

# Setting the stage for predicting climate change effects on Pacific salmon –

## How has salmon abundance varied during the last 85 years and why?

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## Pacific Salmon Status and Abundance Trends

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Most data from  
2009 NPAFC  
Report with  
updated  
official catch  
and hatchery  
release  
estimates

Contributors  
from all  
countries

# Goals of Presentation

- Summarise abundance/survival trends for Pacific salmon & discuss mechanisms for change
- Set the stage for subsequent presentations & discussions today

# Salmon Can be Assessed at Various Scales

- Taxonomic species
- Large geographic areas
- Stock groupings
- Populations or Conservation Units

NPAFC

(Catch can be useful indicator)



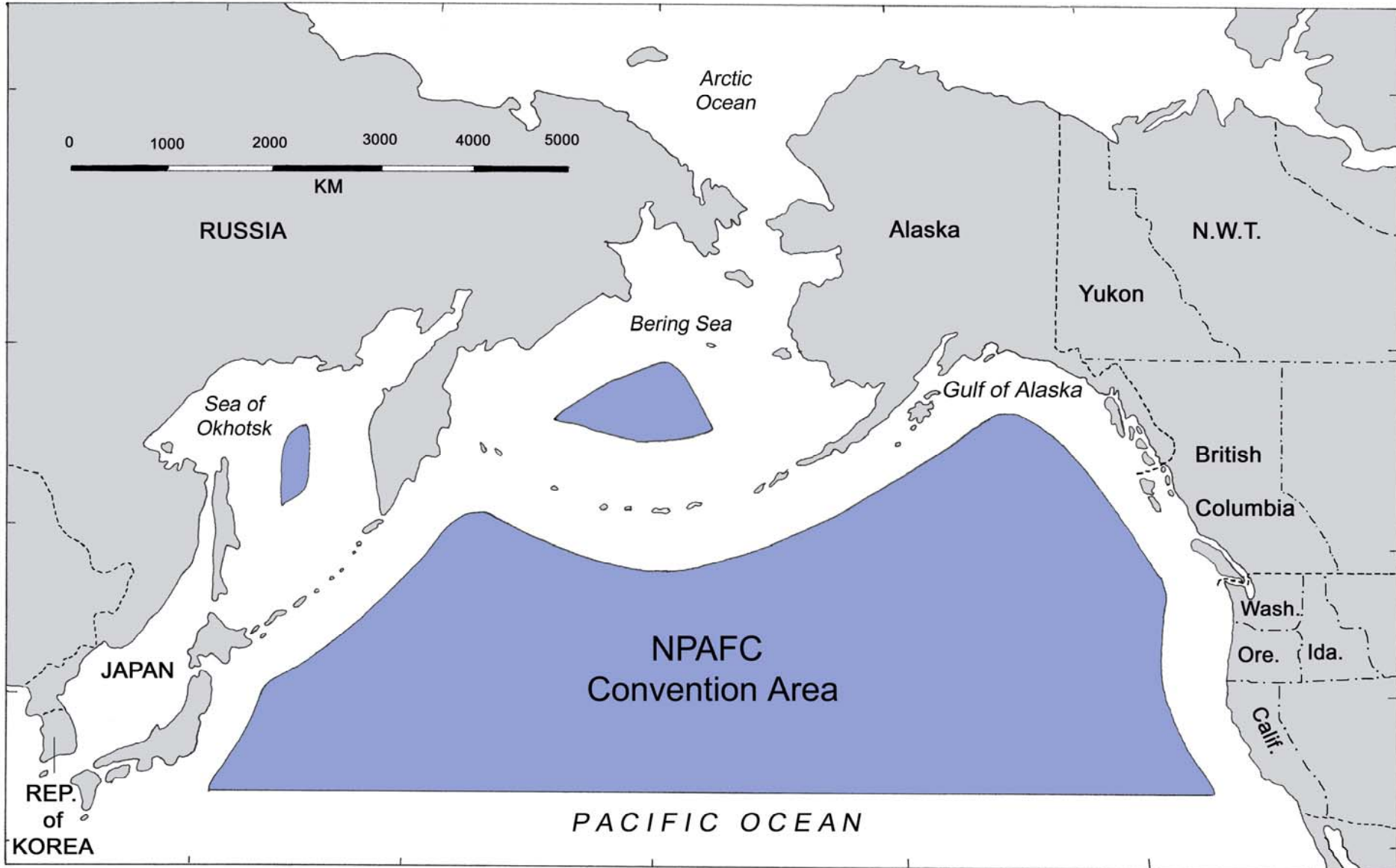
# Salmon can be Assessed at Various Scales

