

What We Know About Changing Size of Fish



JTC Salmon Size Subcommittee
US/Canada Joint Technical Committee

JTC Salmon Size Subcommittee

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- Kristin Mull- YRDFA
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- Chris Stark- BSFA
- Dani Evenson- ADF&G co-chair
- Pat Milligan- DFO co-chair



Goals

- i. Summarize existing literature
- ii. Develop hypotheses and evaluate existing ASL data;
- iii. ID hypotheses that can not be investigated due to limitations of existing data, and make recommendations to the JTC for data collection;
- iv. Assess potential causes for changes in Chinook ASL and weight composition;
- v. Recommend research to address data gaps;
- vi. Provide updates





JTC SSS *Informational Summary*

A SUMMARY OF FACTORS WITH POTENTIAL TO ALTER YUKON RIVER SALMON POPULATIONS

Goal 1. Summarize existing literature

5 Sections

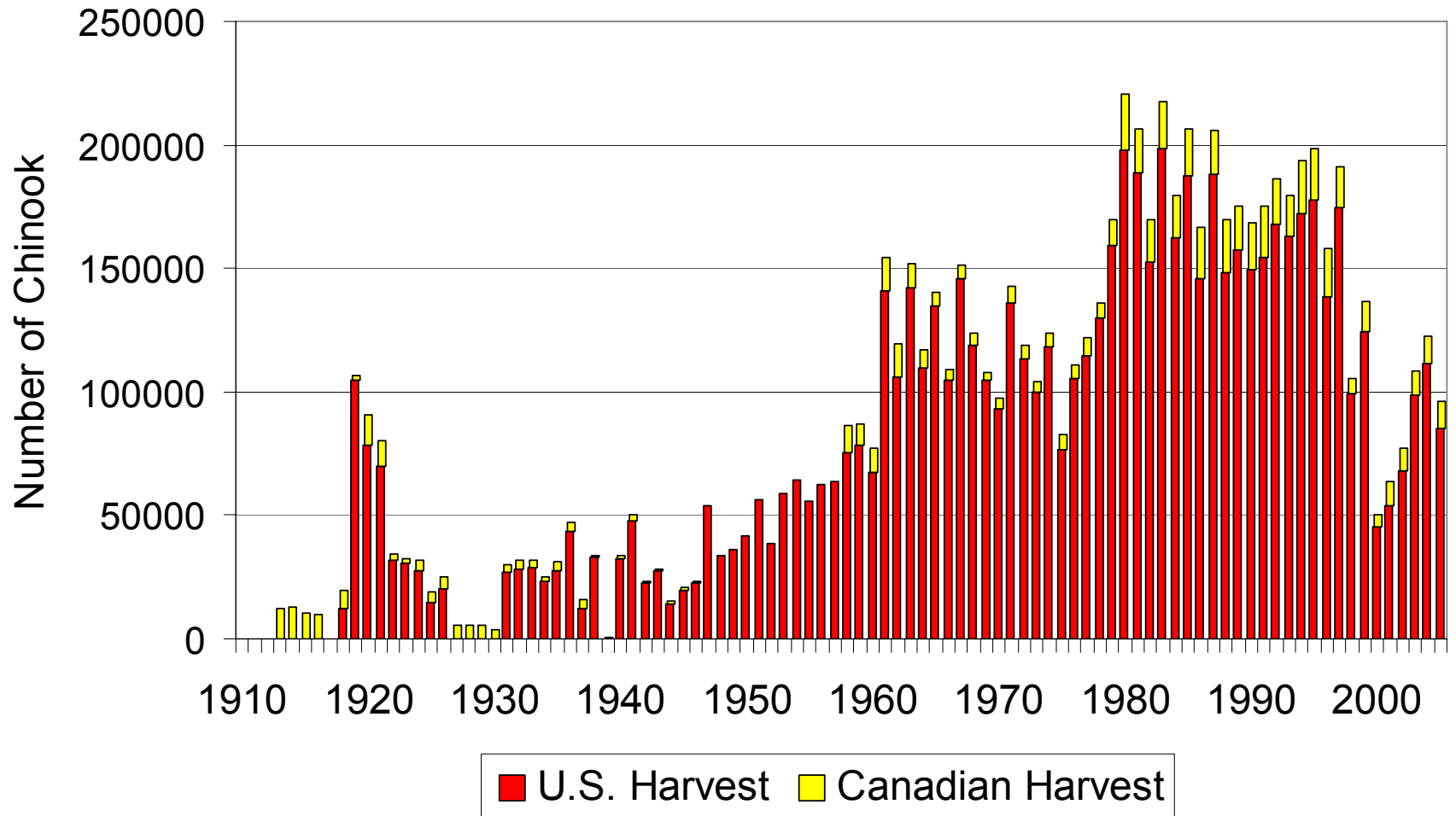
- Harvest History
- Summary of existing age, sex and size studies
- Gillnet selectivity
- Influences on salmon size at sea
- Heritability of traits



