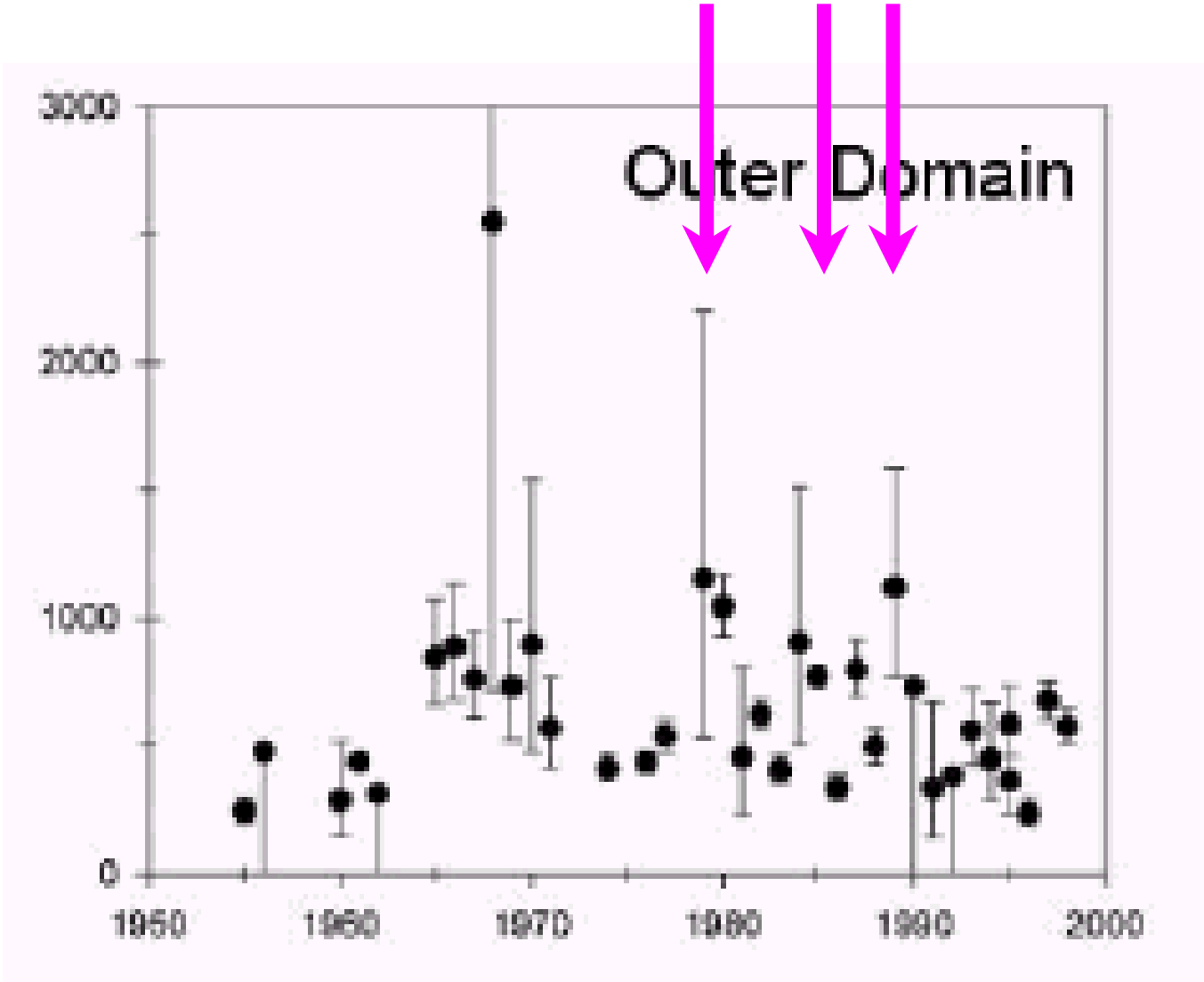


Figure A3.2: Plankton displacement volume on Georges Bank in the early Spring and early Autumn.