- Taxonomic species
- Large geographic areas

National  
Science

- Stock groupings
- Populations or Conservation Units

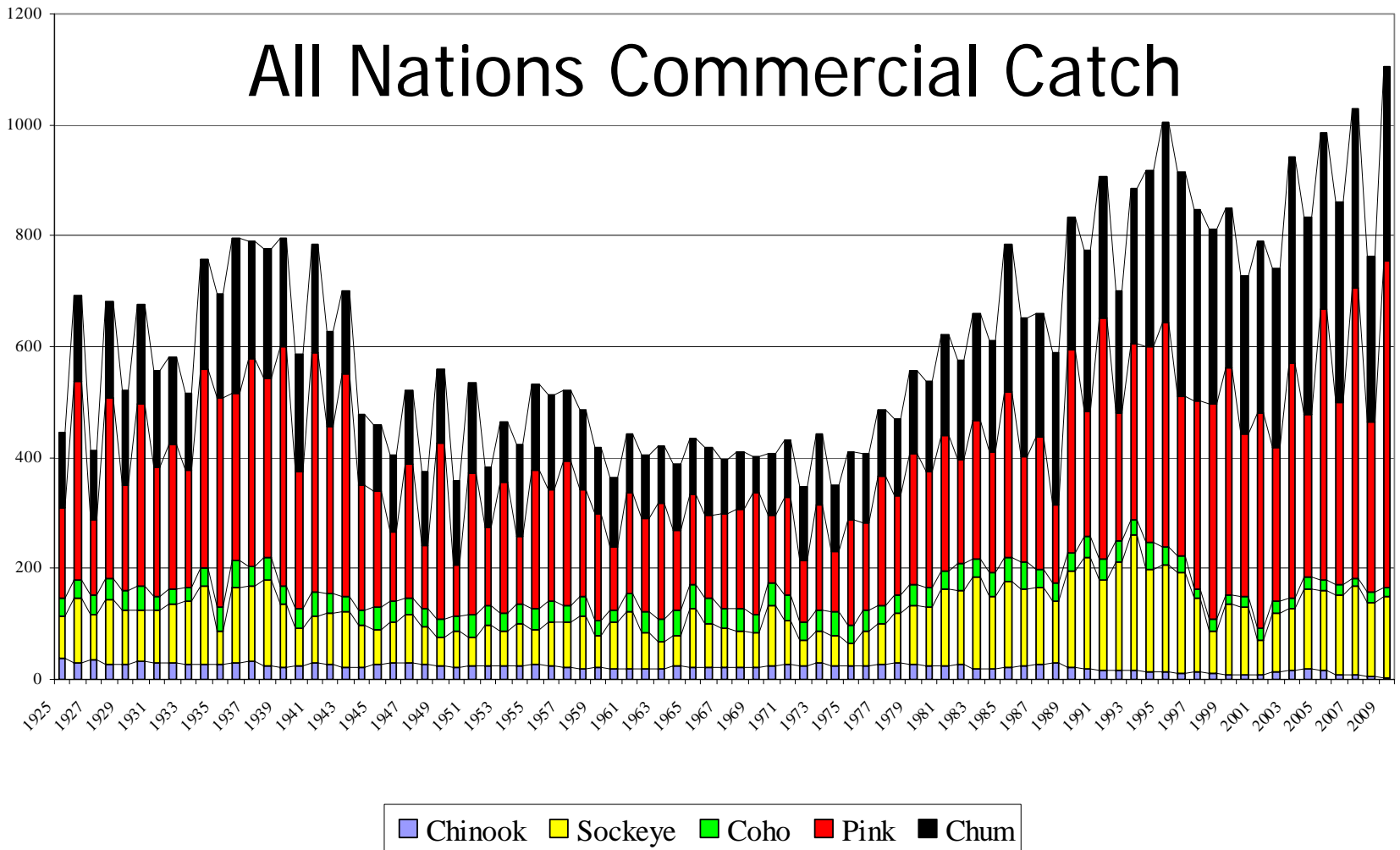




