

# Future Trends in Pacific Salmon

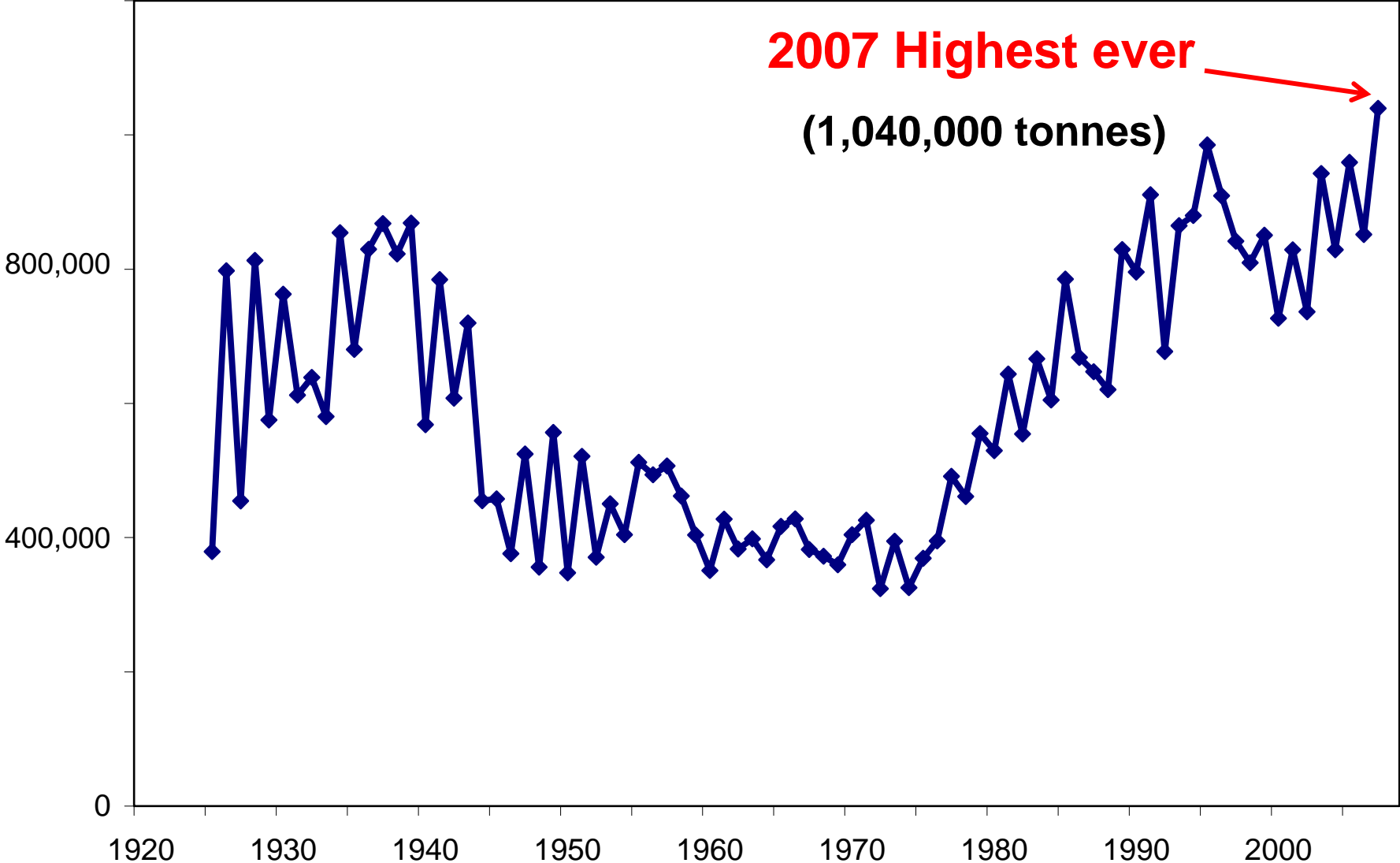
Dick Beamish  
Pacific Biological Station  
Fisheries & Oceans Canada