From ICES WGZE Status Rpt 2000/2001

Bering Sea



W3 Agenda

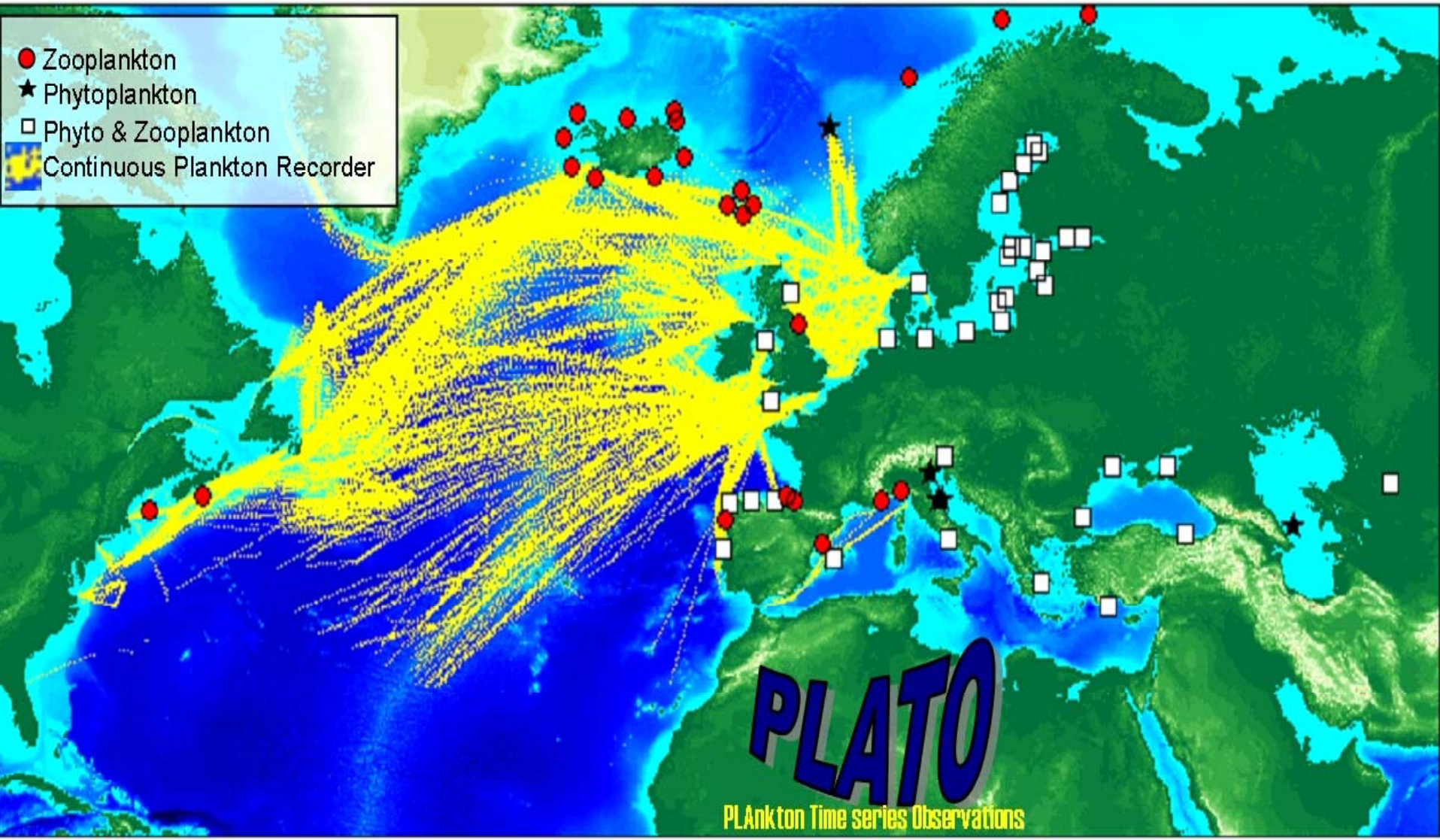
Introductory Remarks	Batchelder	1400
World Ocean Database	O'Brien	1410
PLATO	Richardson	1425
ZP—NE Atlantic	Greve	1440
ZP—NW Atlantic	Durbin	1455
ZP—SE Atlantic	Verheye	1510
ZP—NE Pacific	Mackas	1525
Gulf of Mexico	Benfield	
Project ODATE (Japan)	Chiba	
Peru/Chile EBC	Alheit	
Open Discussion	Panel	1540
Workshop Report/Recos	ALL	1730
Adjourn		1800

- Key Questions
- Capabilities
- Impediments
- Recommendations

1) Key Inter-ocean Zooplankton-Climate Questions

- Is there coherence among globally distributed zooplankton data sets?
- Teleconnections: If they occur, are they propagated through the atmosphere or ocean.
- Does this coherence appear to relate to climate forcing, e.g. NAO, SOI, PDO signals.
- Does this coherence appear to relate to top-down forcing, e.g. by predators?
- Determine whether changes are due to local or remote forcing. How much is due to each? Regional specifics may modify (confuse) larger scale linkages.
- Determine whether changes are due to rare (episodic) events or persistent forcings?