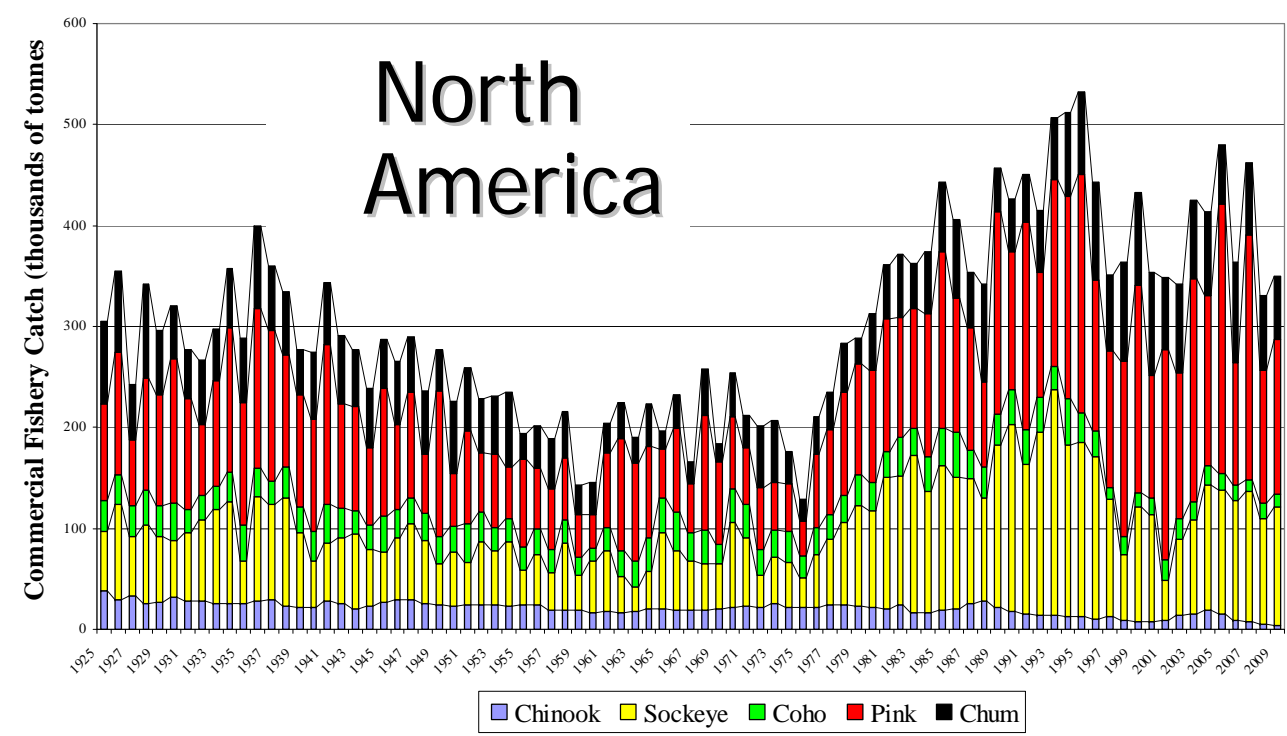
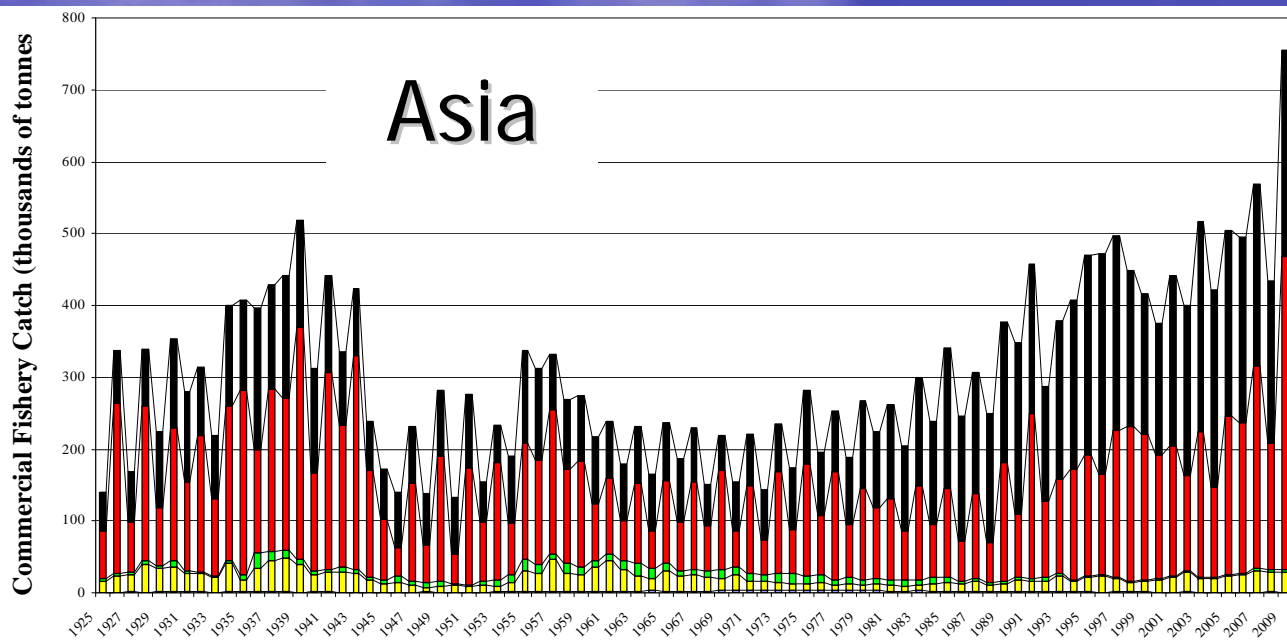
Results presented today are at the scale of the North Pacific, Asia, & North America