In association with  
**2008 SFI & BCMTA  
CONFERENCE**

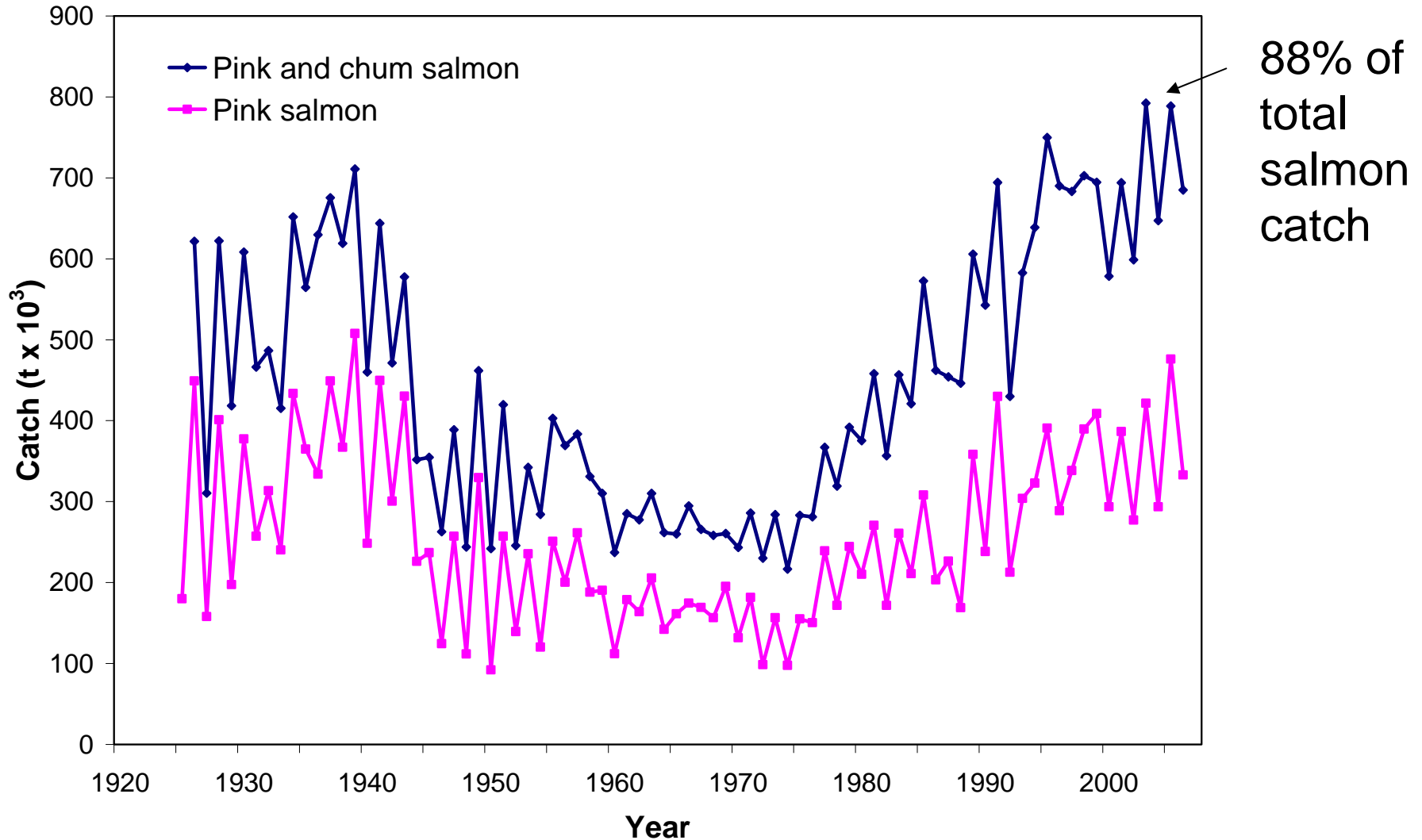


SPORT FISHING  
INSTITUTE  
*of British Columbia*

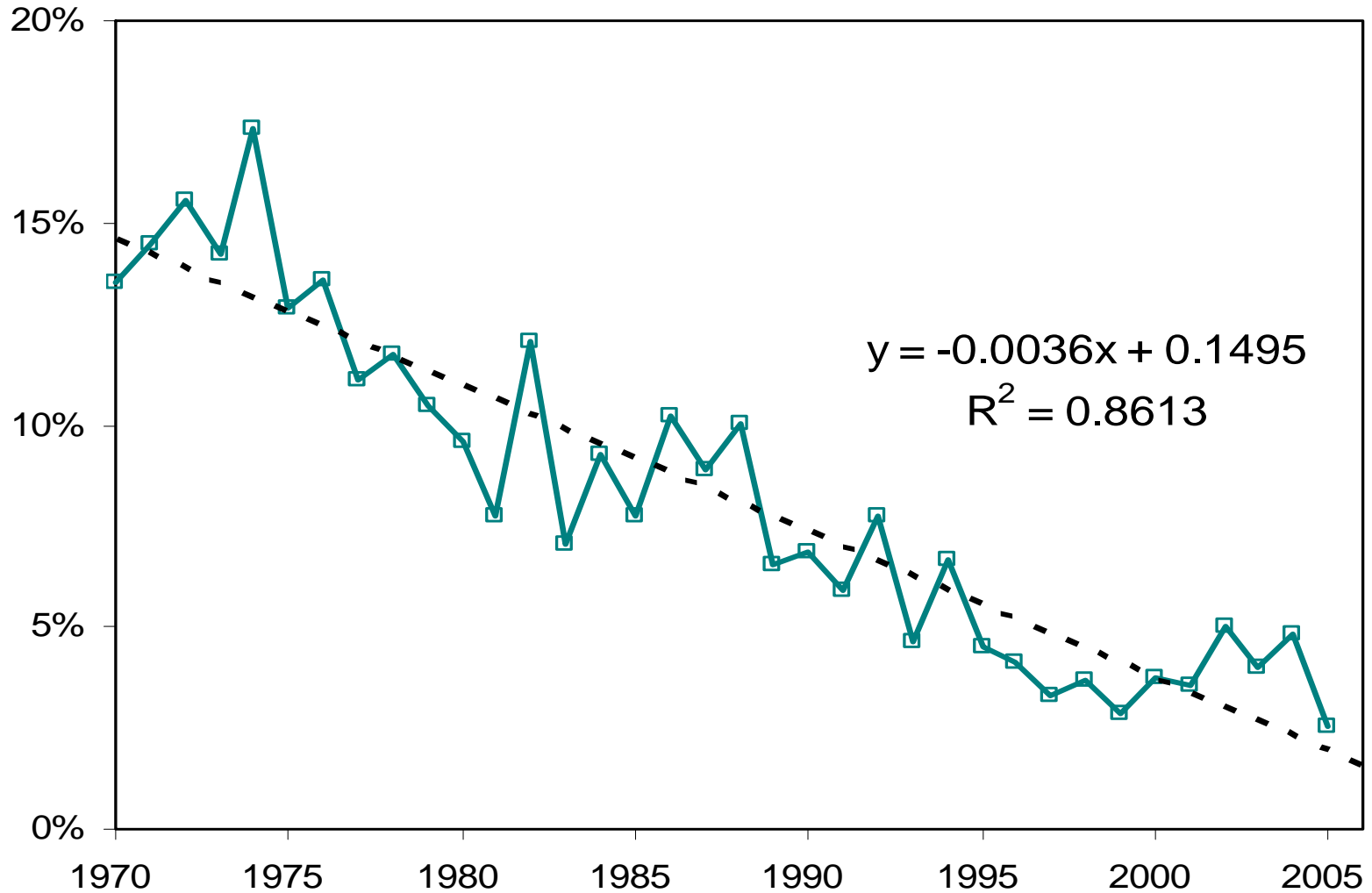
# Commercial Pacific salmon catch by all countries



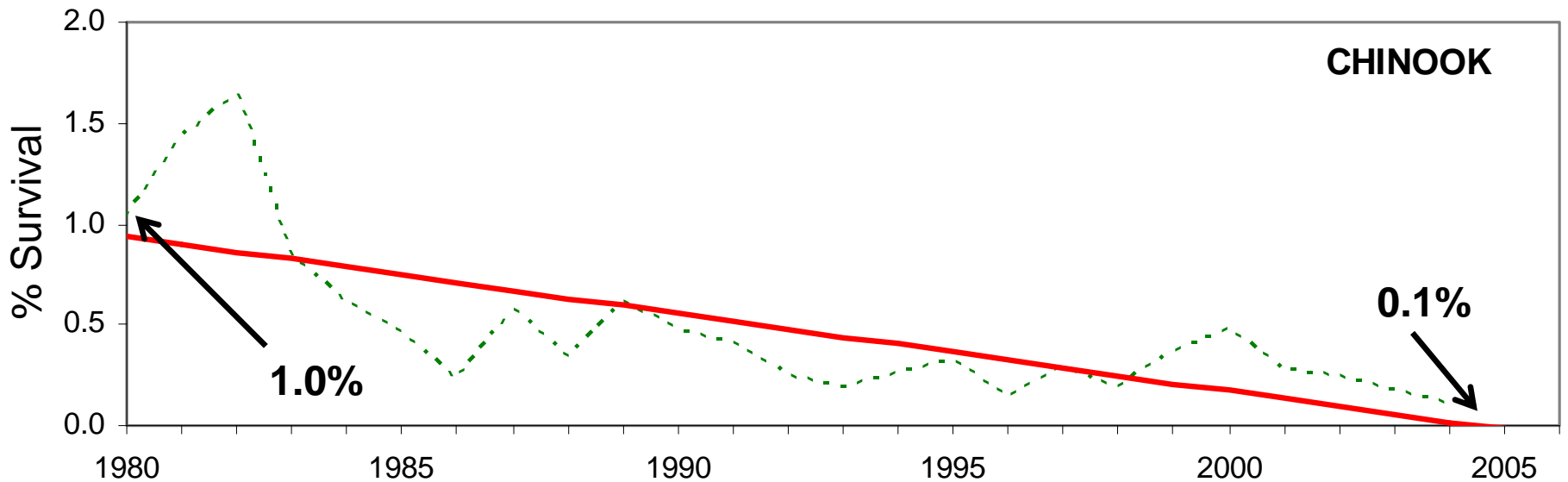
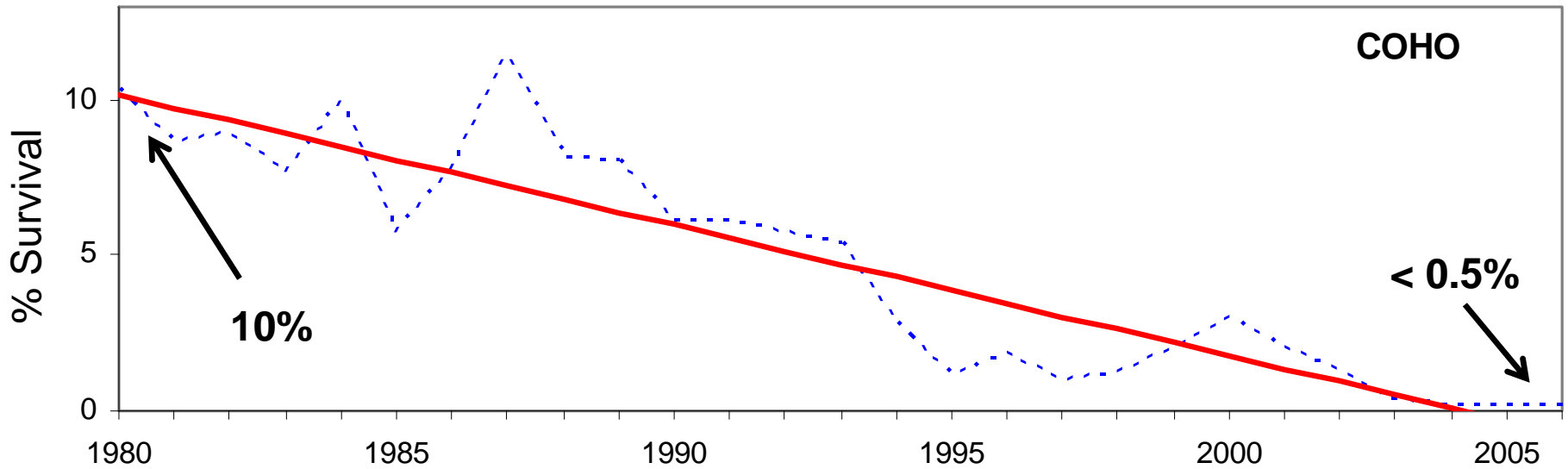
# The total pink and chum salmon catch by all countries is increasing..



# The percent of coho and chinook salmon in the total Pacific salmon catch is decreasing



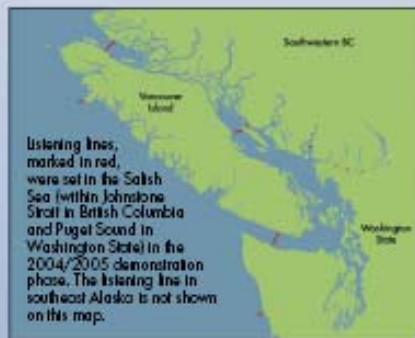
# Marine survival of coho and chinook salmon in the Strait of Georgia has decreased...





## Overview

The Pacific Ocean Shelf Tracking Project (POST) was created to establish a permanent acoustic array on the seabed to track marine animals. This marine telemetry array will permit an almost complete census of the movement and survival of animals as small as salmon smolts and as large as blue whales. The system, which will cover the entire western coast of North America, will also host oceanographic sensors capable of monitoring a wide range of seabed and water column properties.

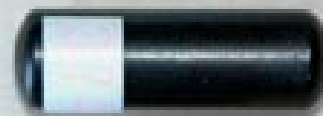
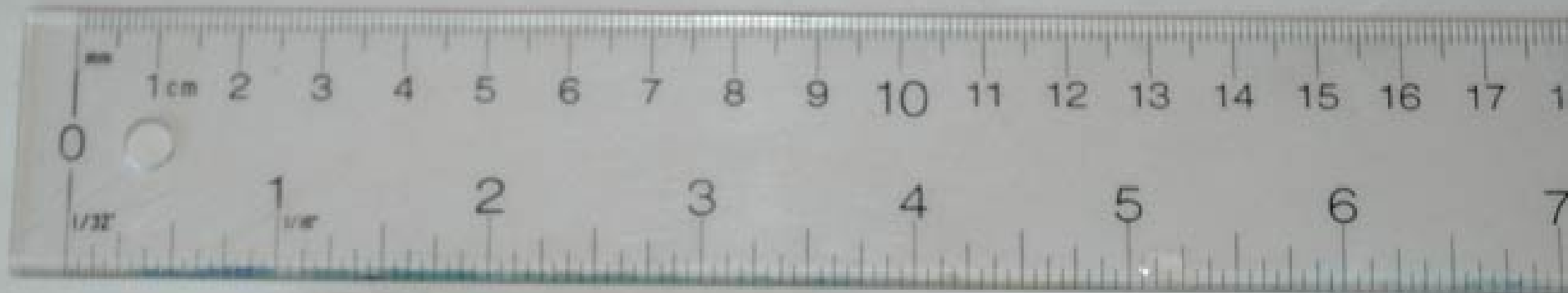


Heidi Lydersen prepares VR-3 units for deployment as part of the test trials preceding the construction of the permanent array.