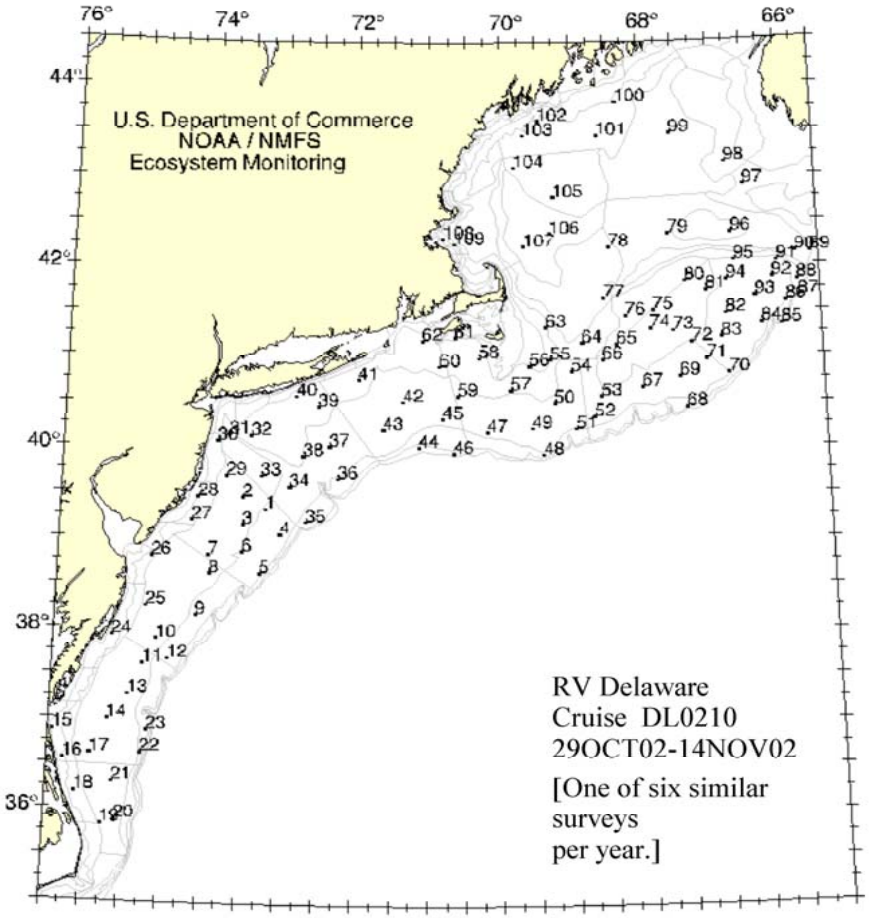
2) Capabilities

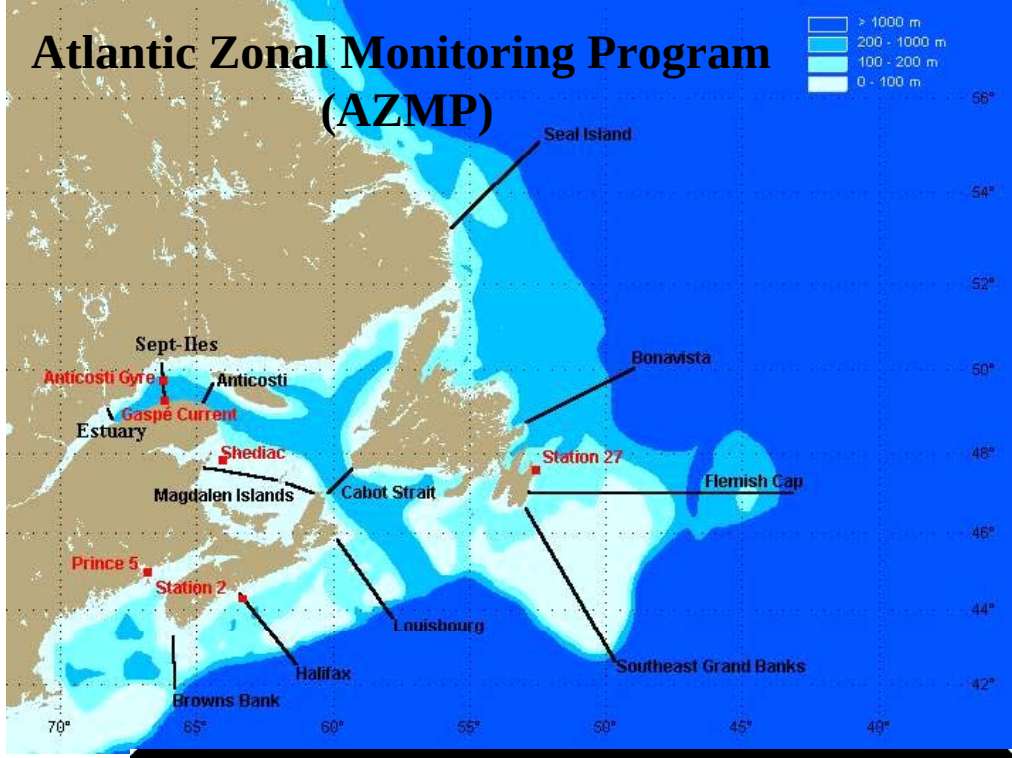