Commercial Fishery Catch (thousands of tonnes)

# All Nations Commercial Catch



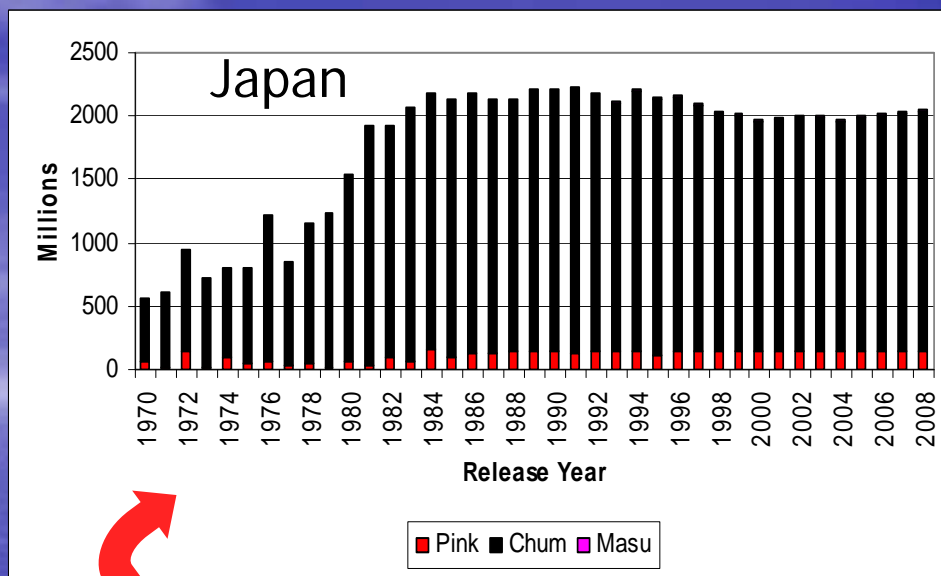
No evidence of declining catches.  
Record catches in 2009 largely due to huge pink salmon catches in Russia.