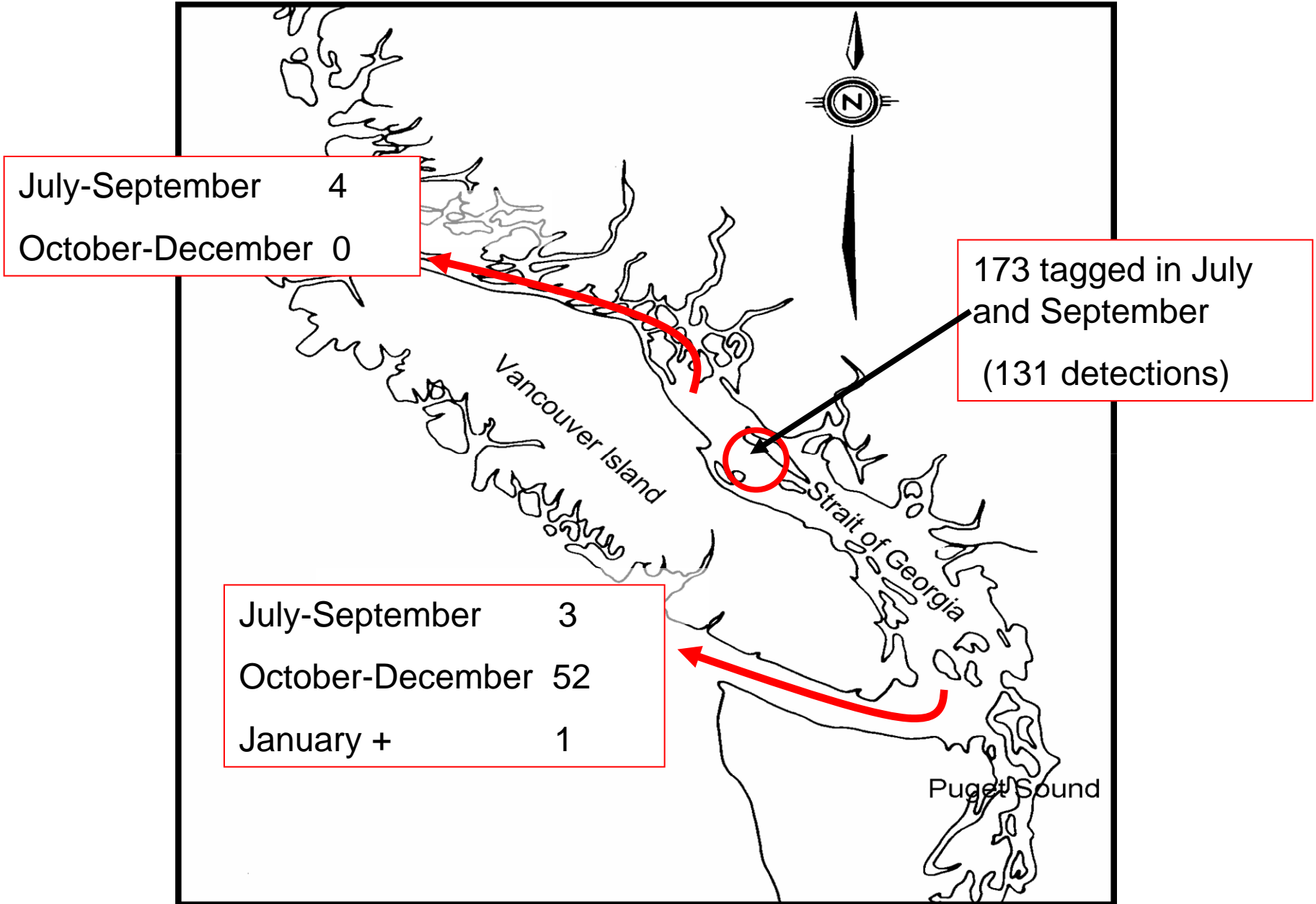
# Pacific Ocean Shelf Tracking Project

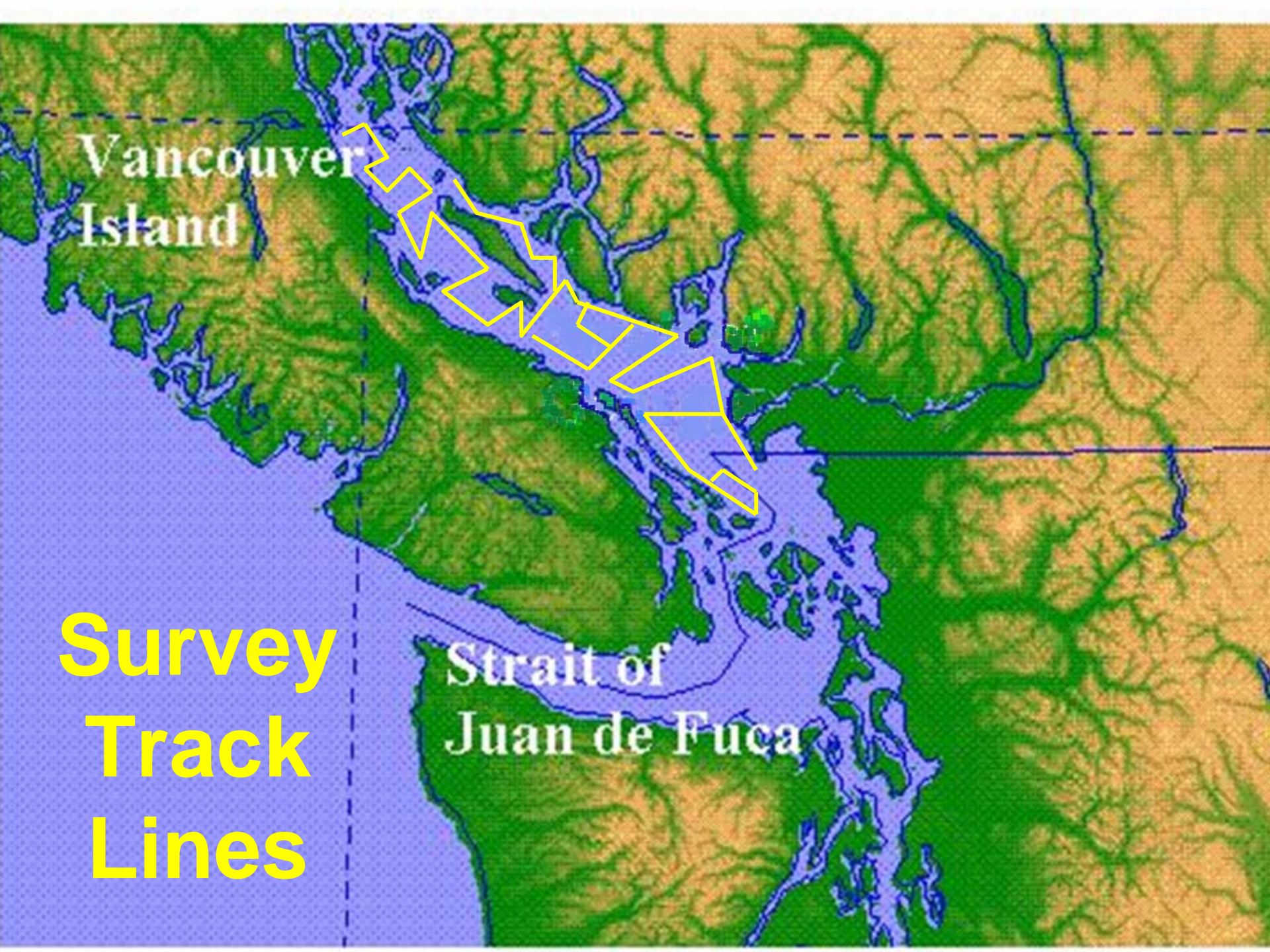
A platform for year-round ocean observation and acoustic monitoring of marine animals