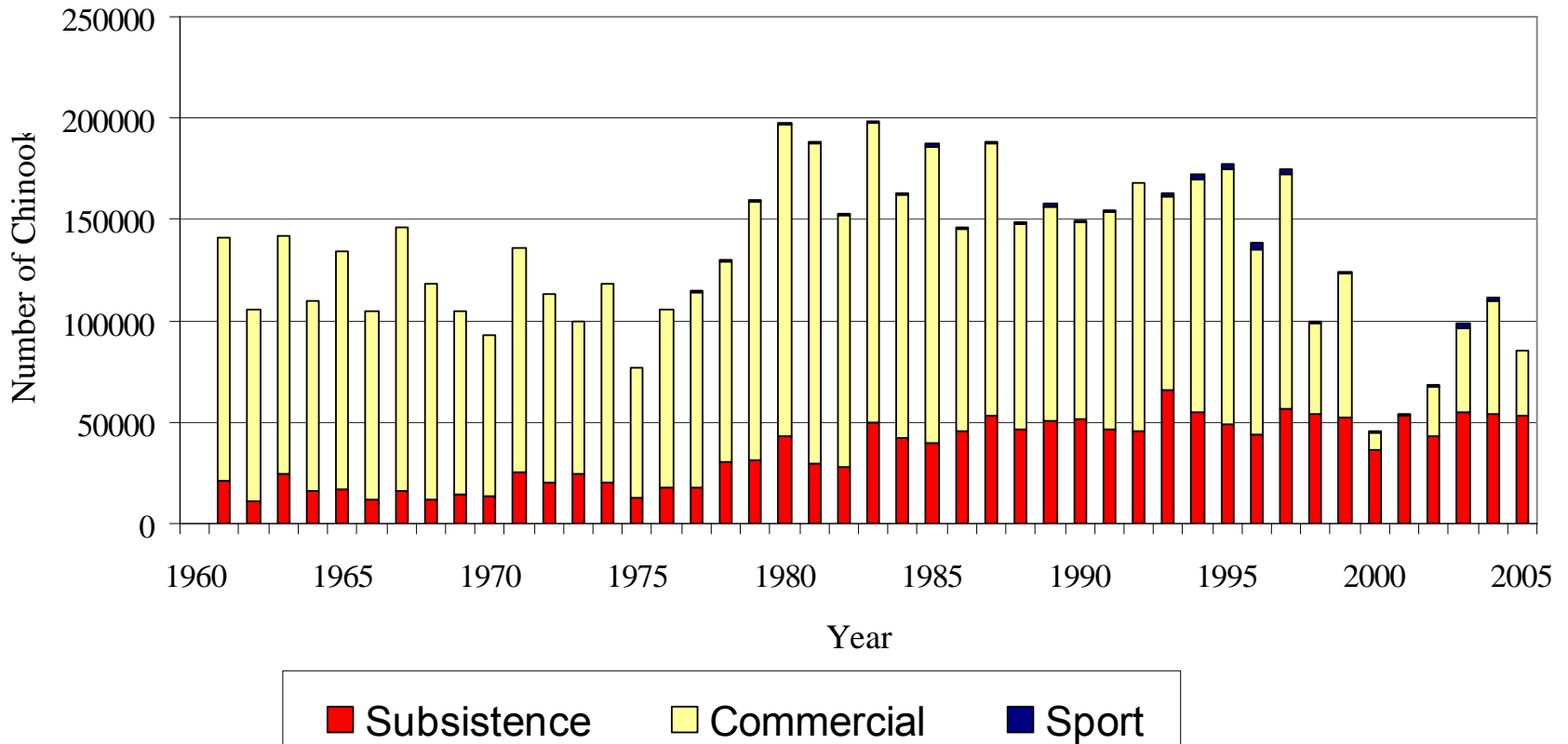
Harvest History



Total Utilization



US Total Utilization



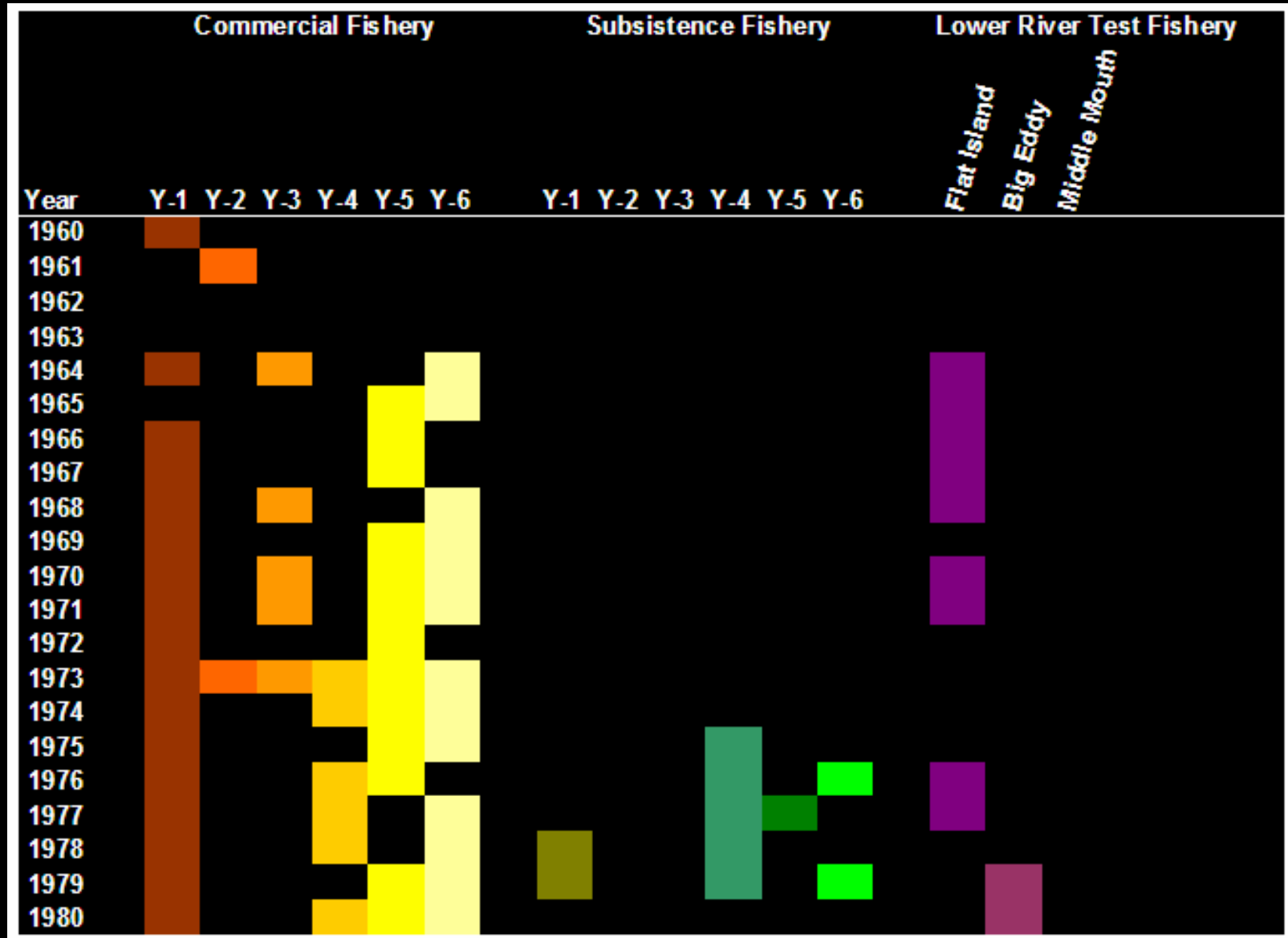
Data Availability



AYK Database project

- Converted ASL data into an electronic format housed in a single location
- Available to the public in July 2007
- Includes ASL data from the Yukon, Kuskokwim and Norton Sound:
 - Commercial, subsistence, and test fisheries
 - Escapement projects
 - Special projects- mark/recap, radio telemetry

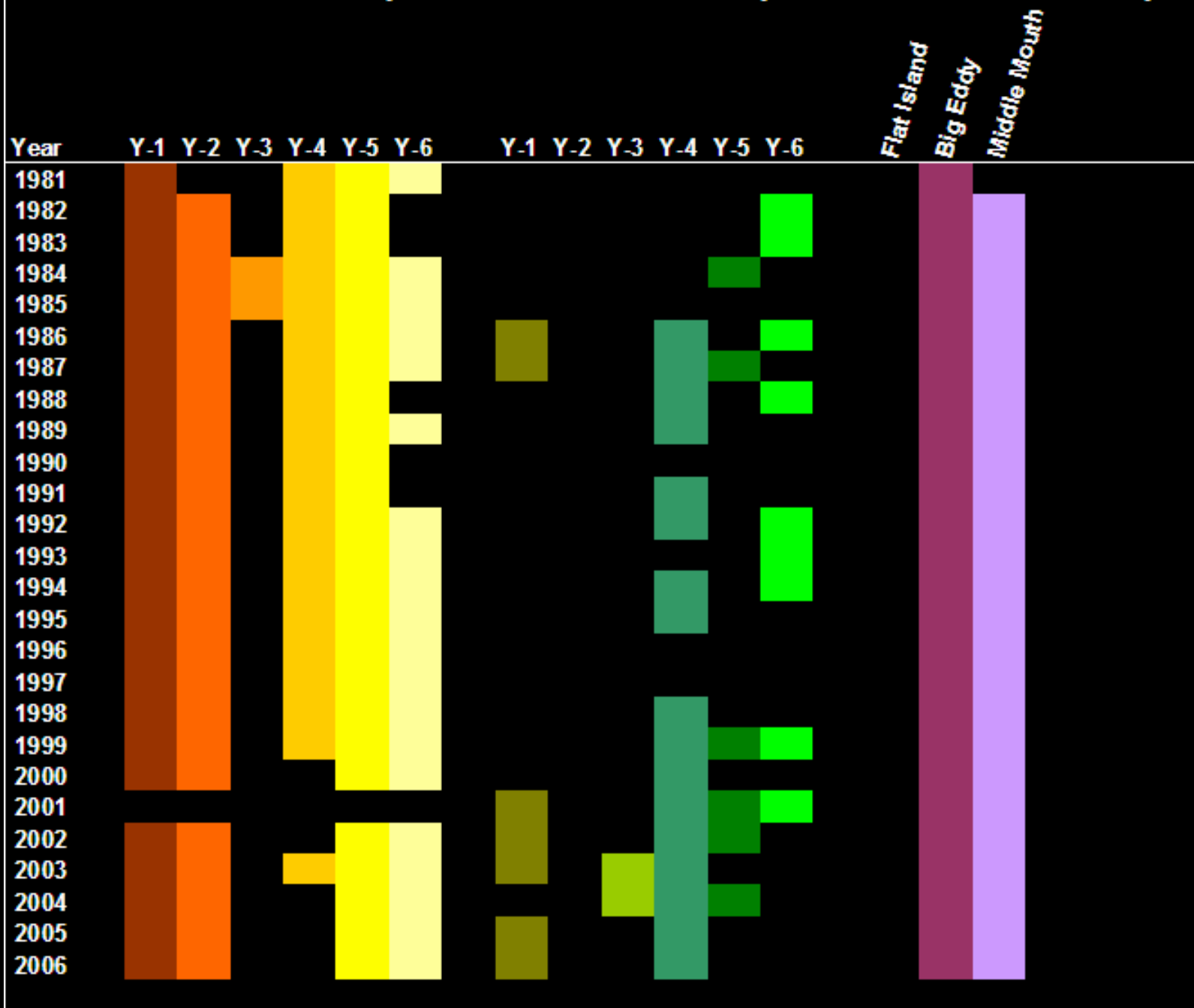
ASL data sampled in Chinook salmon fisheries