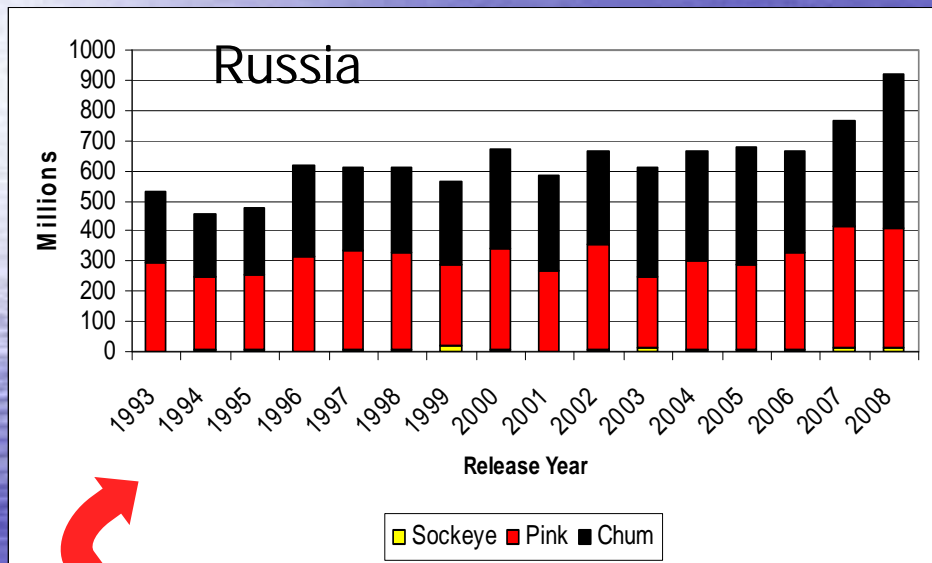


**How important has  
enhancement been to the  
changes in abundance?**

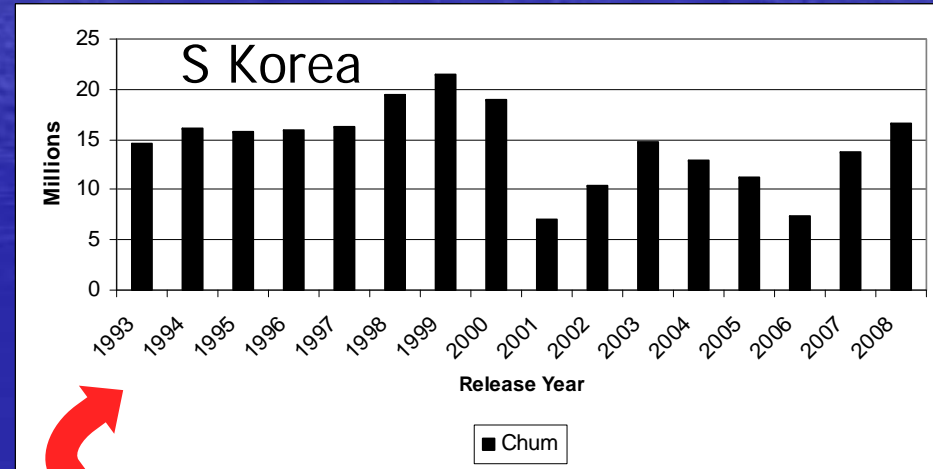
# Asian Hatchery Releases



Stable in Japan – mostly chum salmon

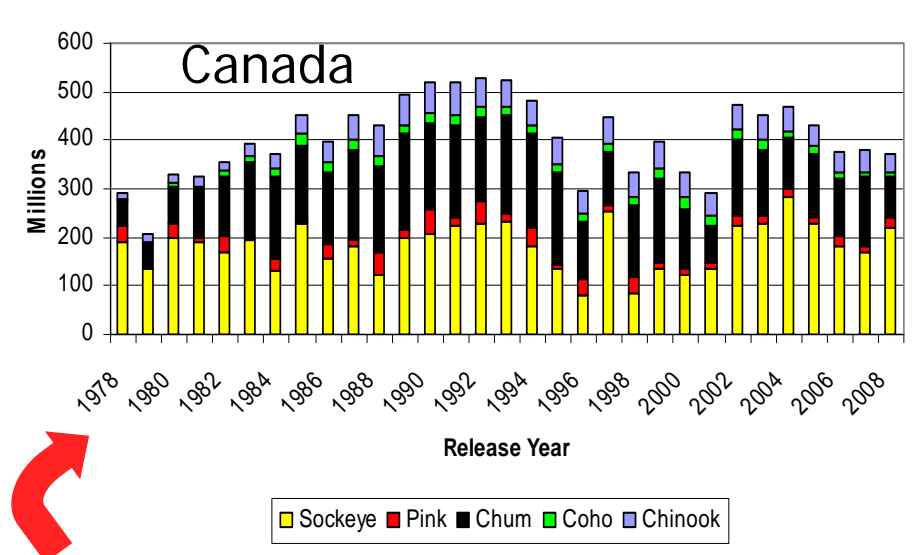