**A coho smolt is shown with 9 mm diameter tags. Only one tag is implanted into the abdominal cavity of an animal**



# Acoustic tags on coho salmon





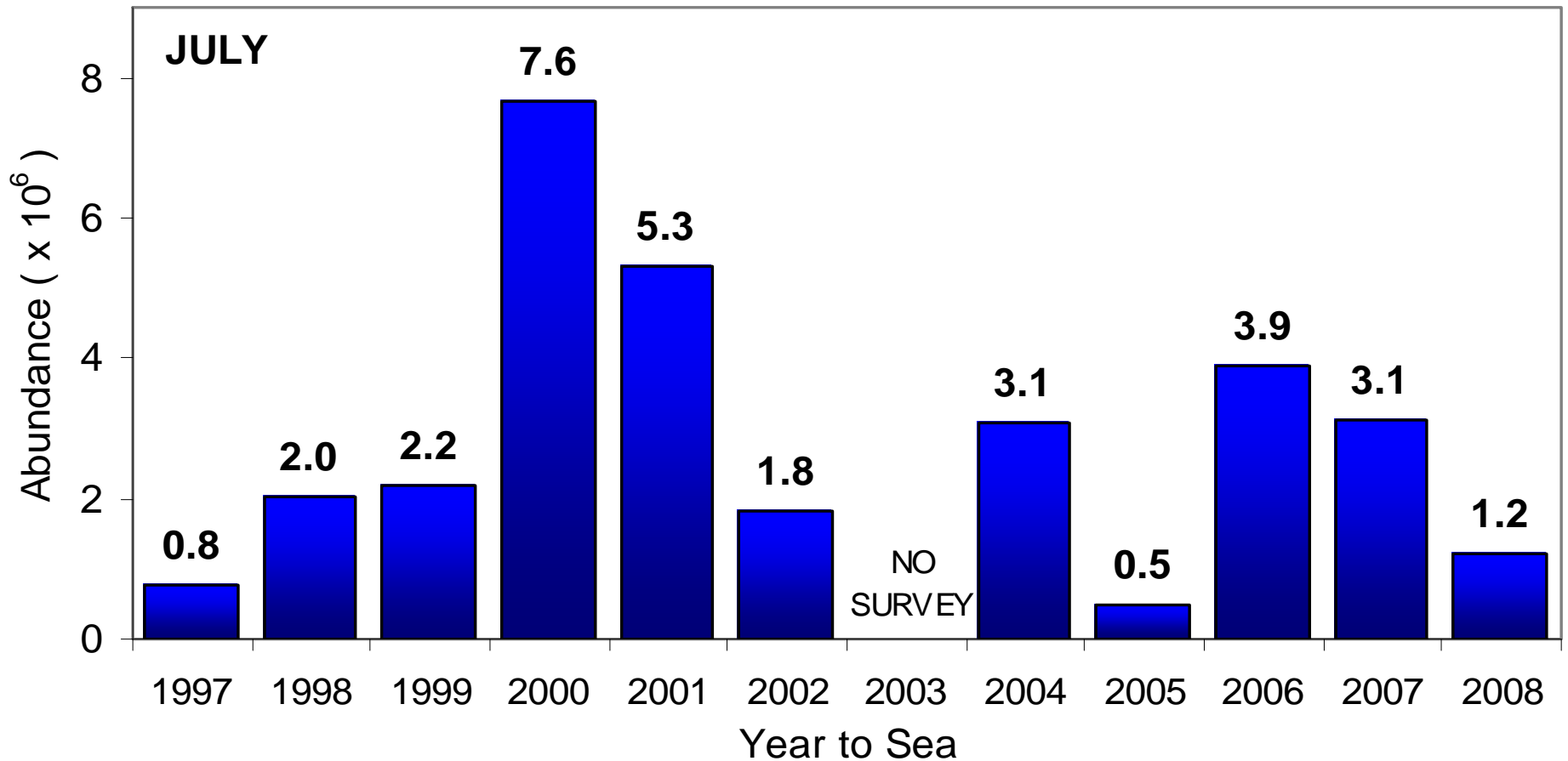
Vancouver  
Island

Strait of  
Juan de Fuca

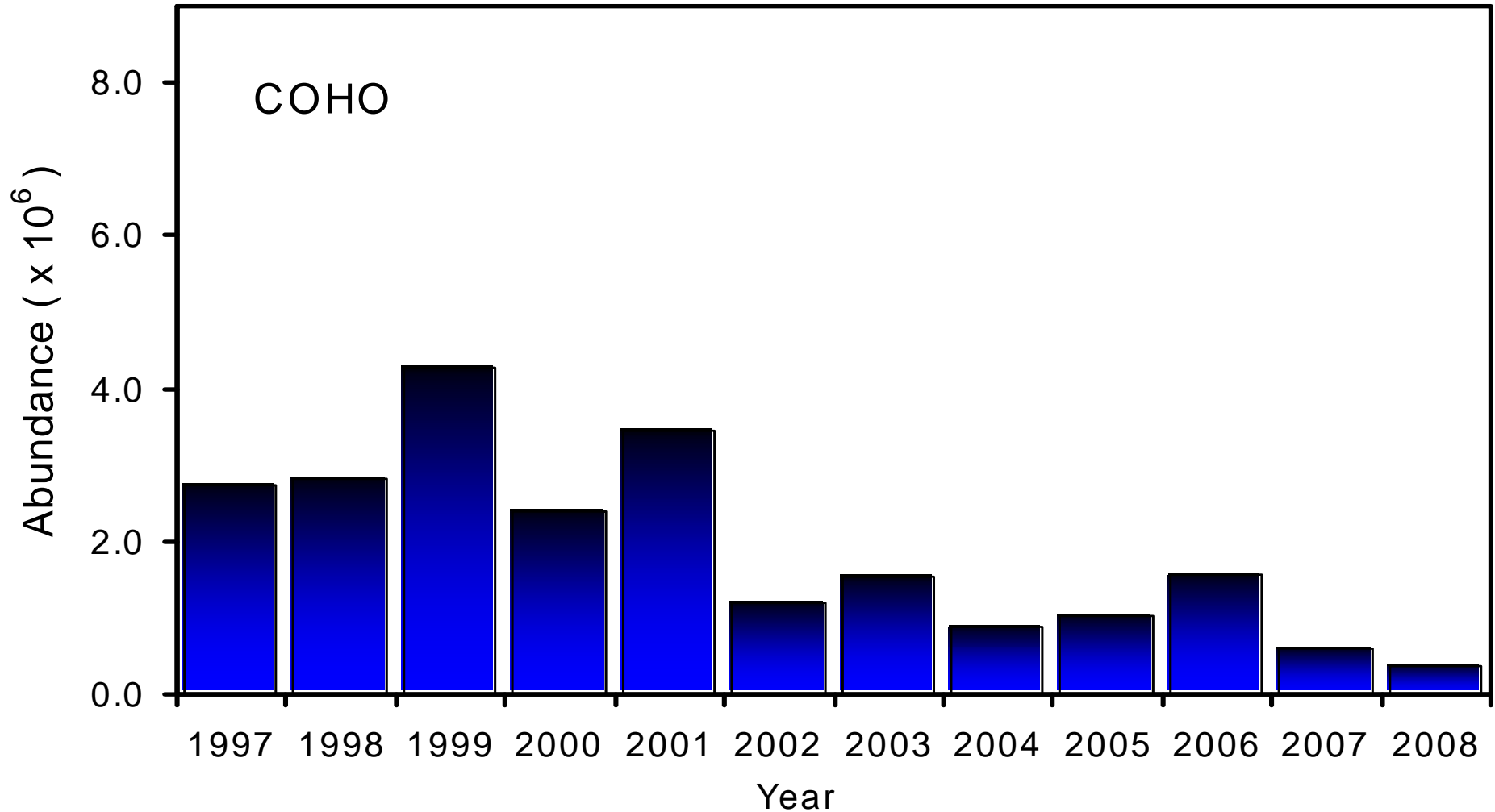
Survey  
Track  
Lines



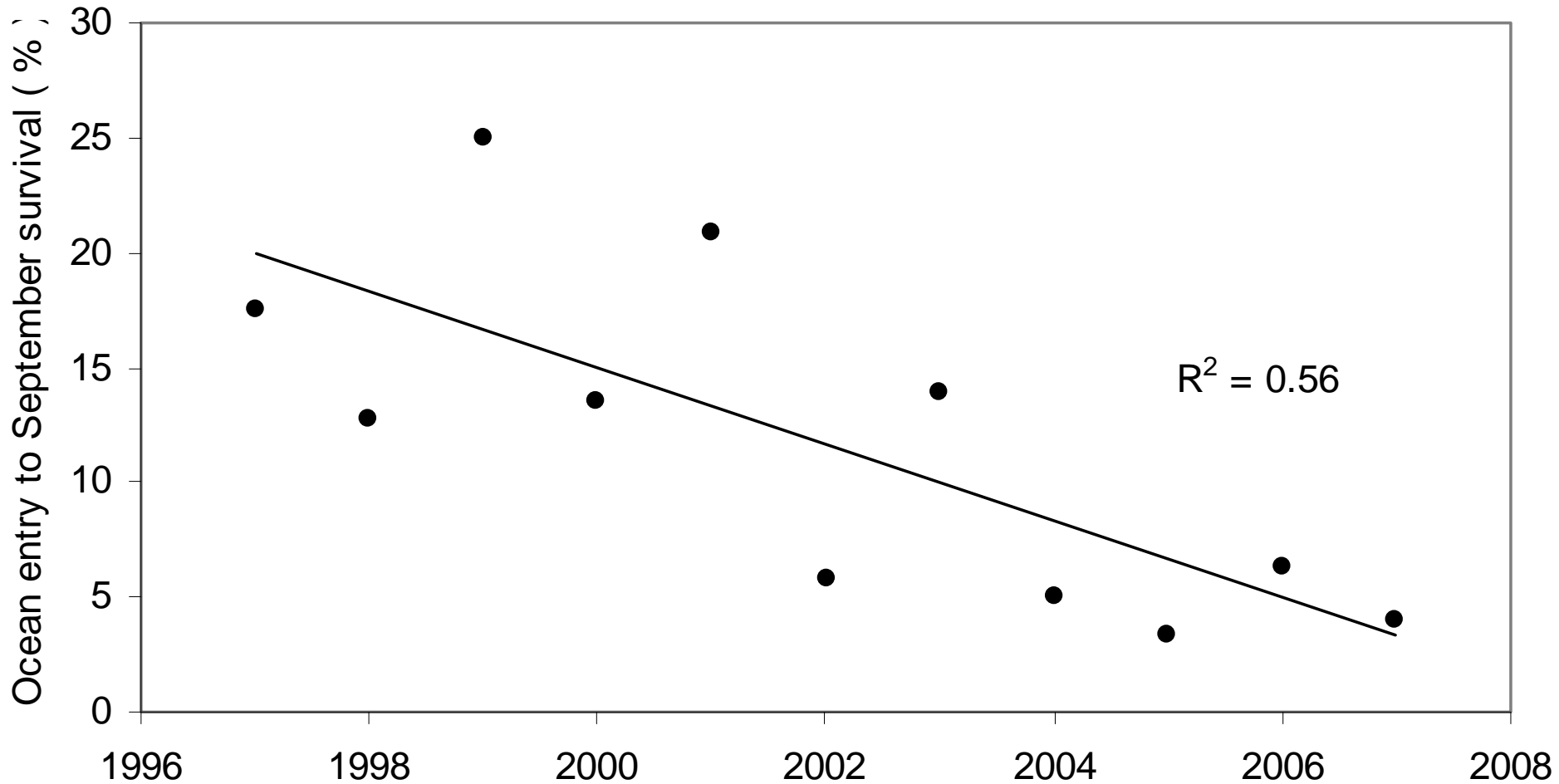
# Coho abundance in the Strait of Georgia, July 1997-2008