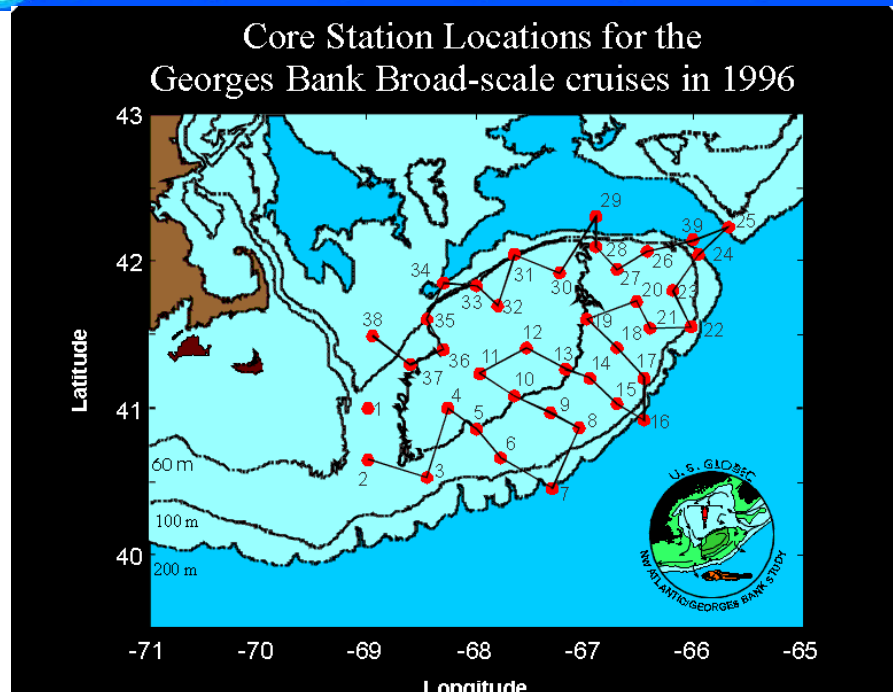
Slide from A. Richardson

Slide from T. Durbin