Commercial Fishery

Subsistence Fishery

Lower River Test Fishery



ASL Studies



Few Studies on the Yukon River

- Hyer and Schleusner 2005
- Bigler et al. 1996
- JTC Report (Buklis) 1998

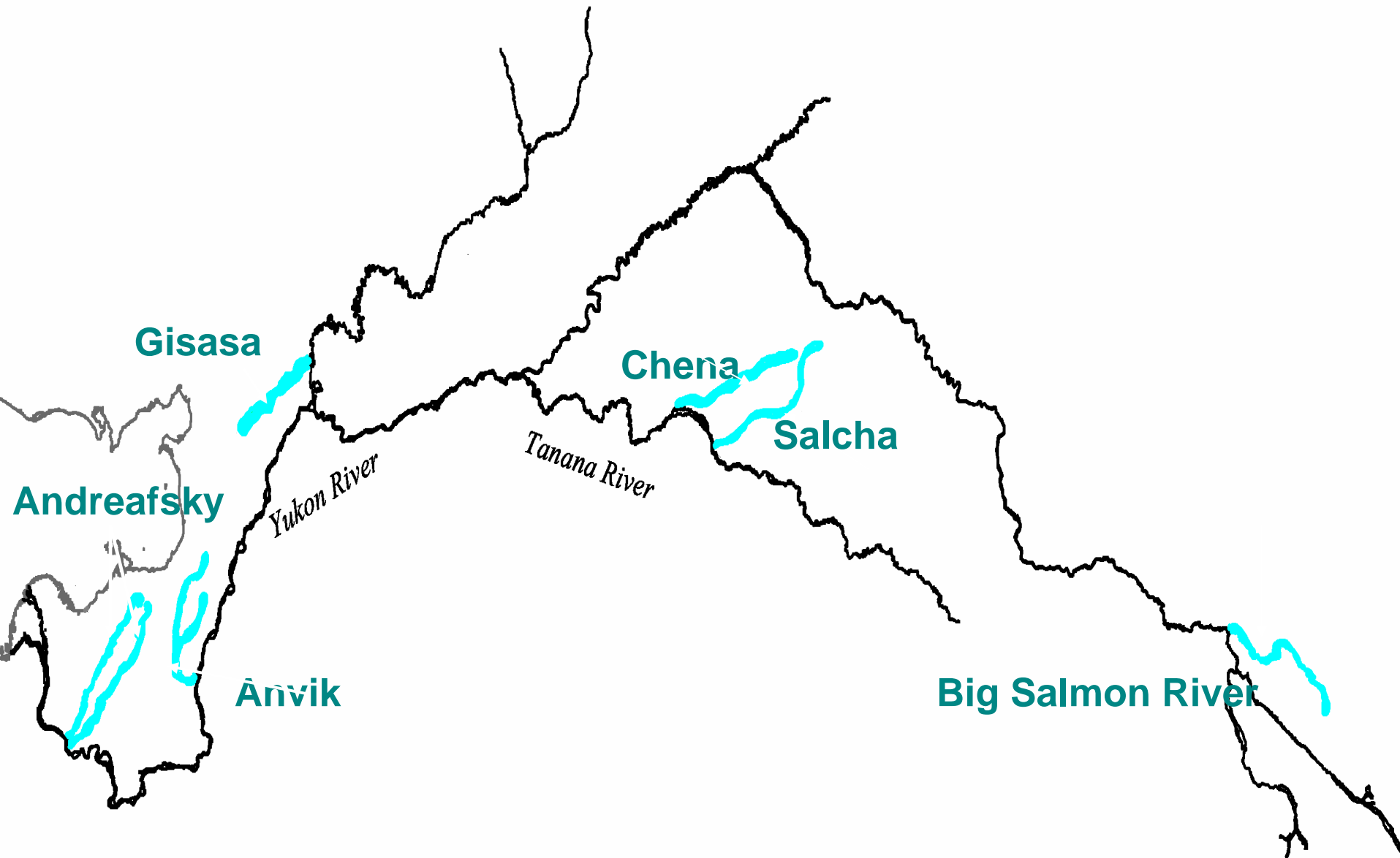
Chinook Salmon ASL Analysis from Selected Escapement Projects

- the proportion of female Chinook,
- the proportion of large (≥ 900 mm) Chinook,
- the proportion of 6- and 7-year-old Chinook,
- the length-at-age of 6- and 7-year-old Chinook.

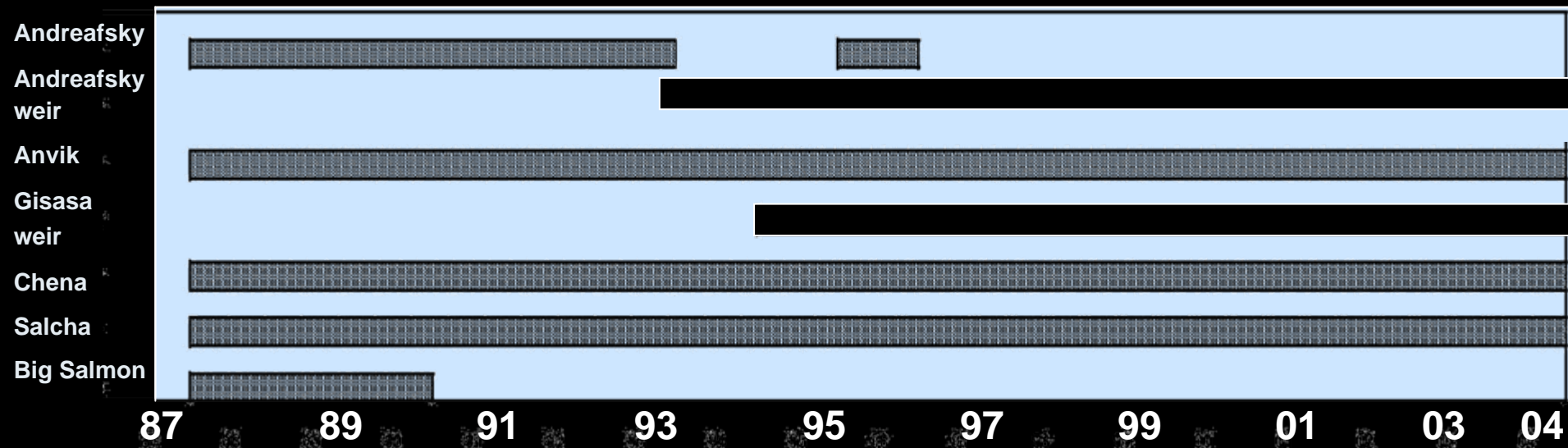
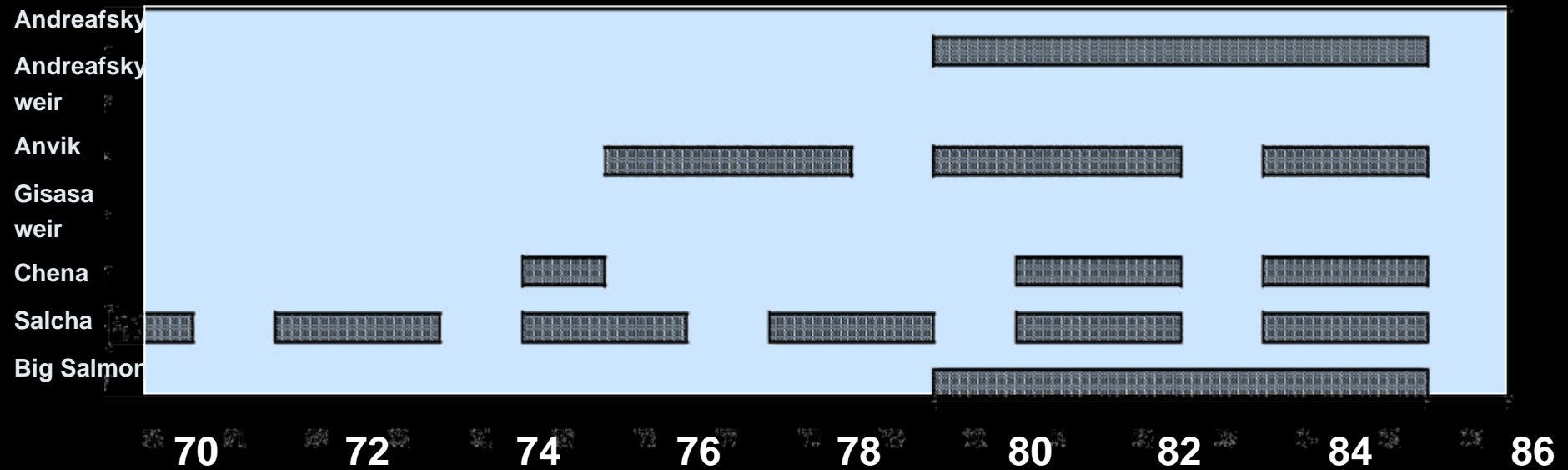
Hyer and Schleusner 2005



ASL Data collected from 6 Yukon River tributaries



Chinook salmon escapement data sets





Objective 1

In **4** of the **7** escapement data sets the proportion of female Chinook salmon significantly changed over time.