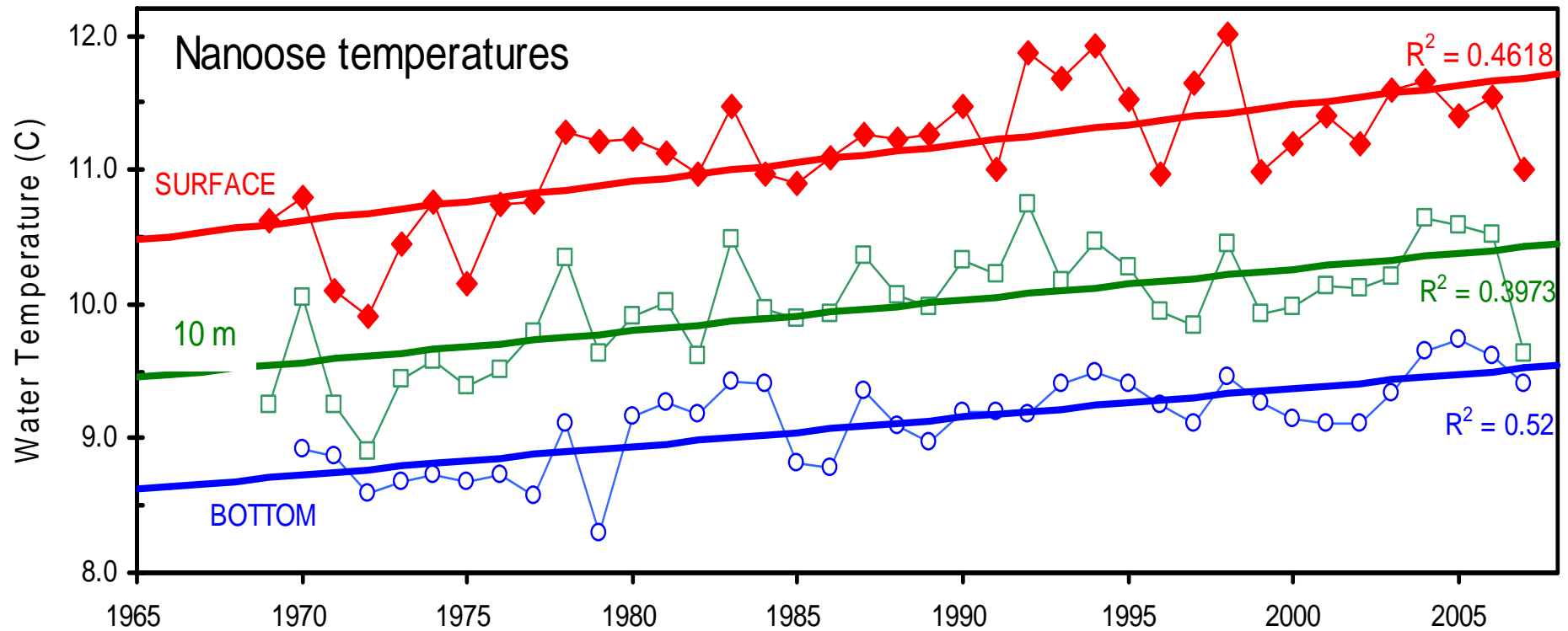
# Coho abundance in the Strait of Georgia, September 1997-2008



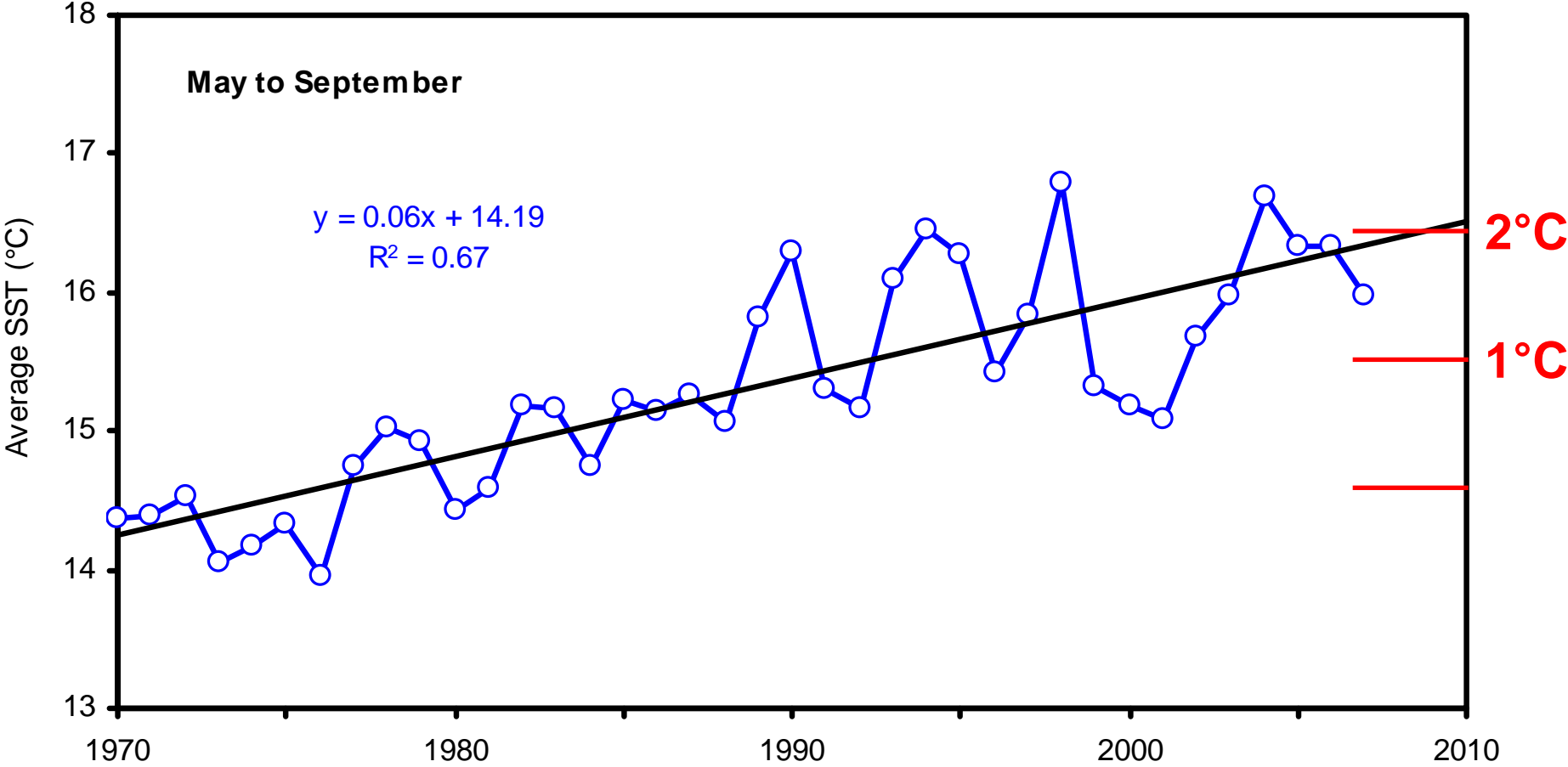
# Early marine survival (May to September) of juvenile coho salmon in the Strait of Georgia



# Strait of Georgia temperatures have warmed throughout the water column



# Average SST from May to September



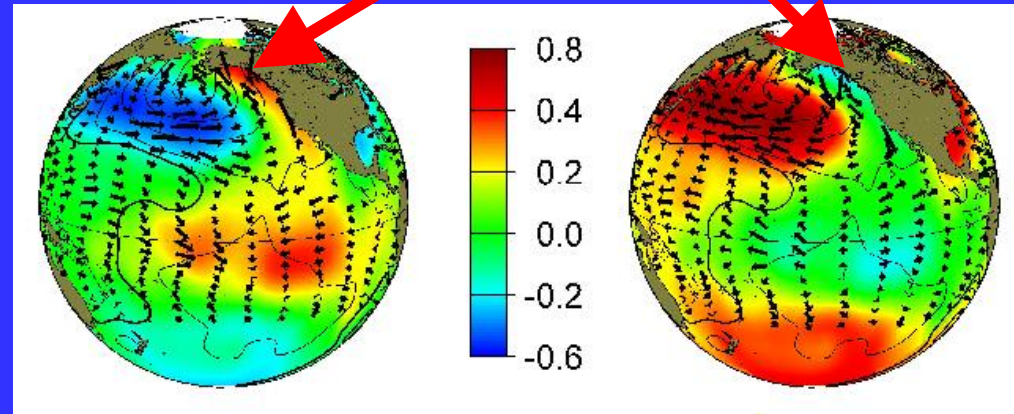
# Climate is a major cause of change in the GOA