Increasing in Russia – pink and chum salmon

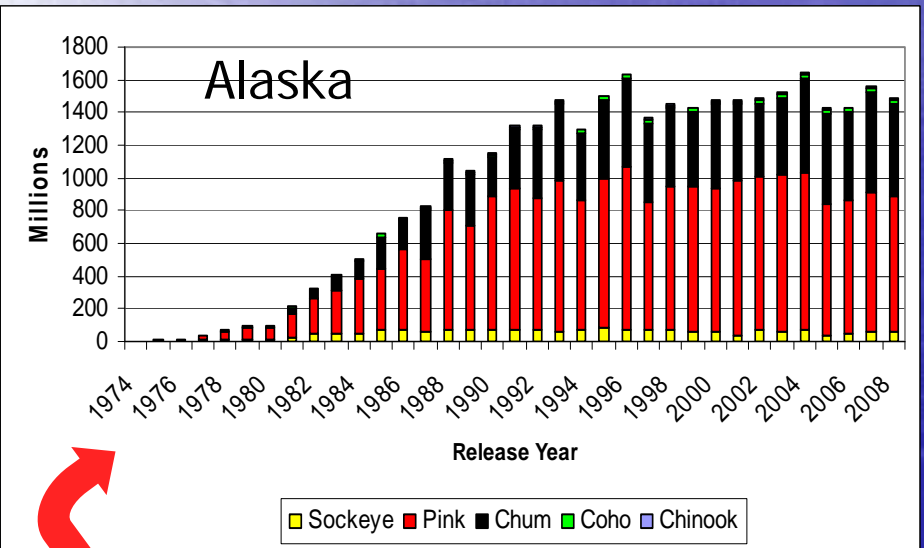


Low numbers in S Korea – mostly chum salmon

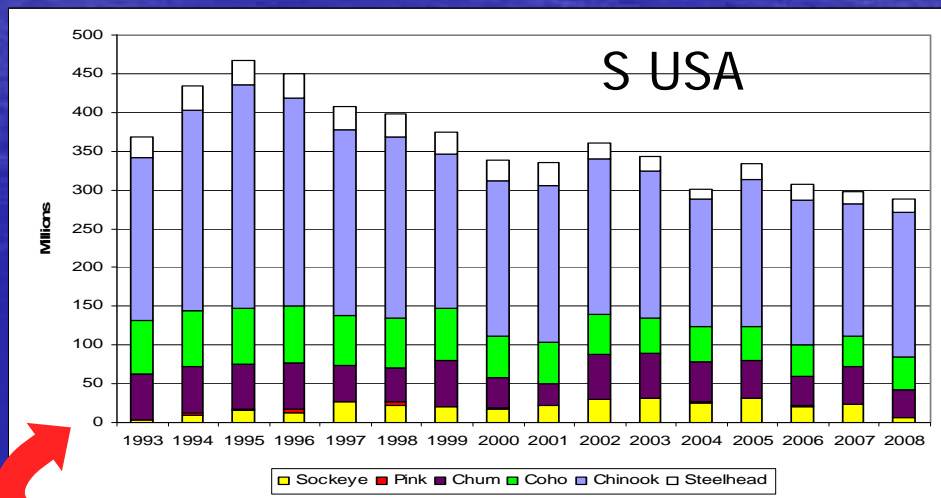
# North American Hatchery Releases



Recent declines in Canada  