No Change

- Andreafsky River Carcass Survey
- Andreafsky River Weir
- Gisasa River Weir

Decreased

- Anvik River Carcass Survey
- Chena River Carcass Survey
- Big Salmon River Carcass Survey

Increased

- Salcha River Carcass Survey

Objective 2



In 4 of the 7 escapement data sets the proportion of large Chinook (≥ 900 mm) significantly decreased over time.

No Change

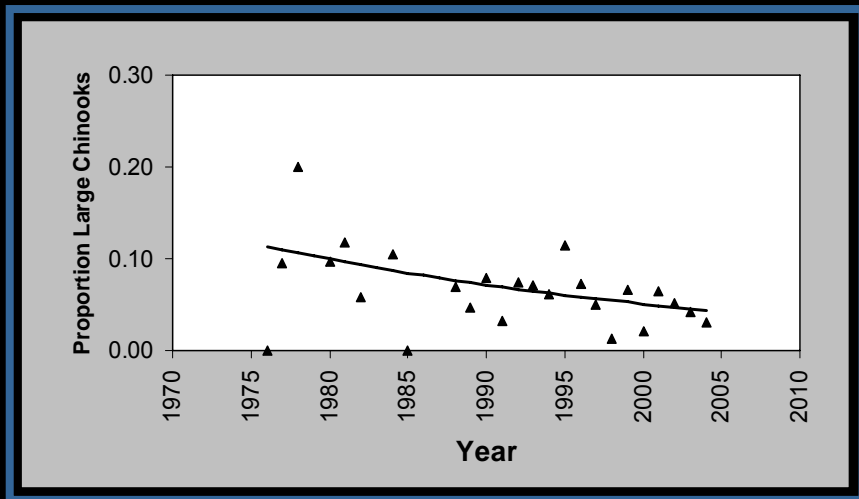
- Andreafsky River Carcass Survey
- Andreafsky River Weir
- Gisasa River Weir

Decreased

- Anvik River
- Chena River
- Salcha River
- Big Salmon

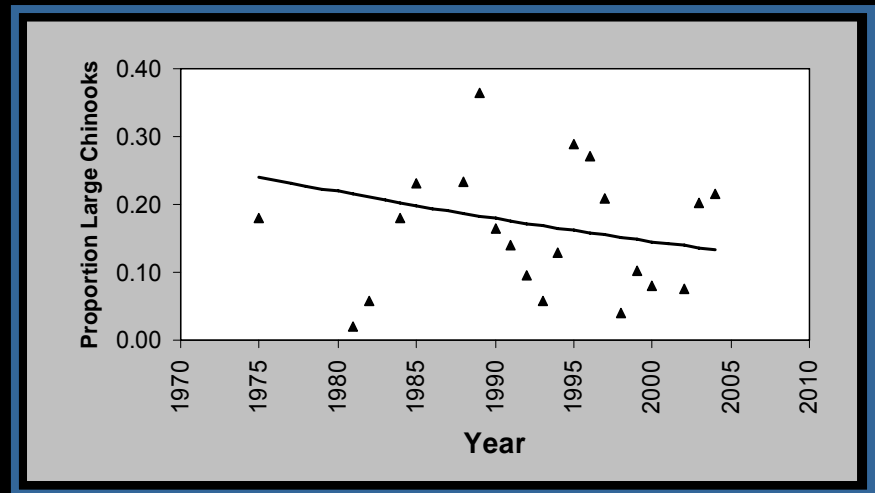
Rivers showing a decreasing trend in the proportion of large (≥ 900 mm) Chinook salmon over time.

Anvik River Carcass Survey



The proportion of large Chinook salmon sampled decreased **4%** per year.

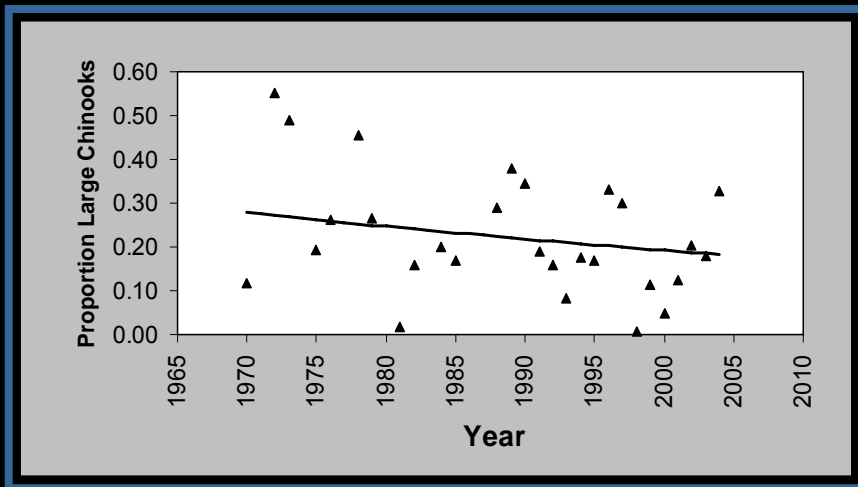
Chena River Carcass Survey



The proportion of large Chinook salmon sampled decreased **2%** per year.

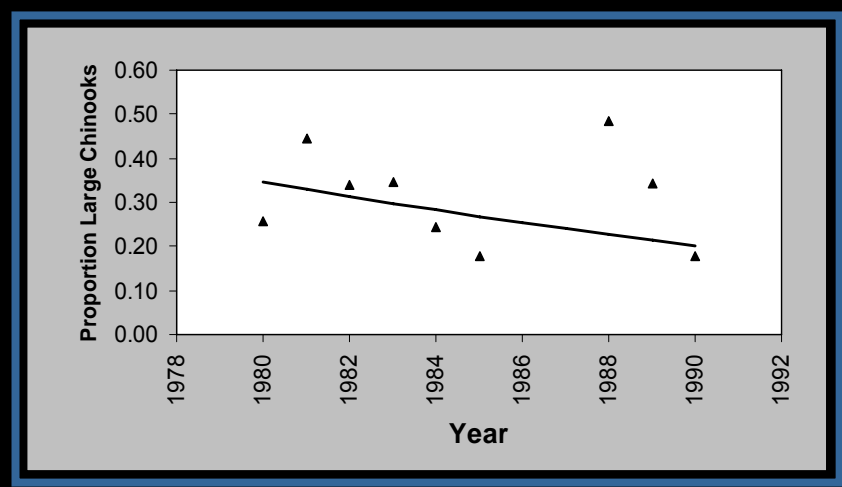
Rivers showing a decreasing trend in the proportion of large (≥ 900 mm) Chinook salmon over time.

Salcha River Carcass Survey



The proportion of large Chinook salmon sampled decreased 2% per year.

Big Salmon River Carcass Survey



The proportion of large Chinook salmon sampled decreased 7% per year.

Objective 3



In 3 of the 7 escapement data sets the proportion of 6-year-old Chinook salmon significantly changed over time.

No Change

- Andreafsky River Carcass Survey
- Andreafsky River Weir
- Gisasa River Weir
- Chena River Carcass Survey

Decreased

- Anvik River Carcass Survey
- Big Salmon River Carcass Survey

Increased

- Salcha River Carcass Survey

Objective 3



In 2 of the 7 escapement data sets the proportion of 7-year-old Chinook salmon significantly changed over time.