Pacific Decadal Oscill. Anomaly Patterns

SST – colors

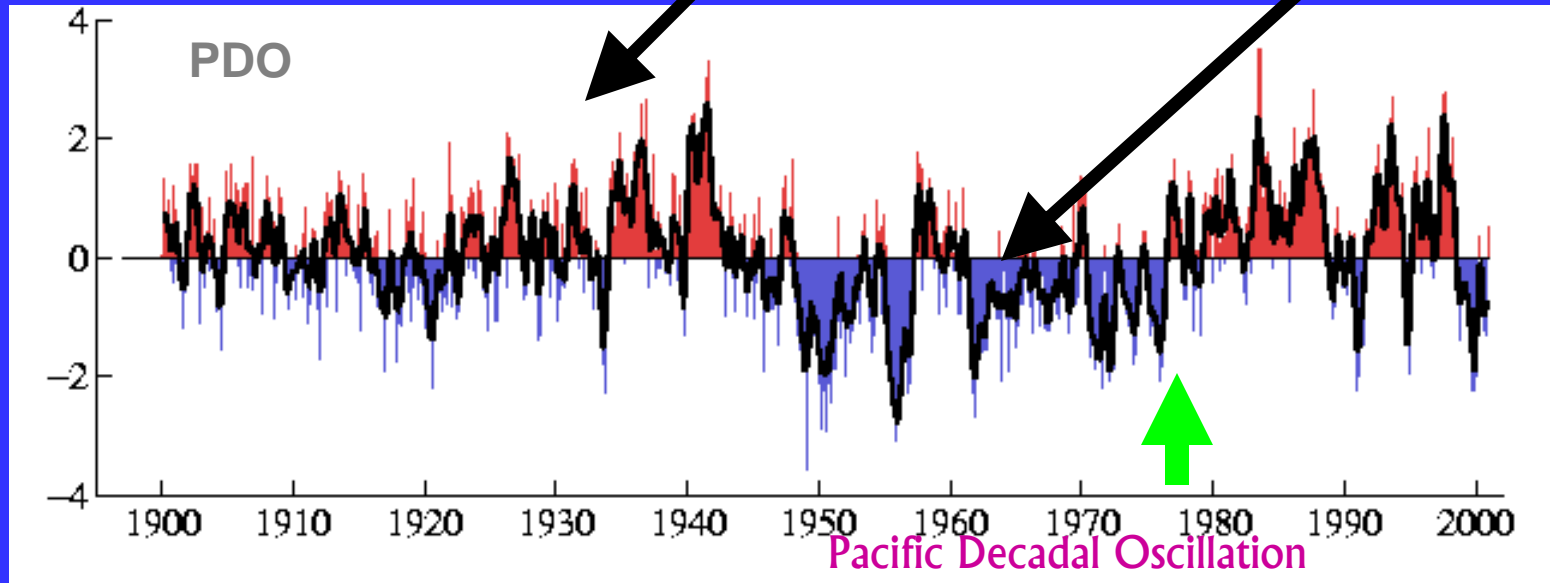
SLP – contours

Windstress - arrows



Warm

Cool



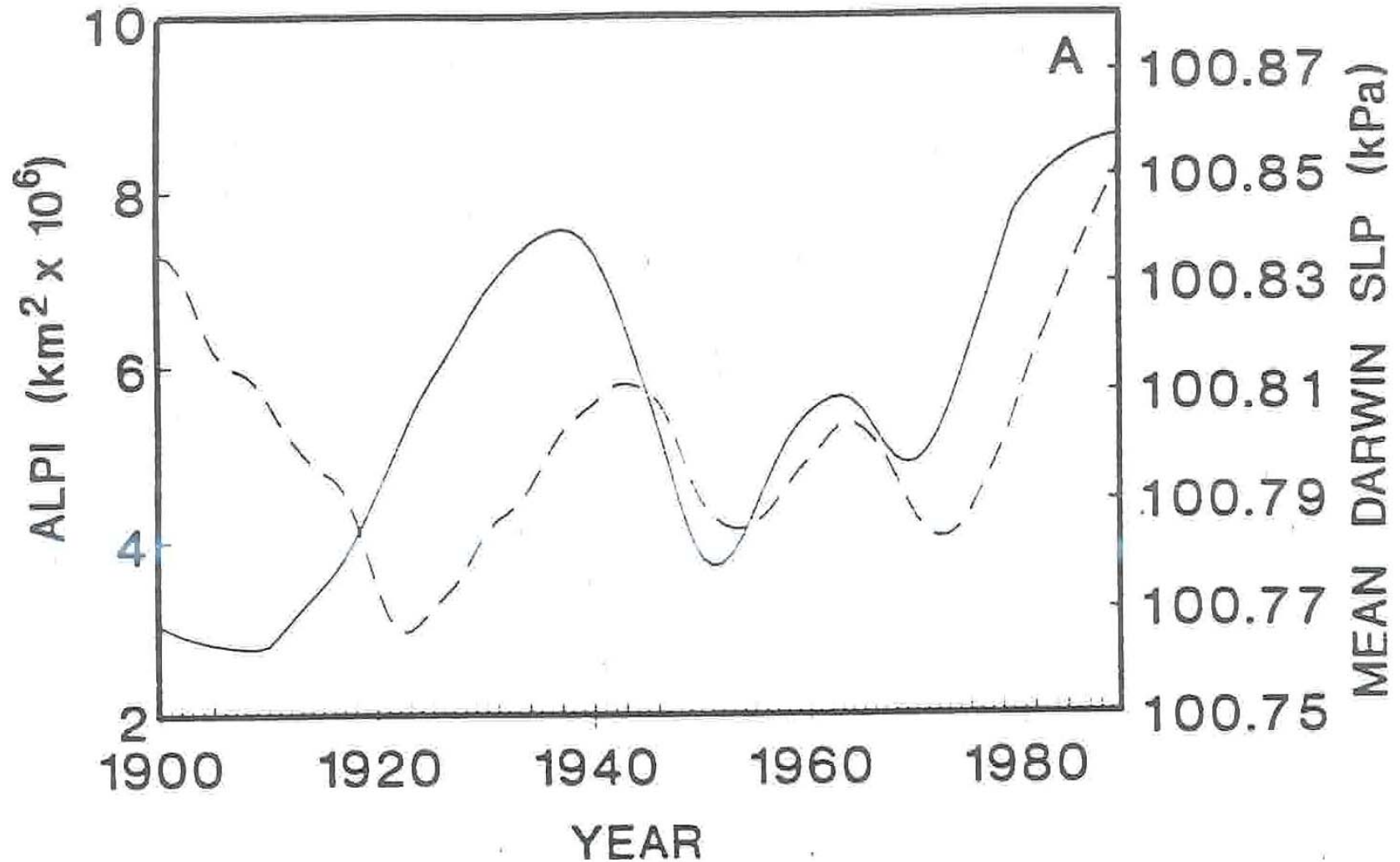
Pacific Decadal Oscillation

Credits: Hare, Mantua, Enfield

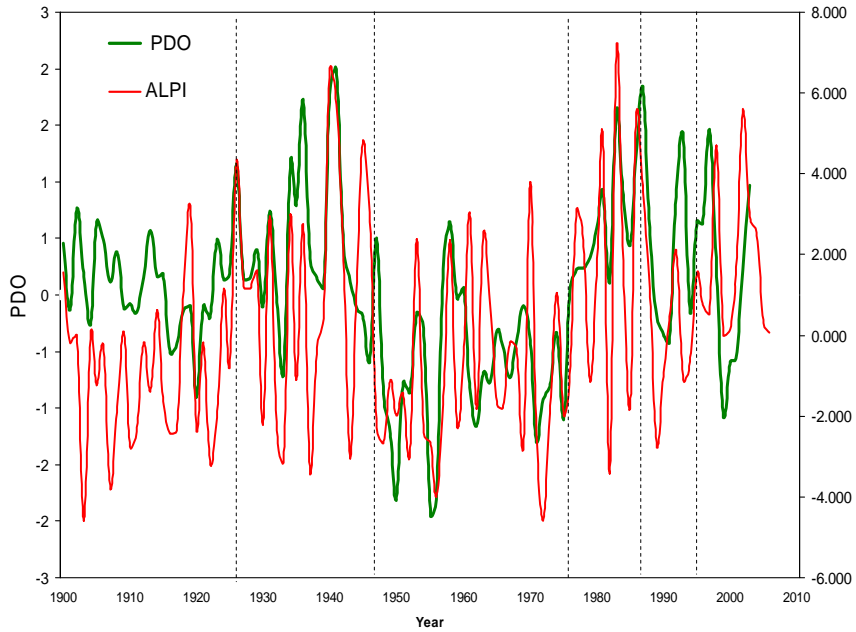
# Definition of PDO and ALPI

- PDO (Pacific Decadal Oscillation) is the first mode of decadal variability in the sea surface temperatures of the North Pacific Ocean.
- ALPI (Aleutian Low Pressure Index) is the anomaly (from established long term average) between December and March that is covered by the low pressure cell at less than 100.5 kPa.