– sockeye, chum



Stable in Alaska post 1995  
– mostly pink and chum

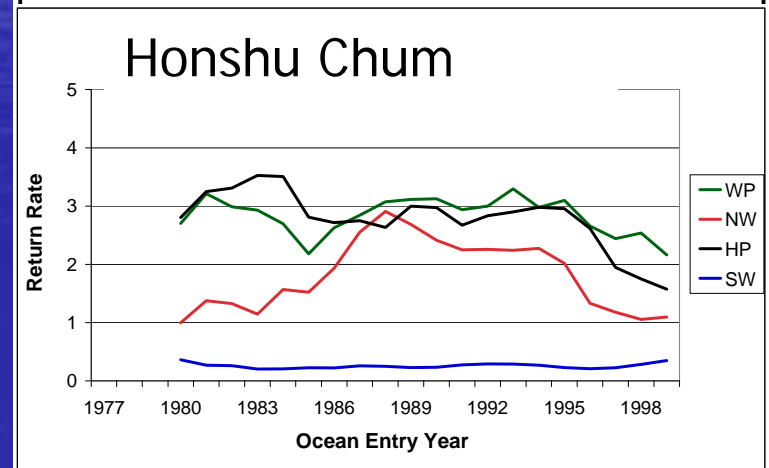
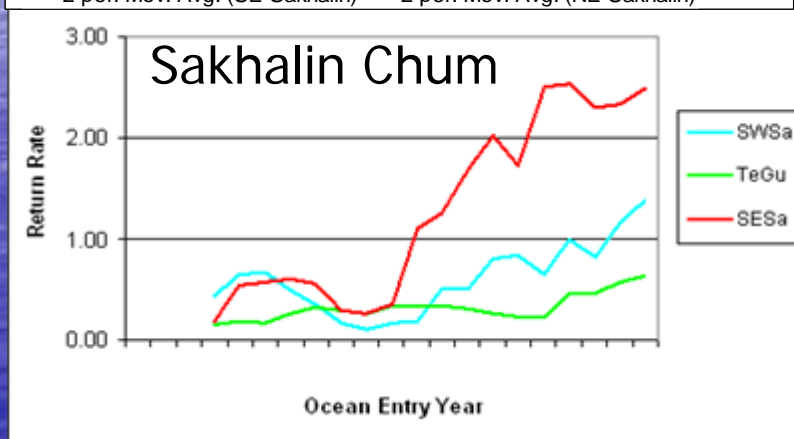
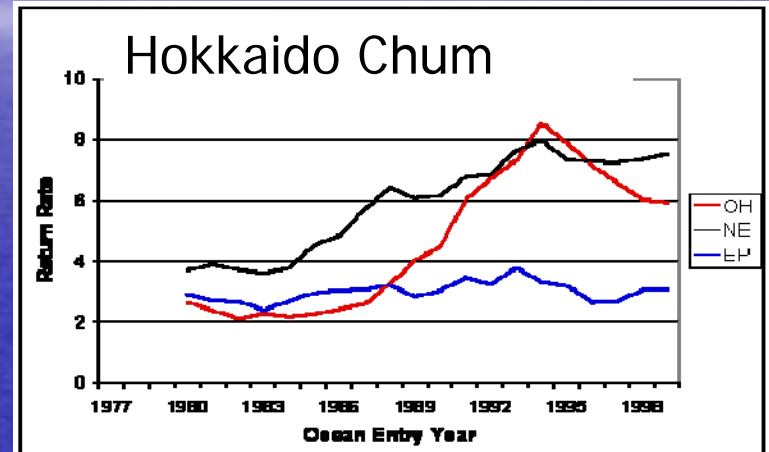
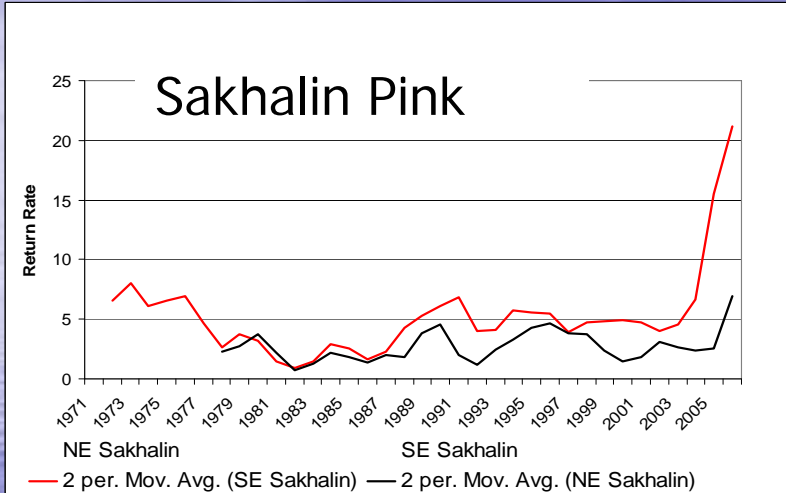