No Change

- Andreafsky River Carcass Survey
- Andreafsky River Weir
- Anvik River Carcass Survey
- Gisasa River Weir
- Salcha River Carcass Survey

Decreased

- Chena River Carcass Survey

Increased

- Big Salmon River Carcass Survey

Objective 4

10 of the **27** escapement data sets showed significant changes in the length-at-age for 6- and 7-year-old male and female Chinook Salmon.

	No Change	Decrease	Increase
Andreafsky River Carcass Survey	6-year male 7-year male / 7-year female	6-year female	
Andreafsky River Weir	6-year male / 6-year female 7-year female		
Anvik River Carcass Survey	6-year male 7-year female / 7-year male	6-year female	
Gisasa River Weir	6-year male / 6-year female 7-year male / 7-year female		
Chena River Carcass Survey	6-year male 7-year male / 7-year female		6-year female
Salcha River Carcass Survey	6-year female	6-year female 7-year male / 7-year female	
Big Salmon River Carcass Survey		6-year male / 6-year female 7-year male / 7-year female	

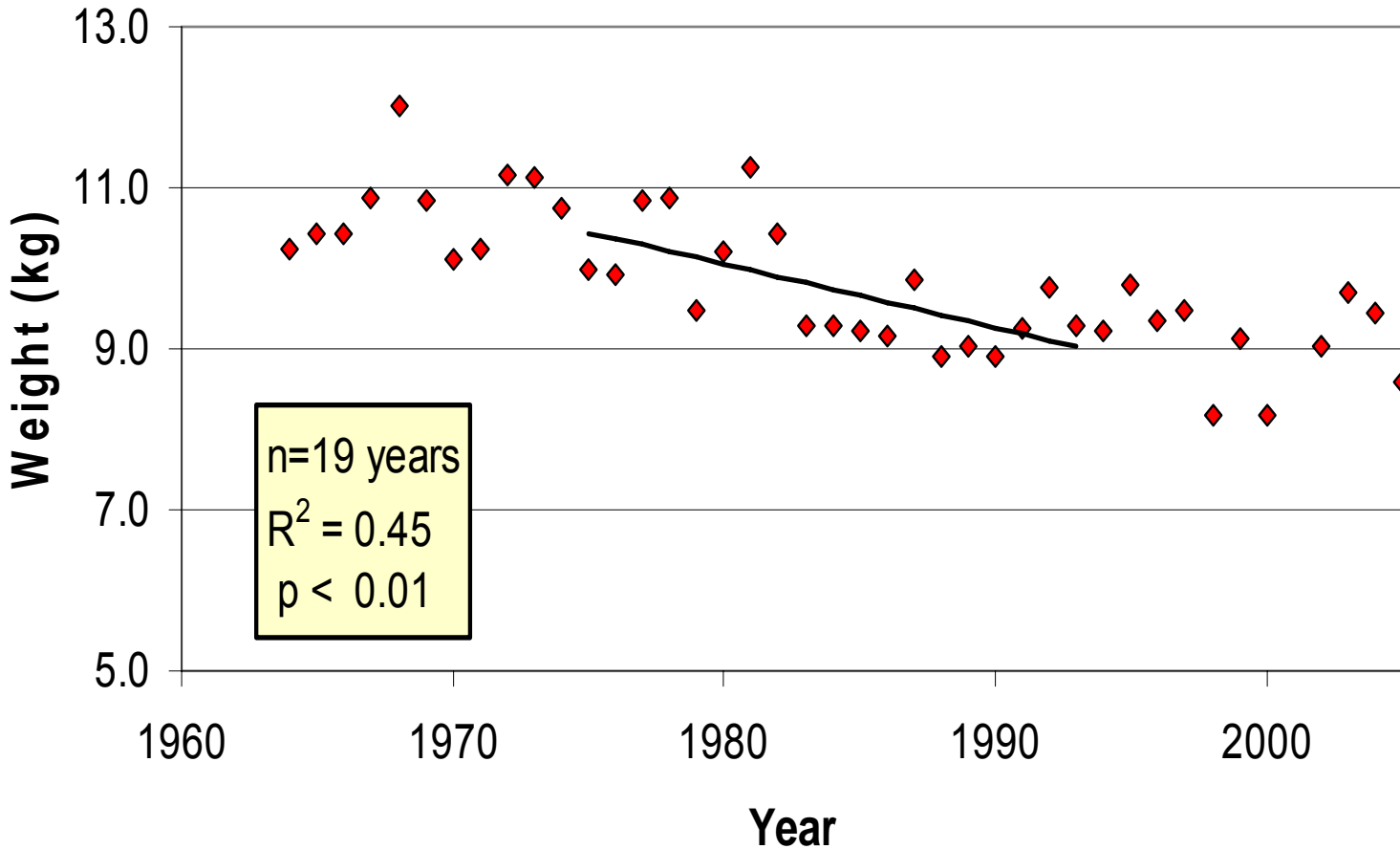
Conclusions

- the proportion of female Chinook,
 - » 1 increased, 3 decreased, 3 no change
- the proportion of large (≥ 900 mm) Chinook,
 - » 4 decreased, 3 no change
- the proportion of 6- and 7-year-old Chinook,
 - » 1 increased, 2 decreased, 4 no change
- the length-at-age of 6- and 7-year-old Chinook.
 - » 9 out of 27 decreased