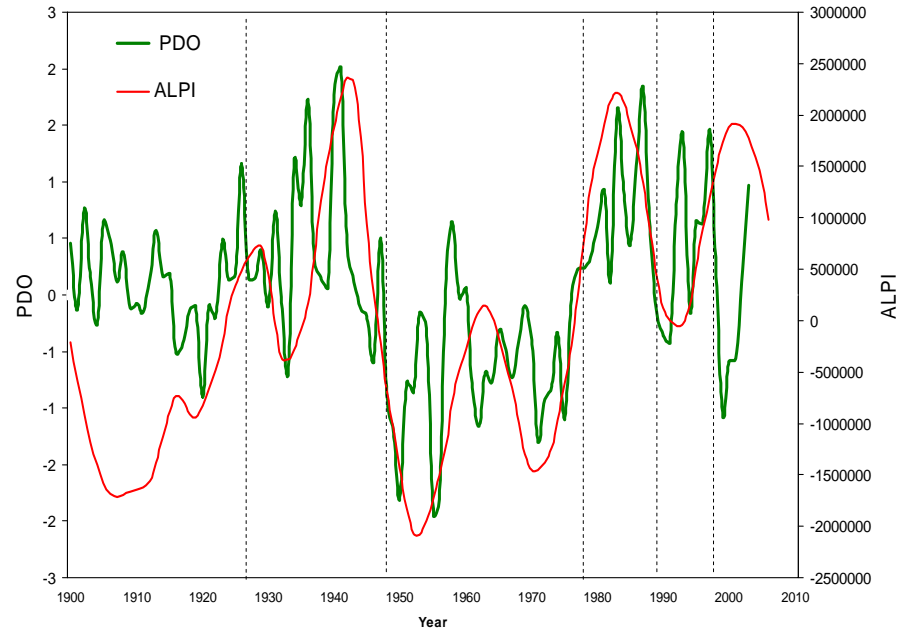
ALPI (solid line) compared with sea level pressure at Darwin (broken line) smoothed using a LOWESS smoother with a bind width,  $f$ , of 0.20 (from Beamish & Bouillon 1993)



# ALPI and PDO



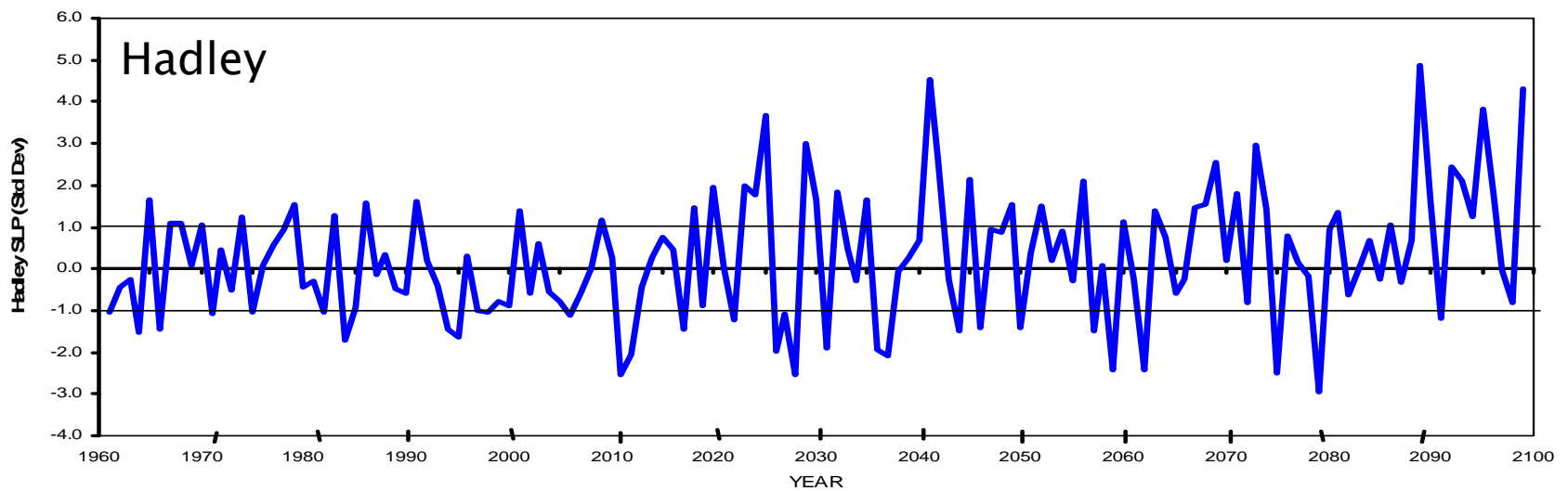
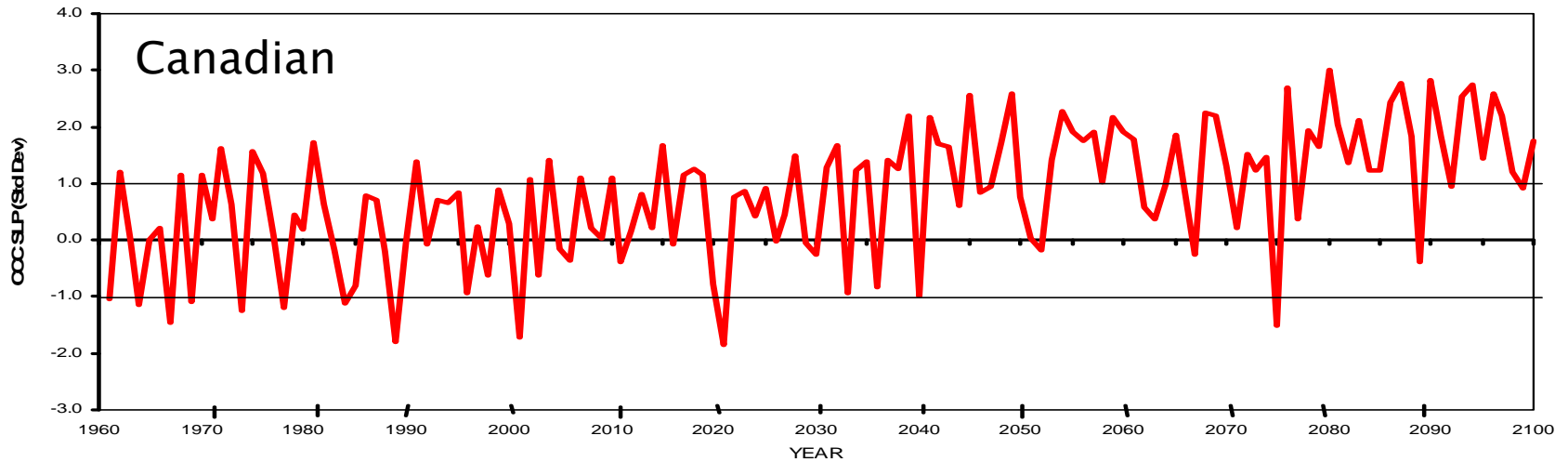
Index