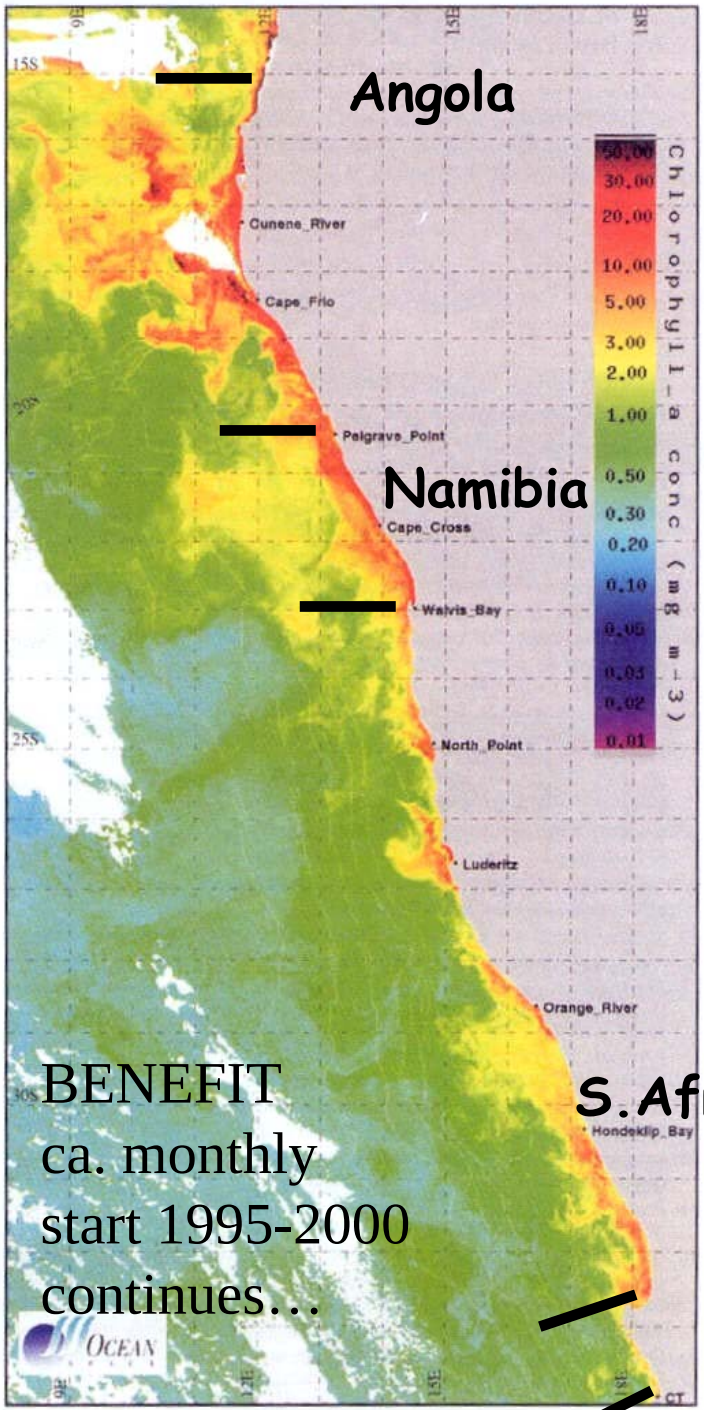
1981-present







Slide from H. Verheye



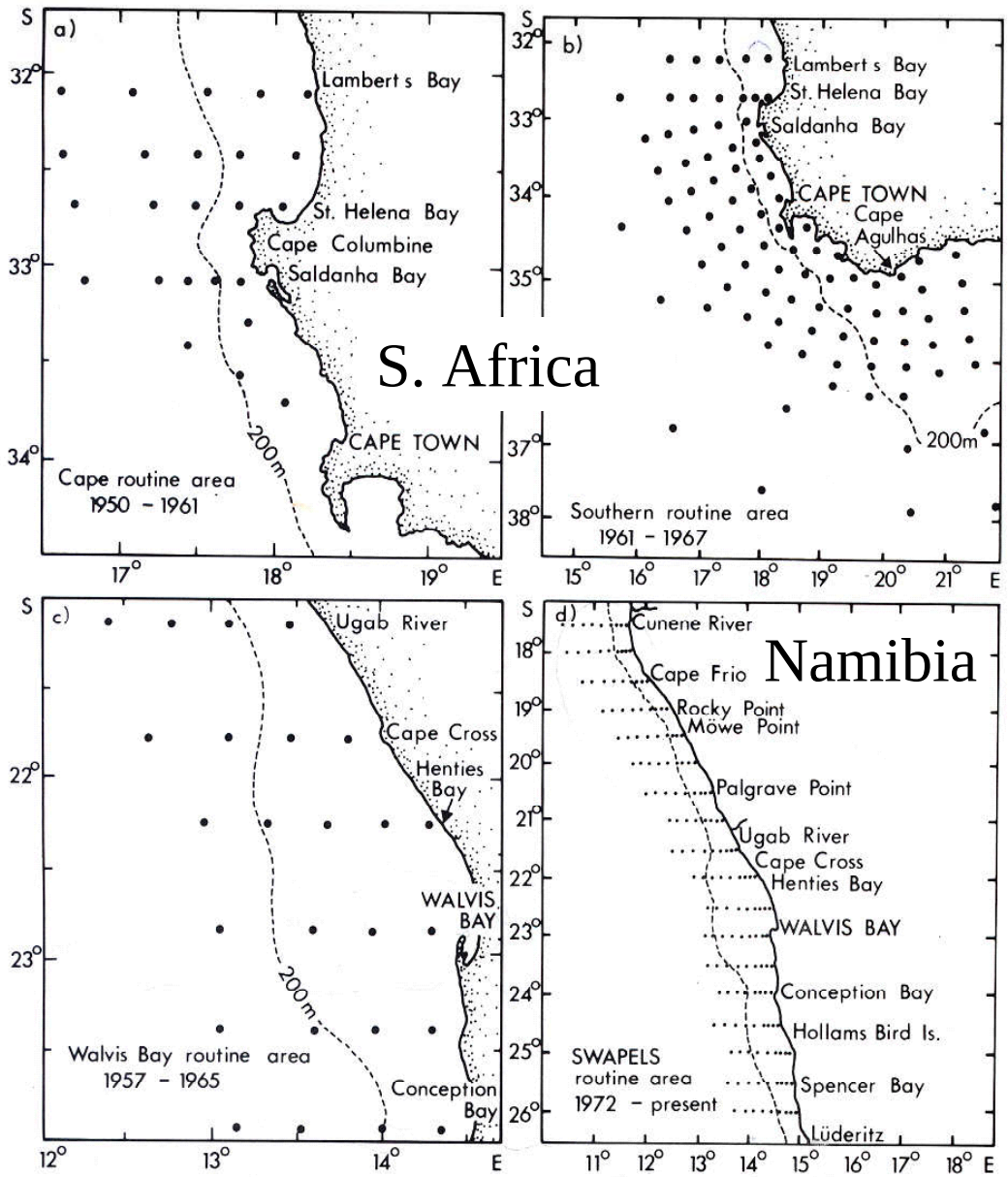