Hyer and Schleusner 2005

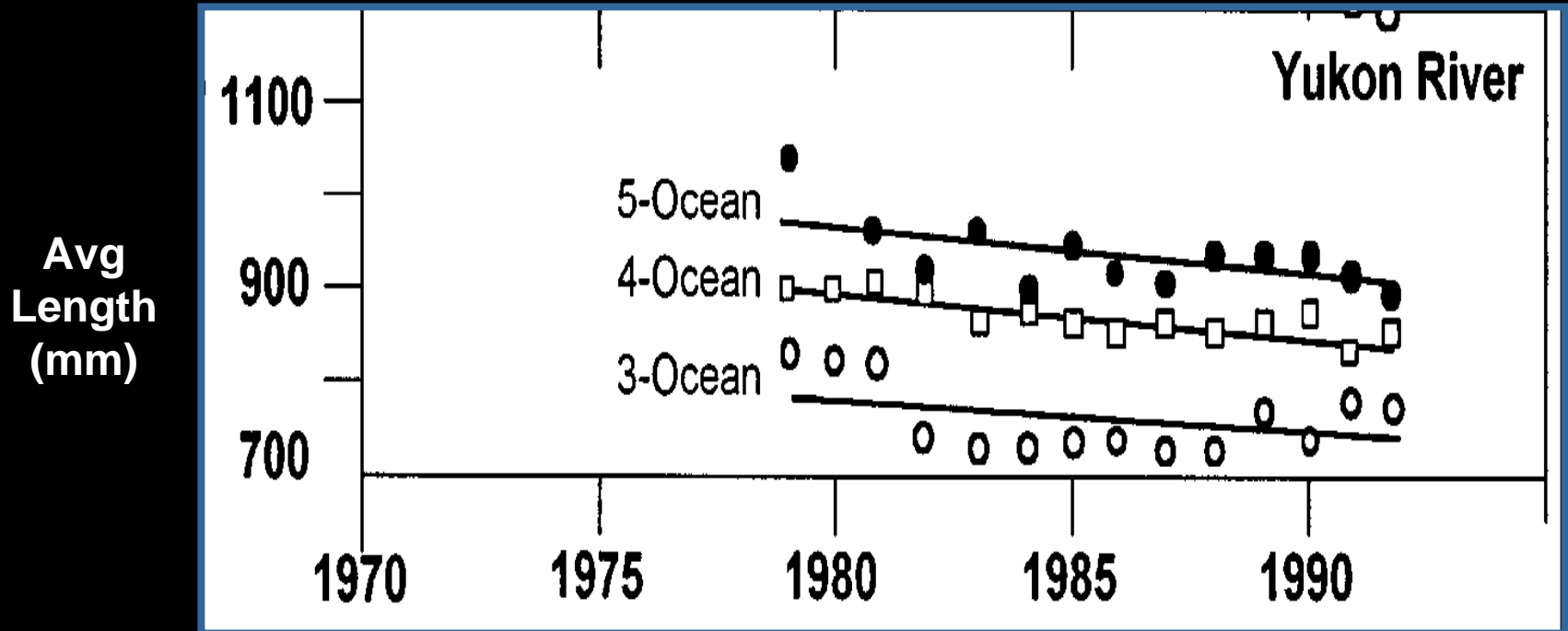


Commercial Weights Analysis



Bigler et al 1996

Change in Average Length and Age of Chinook



Age-6 -5.5%

Age-5 -2.8%

Age-4 -3.8%

Bigler et al 1996

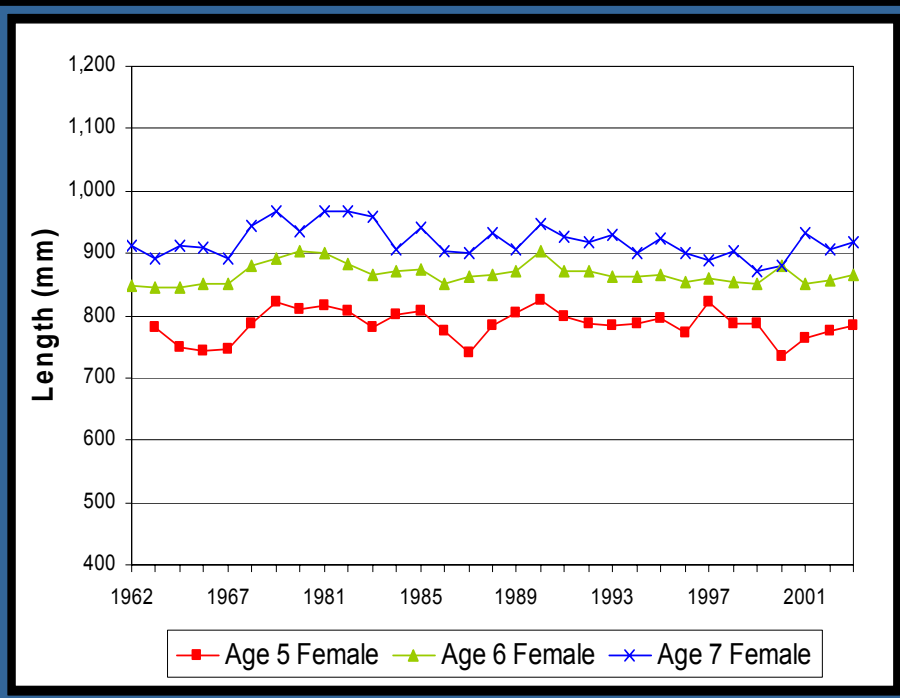
JTC 1998

- Compiled available information on Yukon River Chinook ASL composition
- Examined length-at-age
 - Y-1 commercial fishery (1962, 1964-1968, 1979-1997)
 - Big Eddy test fishery (1979-1997)
 - Andrafsky River (1981-1997)
 - Salcha River (1982-1997)
 - Canadian border fish wheel (1974-1996)
 - Canadian commercial fishery (1975-1996).

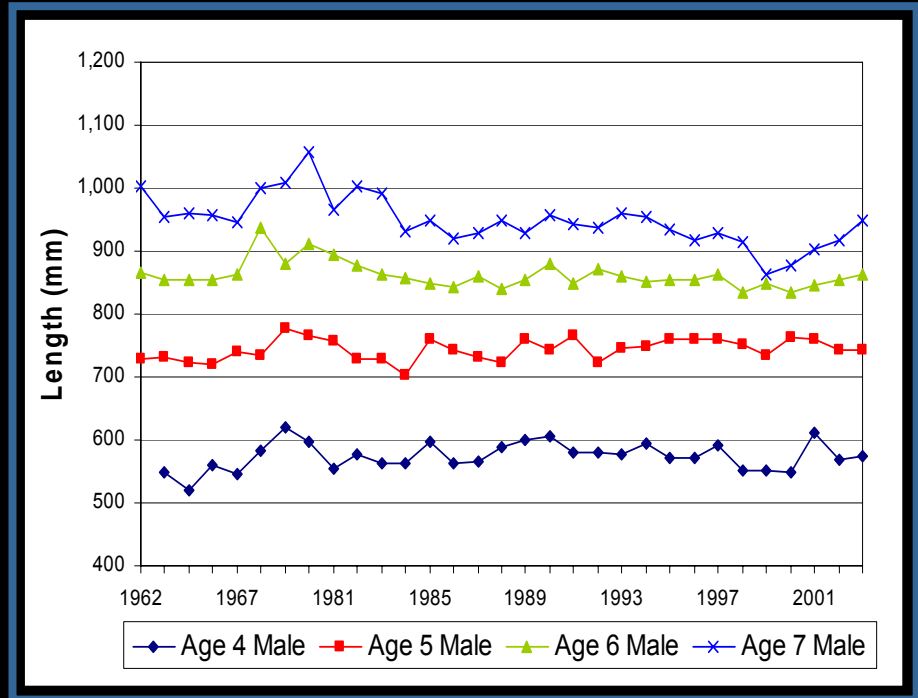
Mean Length by Age

Y-1 Commercial Harvests, Unrestricted Mesh

Females



Males



Net Selectivity



Background

- Intuitively, large mesh nets catch large fish
 - Verified in numerous investigations
- Most published selectivity studies involve commercially exploited marine species
- Published salmon studies limited
 - North Pacific (NPFC, 1960s)
 - British Columbia (Fraser, Skeena)
 - Yukon River



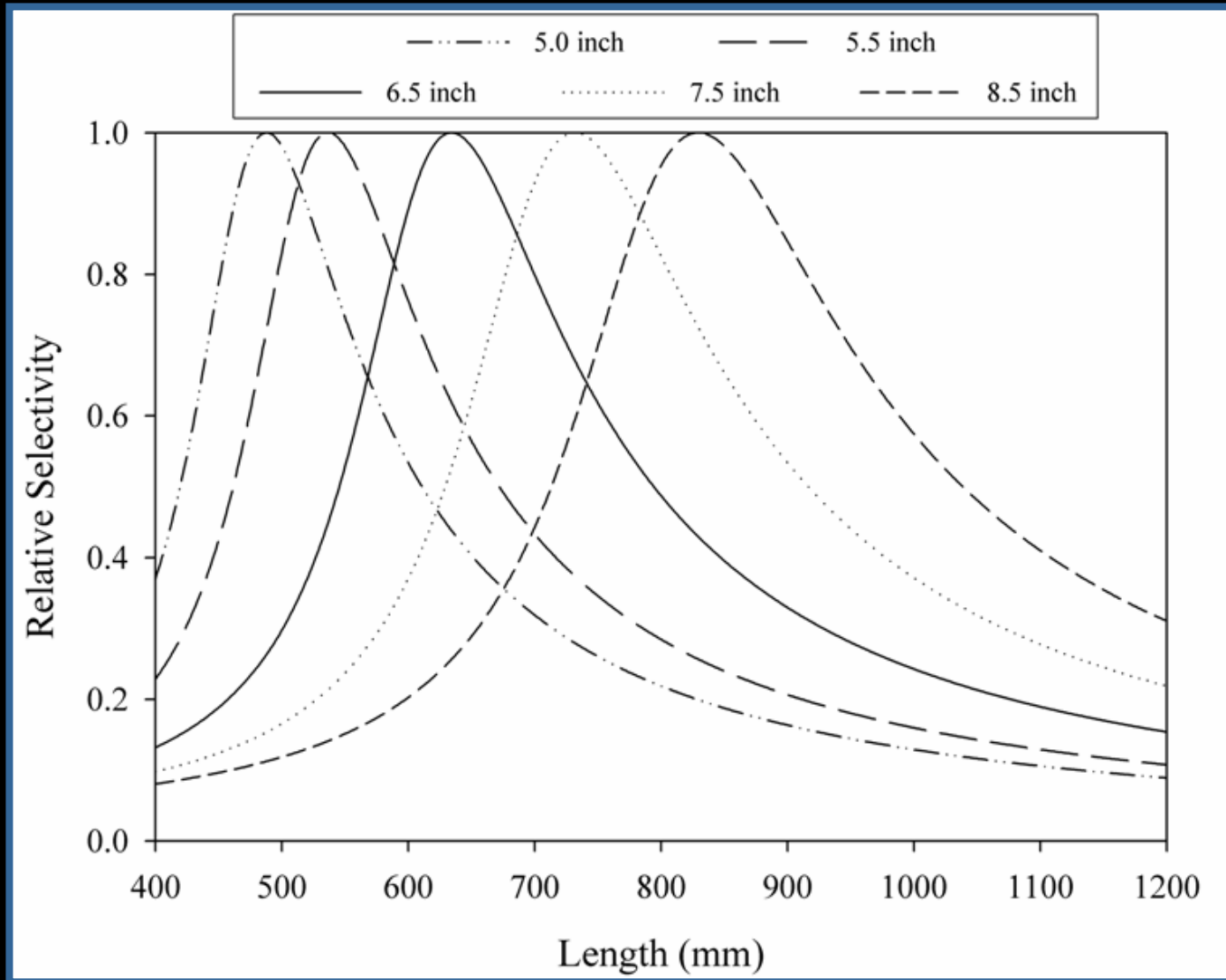
Yukon River Net Selectivity

- ADF&G initiated selectivity studies to apportion sonar estimates of fish passage to species
- Unique data set for estimating salmon selectivity
 - Data base extends back to 1990
 - Multiple meshes from 2.75 to 8.5 inch
 - Contained over 92,000 records through 2003