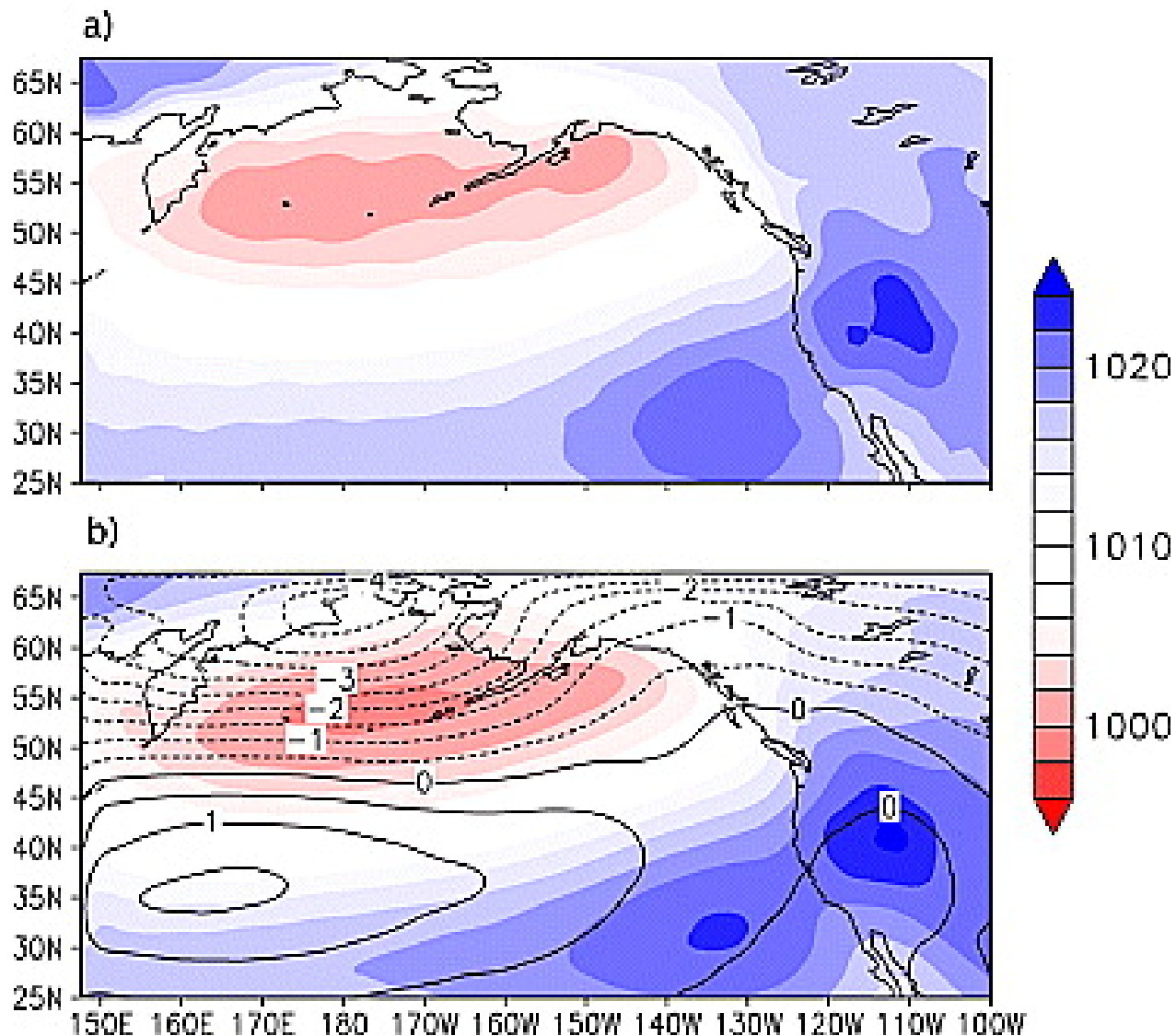


Lowess

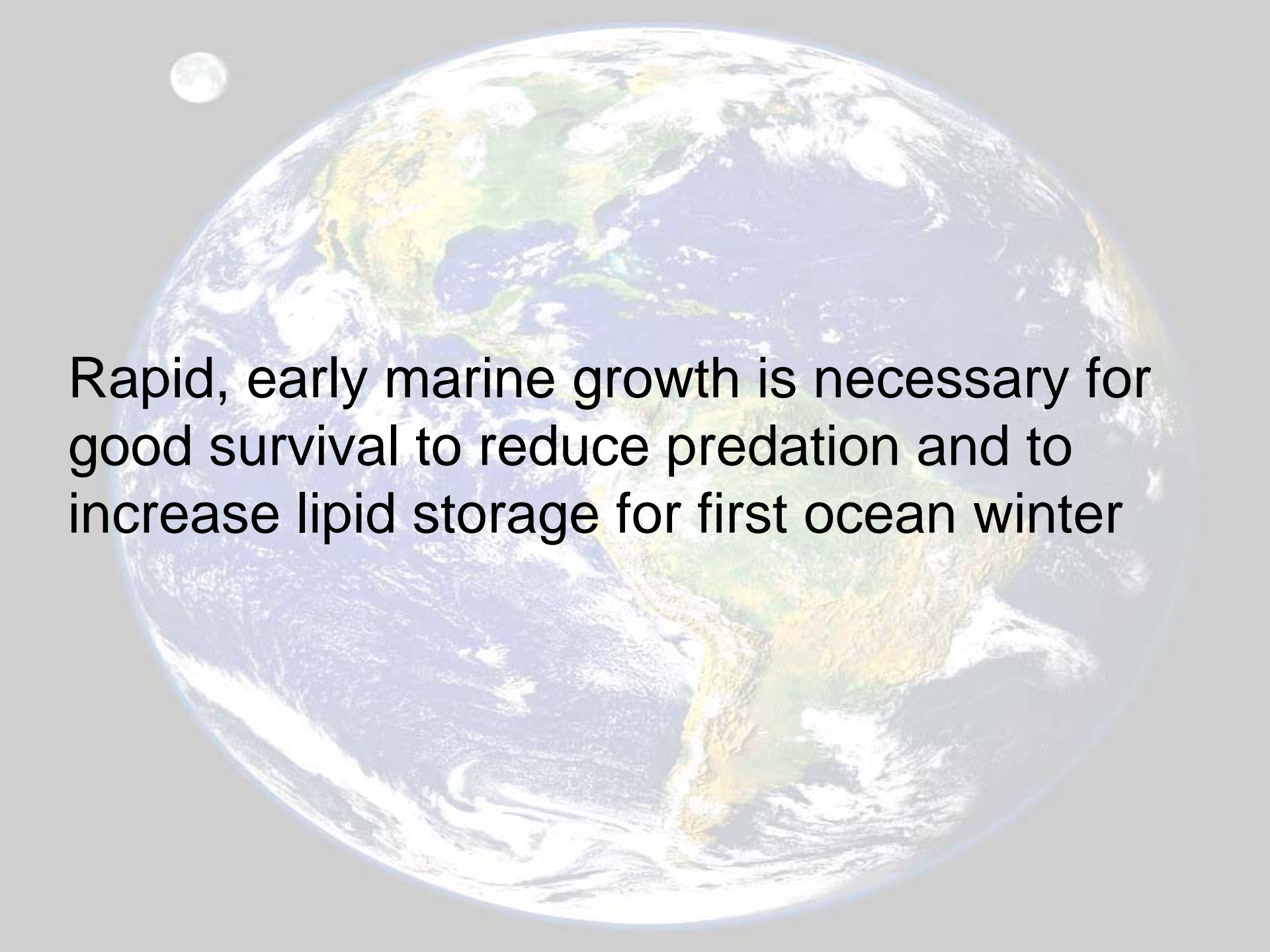
# Possibility 2 - Global warming

## GCM models of the Aleutian Low

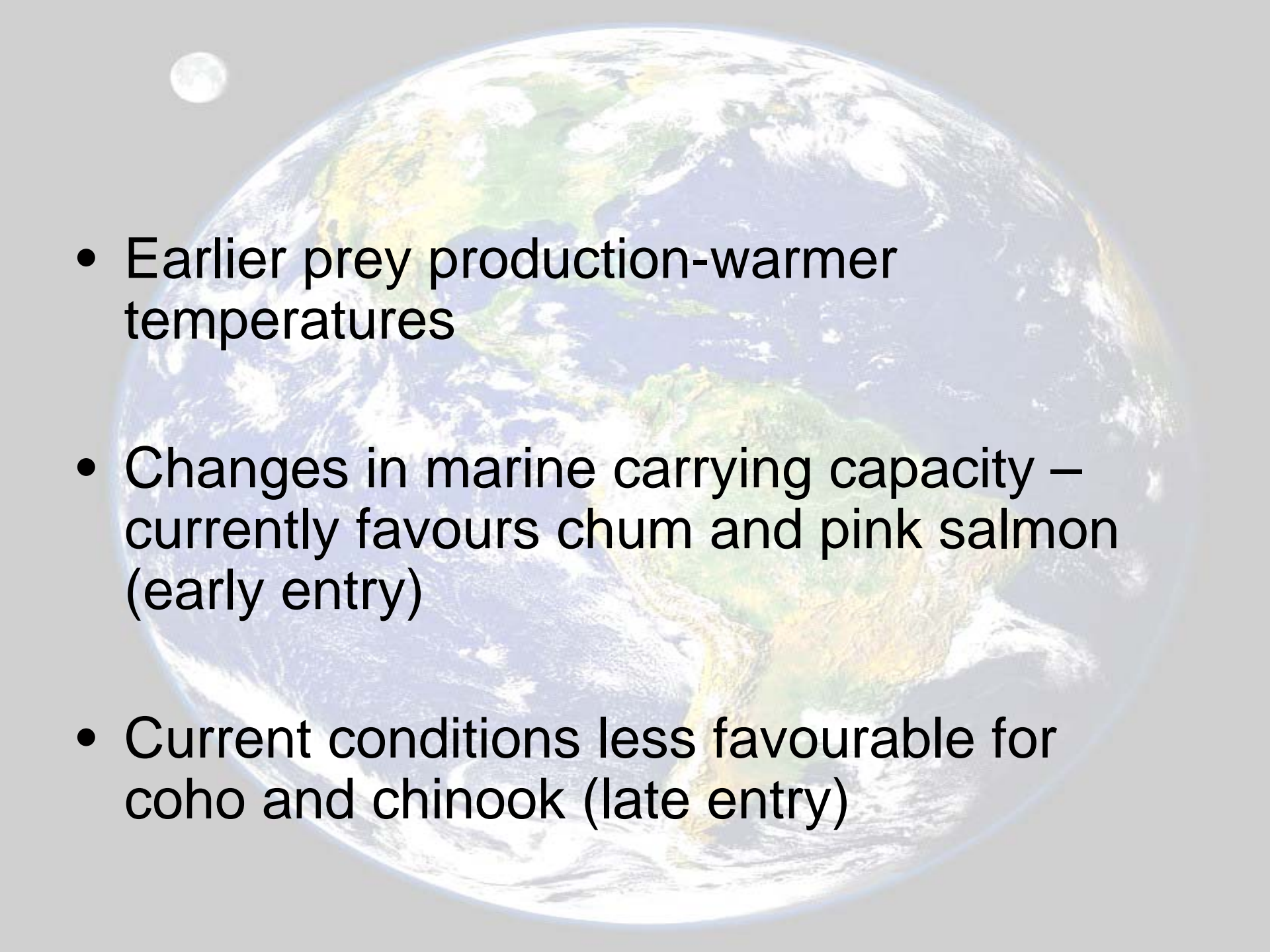




Aleutian Low for (a) NCEP-NCAR reanalysis, (b) model composite for 1950-2000. Contour lines show difference between 1950-2000 and 2050-2100 patterns. (from Salathè 2006)

A satellite view of Earth from space, showing the Americas and the Moon in the upper left corner. The text is overlaid on the image.

Rapid, early marine growth is necessary for good survival to reduce predation and to increase lipid storage for first ocean winter

- 
- A satellite view of Earth showing the Americas, with the moon in the upper left corner. The image is semi-transparent, allowing the text to be overlaid.
- Earlier prey production-warmer temperatures
  - Changes in marine carrying capacity – currently favours chum and pink salmon (early entry)
  - Current conditions less favourable for coho and chinook (late entry)

# Early marine survival (May to September) of juvenile coho salmon in the Strait of Georgia