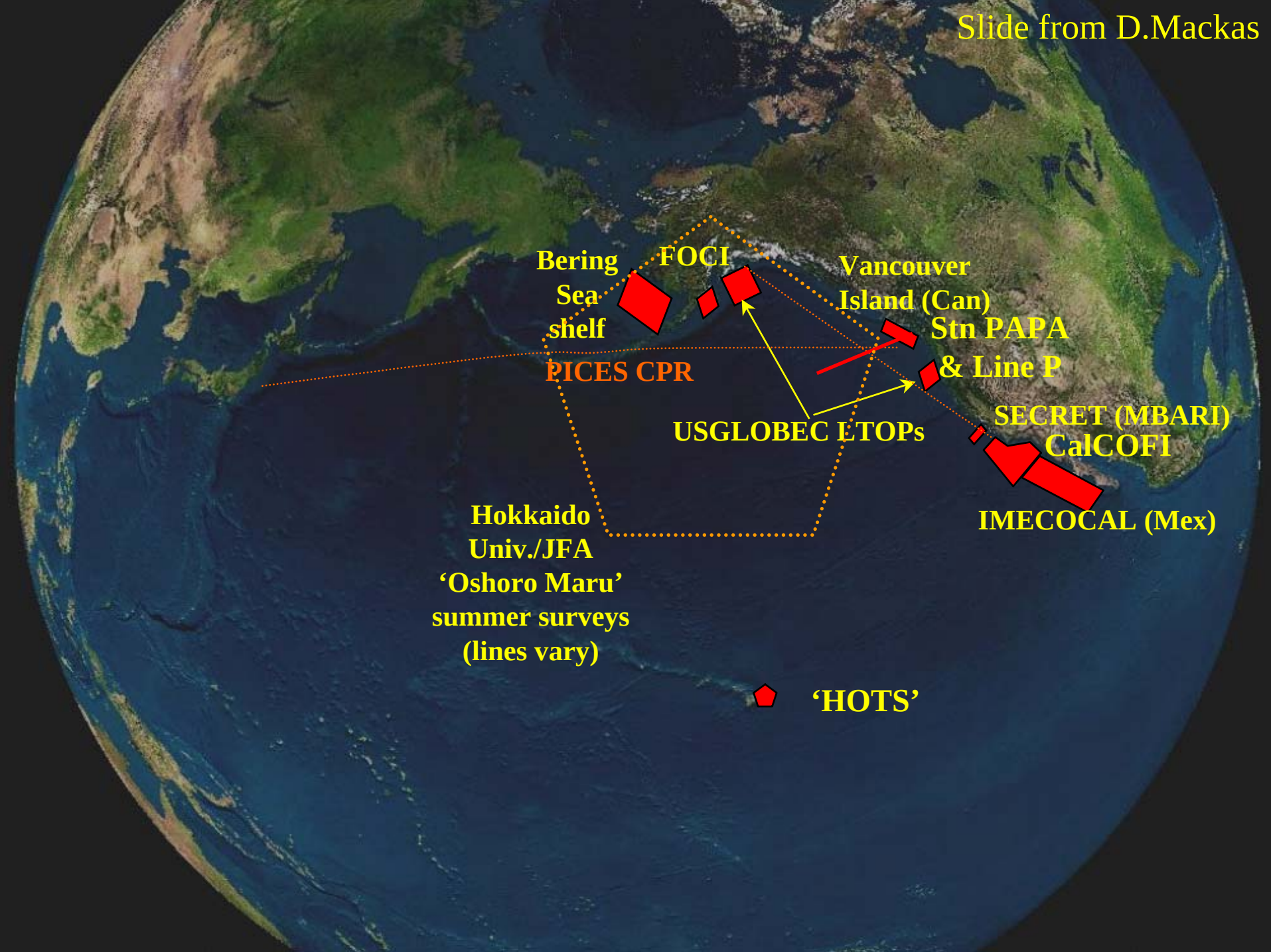
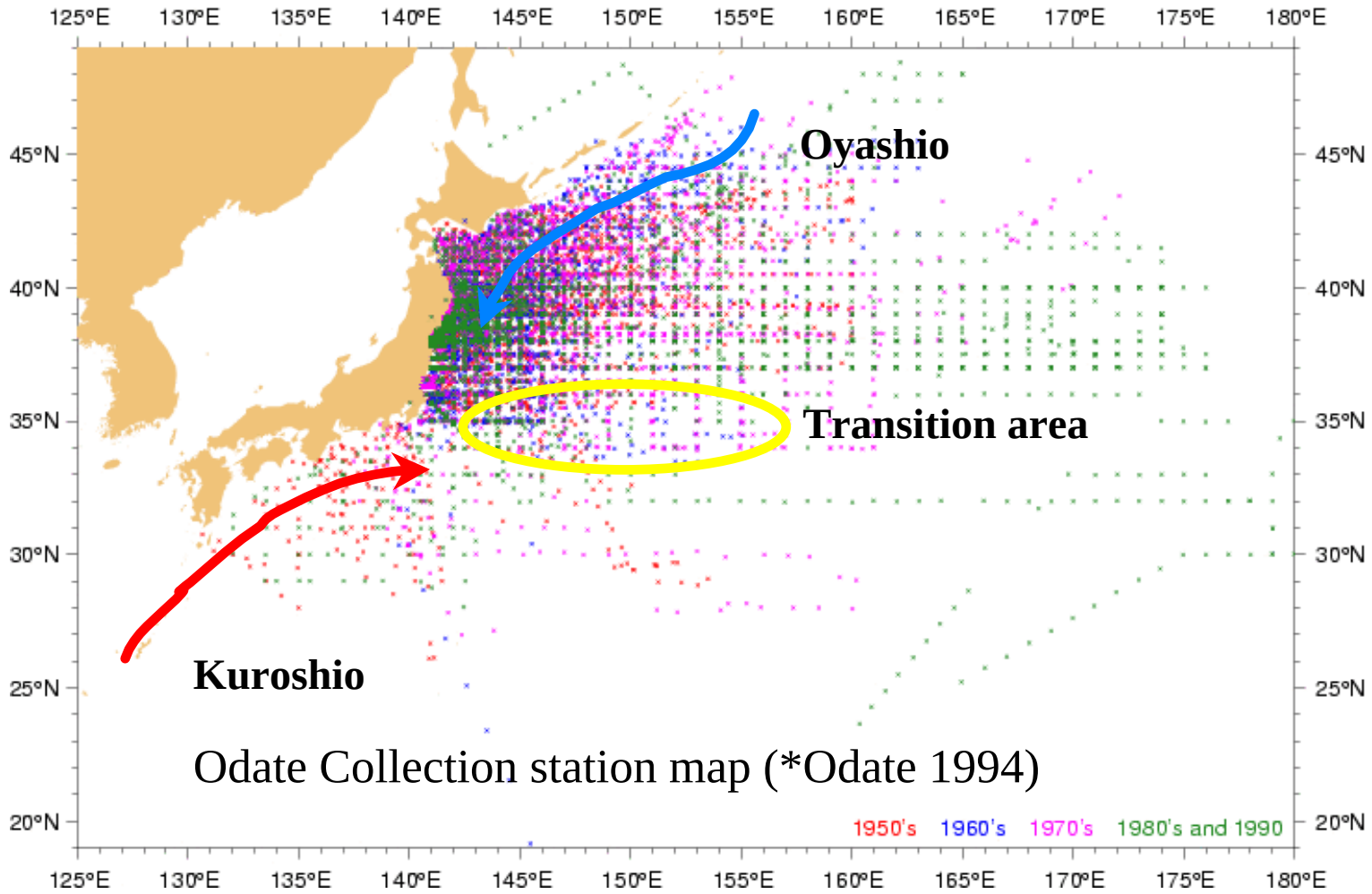