Recent declines in S USA  
– mostly chinook

# Changes in survivals of Asian hatchery salmon?

# ↑ Survivals for hatchery chum in Sakhalin & parts of Hokkaido

Fewer data for pink; recent increases apparent in Sakhalin



Return rates for hatchery salmon

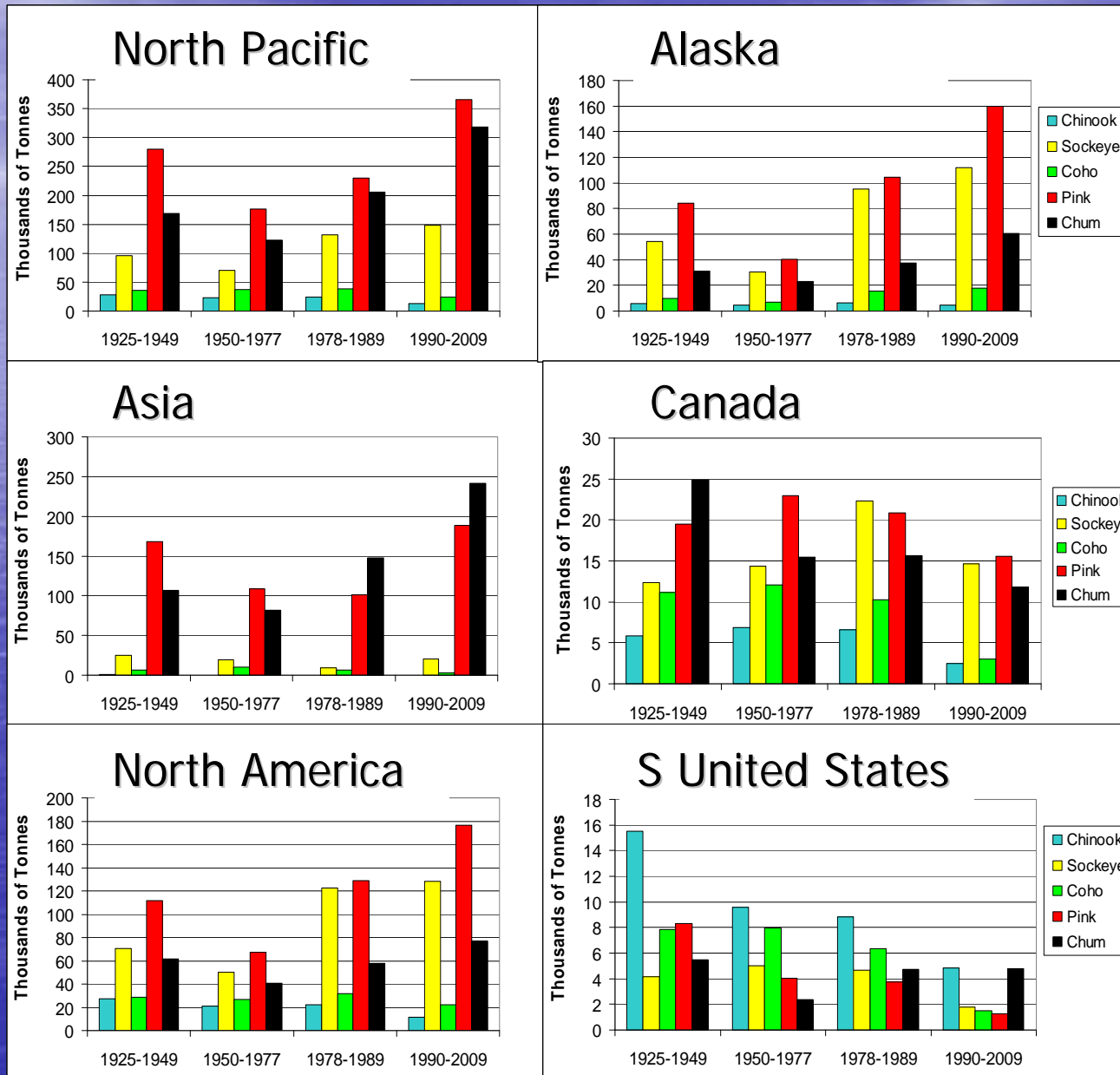
# Hatchery Influence Overview

- Japanese enhancement stable after early 1980's but Russian enhancement increasing
- Large, recent survival increases for (Sakhalin) pink salmon
- Hatchery chum survivals increasing in northern parts of Asia
  - in part because of improved technology
  - also favourable marine environment
- > 40% of North Pacific salmon catch (chum & pink) now of hatchery origin (Eggers 2009)

# Role of Climate

Consider regime impacts first

# Mean Commercial Catch by Regime and Species





# Conclusions / Summary

## North Pacific

- North Pacific produces more salmon now than previously century (2007 and 2009 catches highest in history)
- Chum & pink production high
- Chinook & coho & some sockeye low
- N/S differences and apparently W/E differences

# Conclusions / Summary

## Asia

- Asian chum and pink salmon doing well
- Expanding hatchery operations & improved technologies partly responsible
- Also climate change, & shifting fisheries

# Conclusions / Summary

## North America

- Continued high catches of sockeye, pink, & chum salmon in Alaska only
- Catches S of Alaska declining
- Coho, chinook & sockeye marine survival declines in many areas largely responsible for reduced status of these species
- Habitat perturbations also important

# Conclusions Continued

- Effects of interactions between hatchery & wild salmon poorly understood although density dependent effects on growth & maturity documented
- Climate change-related lower survivals for chinook, coho, & sockeye salmon in Canada and S United States
- At North Pacific scale, difficult to separate enhancement effects from climate change