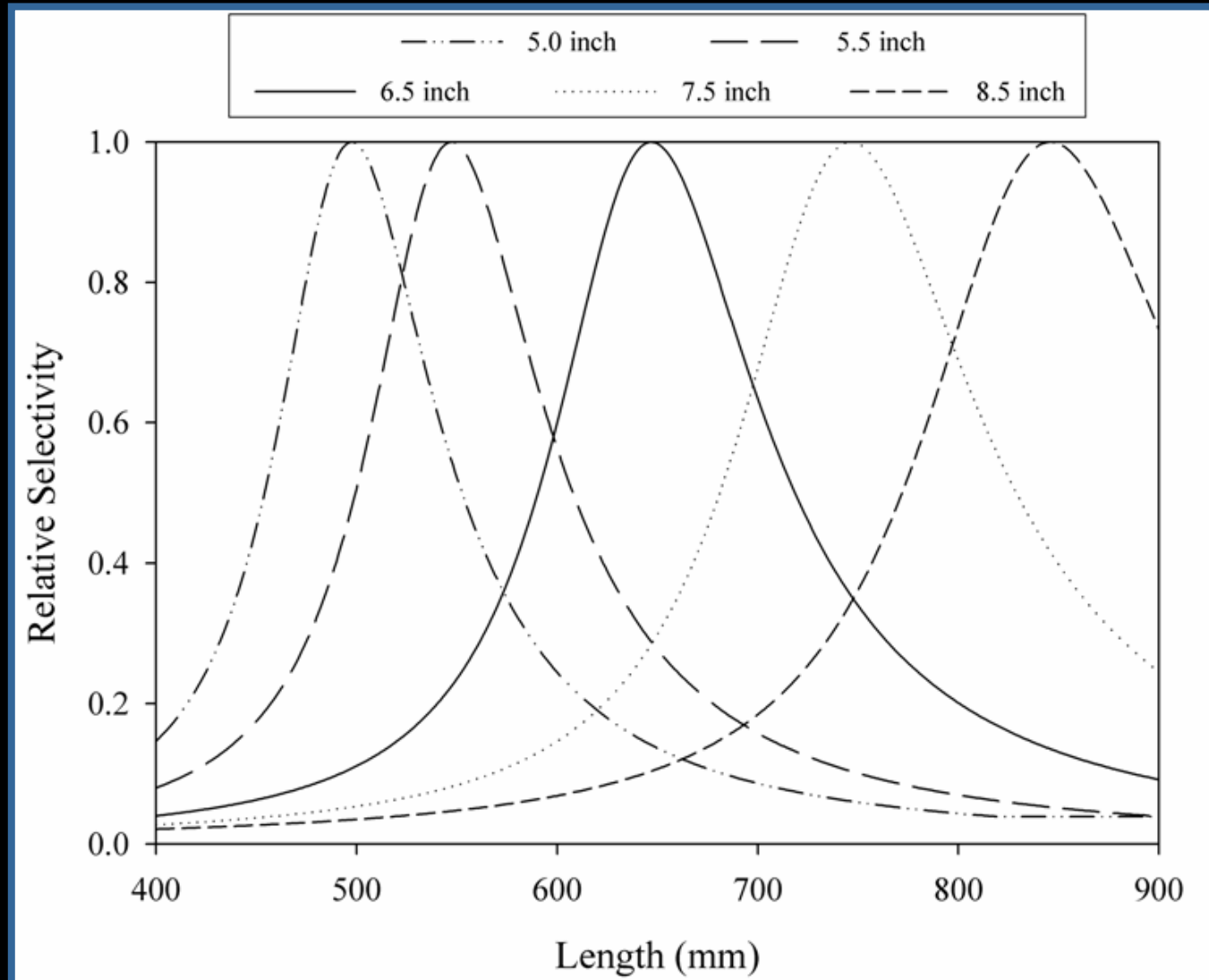
Estimated Selectivity

Chinook salmon



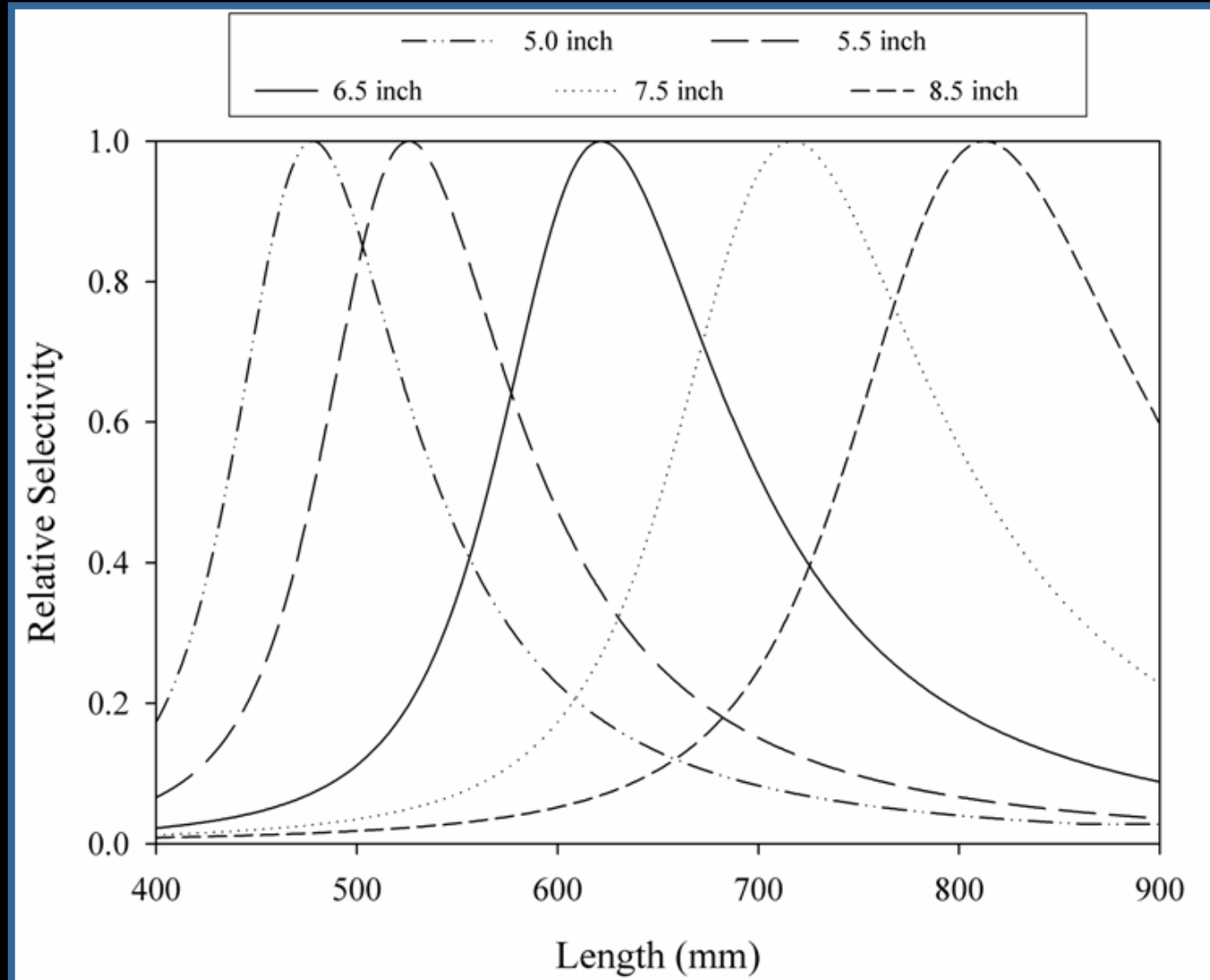
Estimated Selectivity

Summer chum salmon



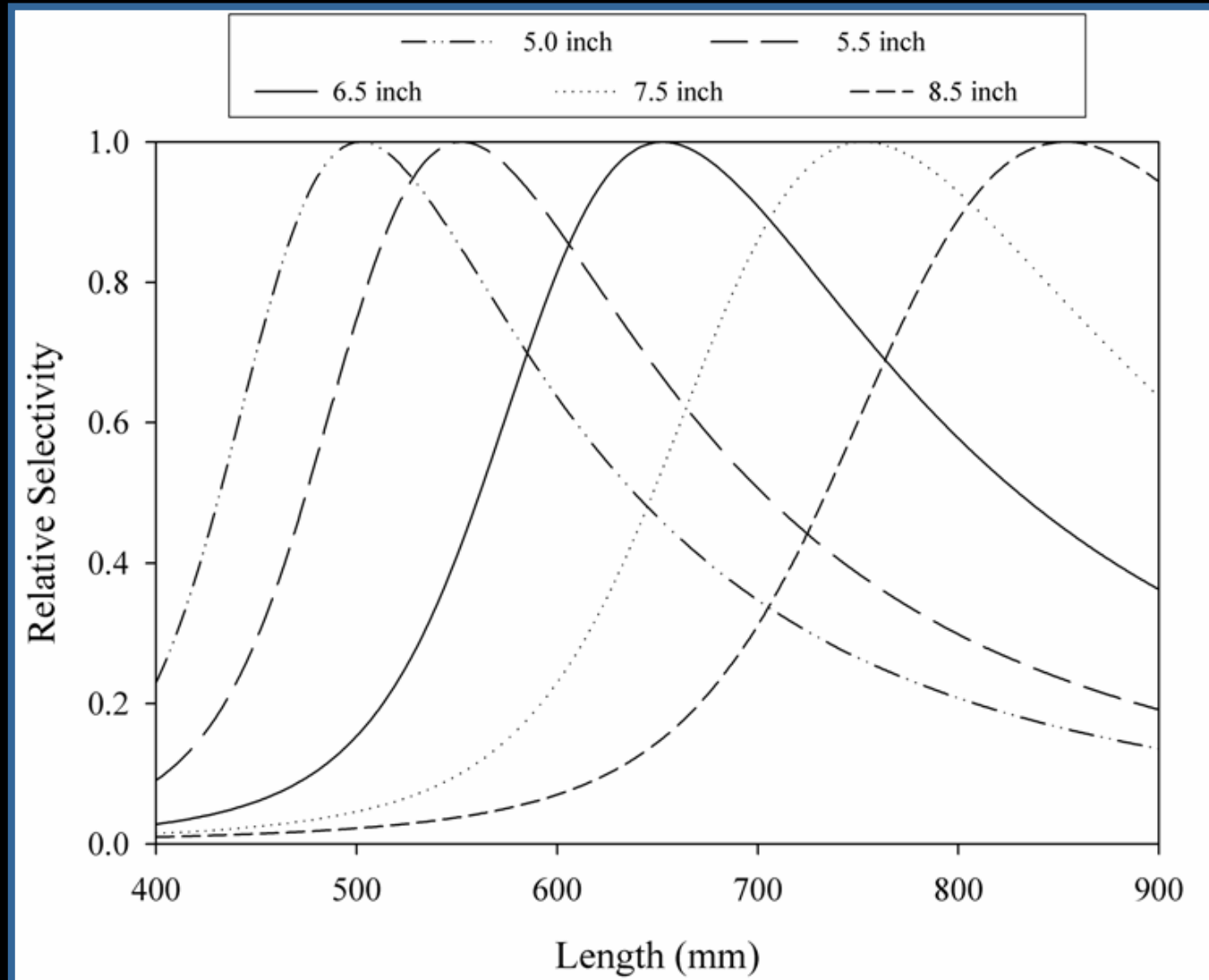
Estimated Selectivity

Fall chum salmon



Estimated Selectivity

Coho salmon