Fig. 24.—Zooplankton routine and research areas in the Benguela region between 1950 and 1977.


Slide from D.Mackas
Bering Sea shelf
FOCI
Vancouver Island (Can)
Stn PAPA & Line P
PICES CPR
USGLOBEC LTOPs
SECRET (MBARI)
CalCOFI
IMECOCAL (Mex)
Hokkaido Univ./JFA 'Oshoro Maru' summer surveys (lines vary)
'HOTS'



1951- present

Slide from S. Chiba

>20000 zooplankton samples preserved in a good condition

*Kazuko Odate (1994) Zooplankton Biomass and its Long-Term Variation in the Western North Pacific Ocean, Tohoku Sea Area, JAPAN. *The Bulletin of Tohoku National Fisheries Research Institute*, No. 56, 115-173.

2) Capabilities

- Lots of potential data sets
- GODAR – global ocean data archeology & rescue
- Moving beyond single species comparisons to comparisons of community changes
- Phenology rather than just abundance/biomass.
- Within similar ocean regions, comparisons to date indicate similar ZP responses suggesting large spatial “footprint” of synchrony.
- Data access issues are beginning to be addressed. (e.g., World Ocean Database)
- Mindset change on the value of long-term time series of ZP, because of documented climate variability.

3) Impediments

- Data access issues
  - Several long-term data sets have >10K samples unanalyzed (in jars)
  - Many useful data sets not widely available
- No mandated zooplankton sampling comparable to fisheries mandates
- Taxonomic identification/consistency issues.
- Methodological issues
  - Sampling
  - Analysis
- Risks of time-series continuity with forced interregion standardization
- Relevance of zooplankton data sets not appreciated by decision makers and funders. Failure of the community to “resolve” promises to “solve” fisheries issues.
- Fundamental lack of life history and ecosystem understanding
- Structural issues – no procedure for encouraging/funding international comparisons of zooplankton data sets.

“How to do it”

- **Separating multi-year change from other large ‘real’ sources of variability (seasonal, spatial, diel, ….)**
  [filtering methods, ‘anomalies’ from region climatology]
- **Detecting & correcting data biases**
  [intercalibration & standardization of gear & taxonomy]
- **Statistical effects of autocorrelation**
  [‘effective degrees of freedom’ < *n*, ensemble averaging]
- **Sensitivity & consistency of analysis & interpretation**
  [intercalibration/standardization of data processing??]

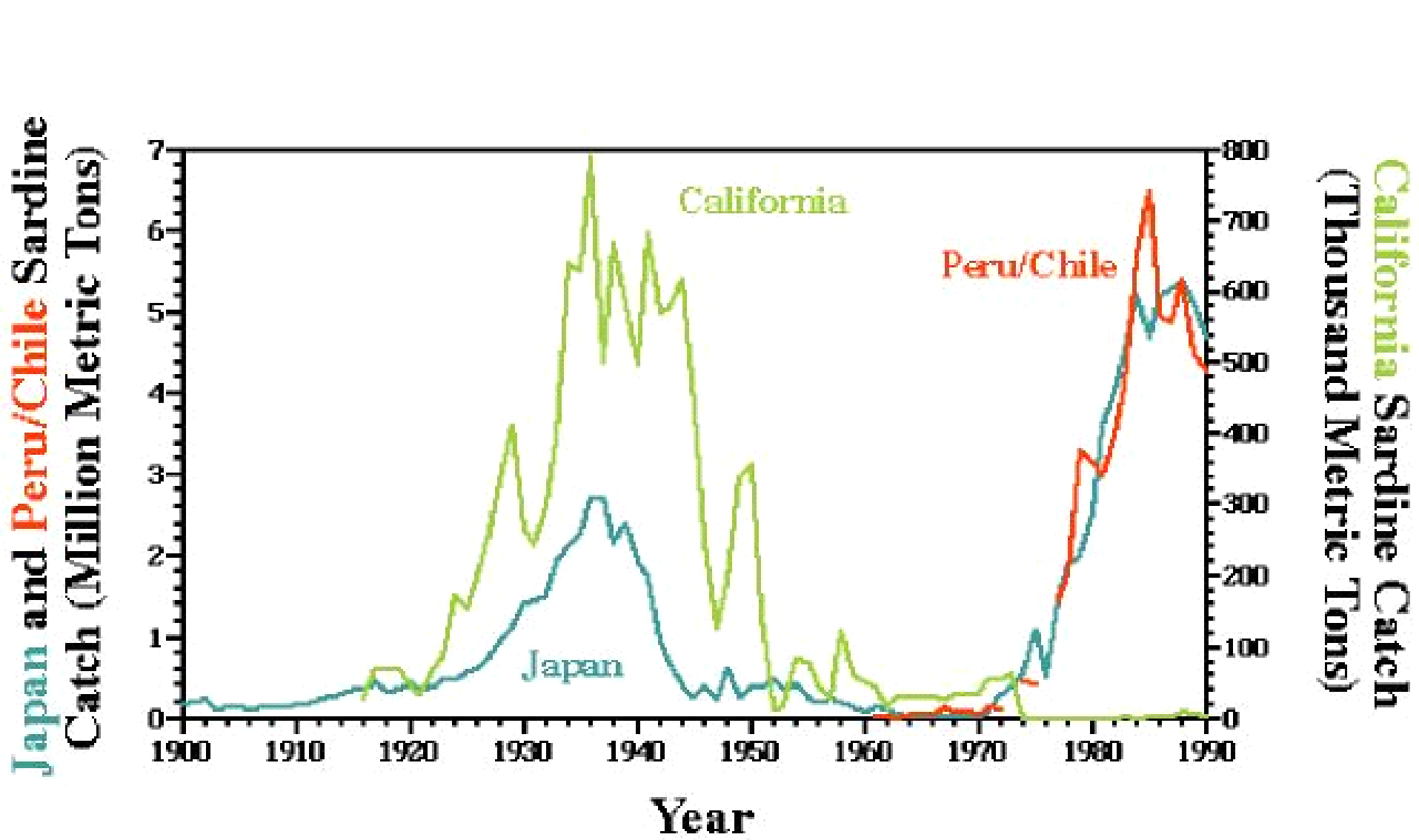
Slide from D.Mackas

3) Impediments

- Data access issues
  - Several long-term data sets have >10K samples unanalyzed (in jars)
  - Many useful data sets not widely available
- No mandated zooplankton sampling comparable to fisheries mandates
- Taxonomic identification/consistency issues.
- Methodological issues
  - Sampling
  - Analysis
- Risks of time-series continuity with forced interregion standardization
- Relevance of zooplankton data sets not appreciated by decision makers and funders. Failure of the community to “resolve” promises to “solve” fisheries issues.
- Fundamental lack of life history and ecosystem understanding
- Structural issues – no procedure for encouraging/funding international comparisons of zooplankton data sets.

4) Recommendations

- Data access issues—analyze samples and submit the data to WODC
- No mandated zooplankton sampling comparable to fisheries mandates--?
- Taxonomic identification/consistency issues—resolve identifications in existing data sets; establish voucher specimens in ongoing projects
- Methodological issues—intercalibrations; standardization of sample processing; common visualization and statistical tools.
- Risks of time-series continuity—first step: PUBLISH; second step: DISTRIBUTE data to foster broad community support.
- Relevance of zooplankton data sets not appreciated--??
- Fundamental lack of life history and ecosystem understanding—iterative process of discovery using time series data sets—identifying unknowns; directed studies
- Structural issues—look to GLOBEC, ICES, PICES and other intergovernmentals and NGOs to reduce barriers for “International Marine Science”
- Develop the Zooplankton “Poster Child” like the “Kawasaki”comparison for fish.


Japan and Peru/Chile Sardine Catch (Million Metric Tons)
California Sardine Catch (Thousand Metric Tons)
California
Peru/Chile
Japan
0
1
2
3
4
5
6
7
0
100
200
300
400
500
600
700
800
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
Year