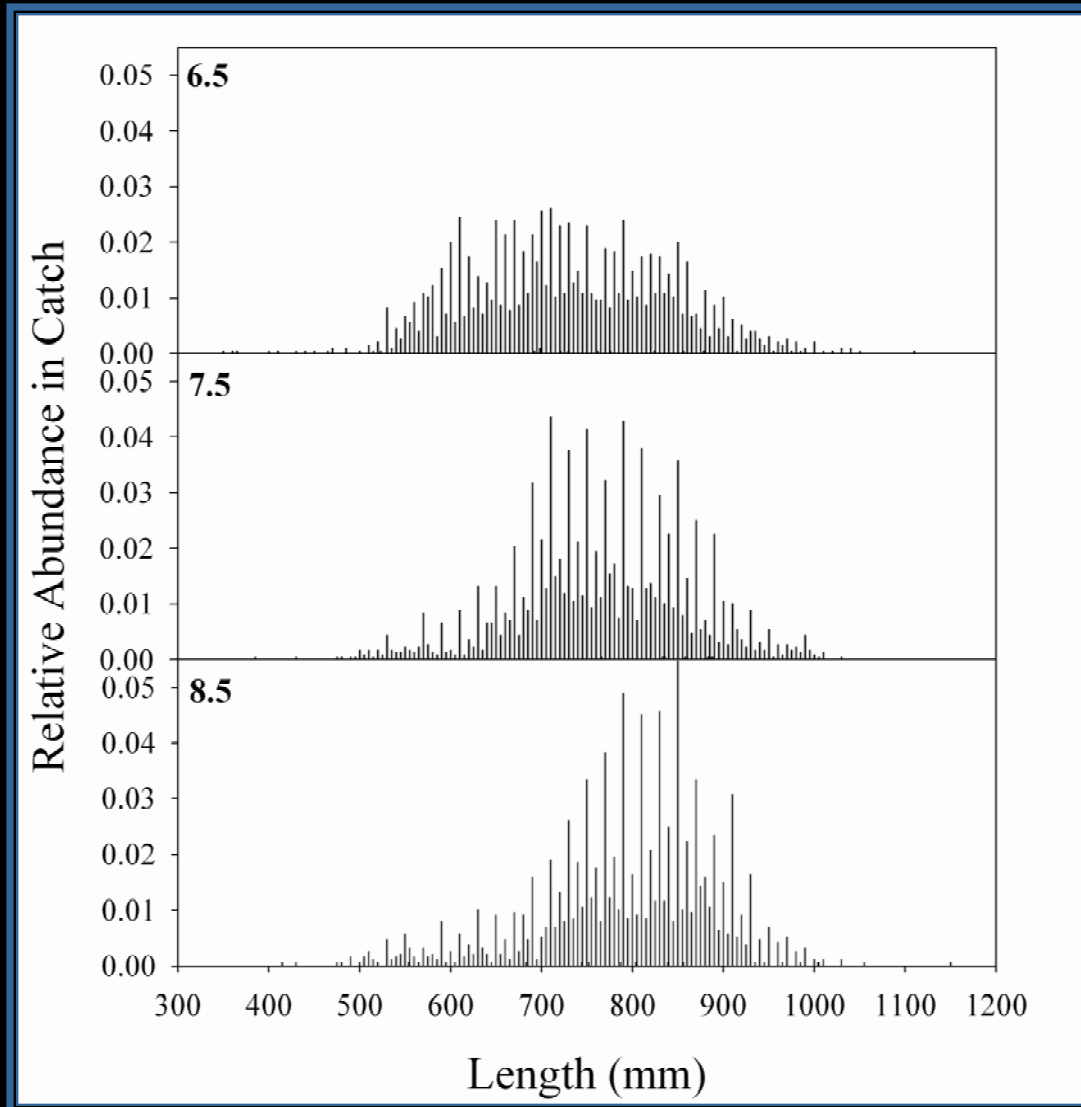
Things to note

- Gillnets tend to have peak efficiency for salmon with $length = 3.8 \times stretch\ mesh$
- Any sized mesh can catch a fish of nearly any size
- What is caught depends on
 - Selectivity of the net
 - The size of fish present



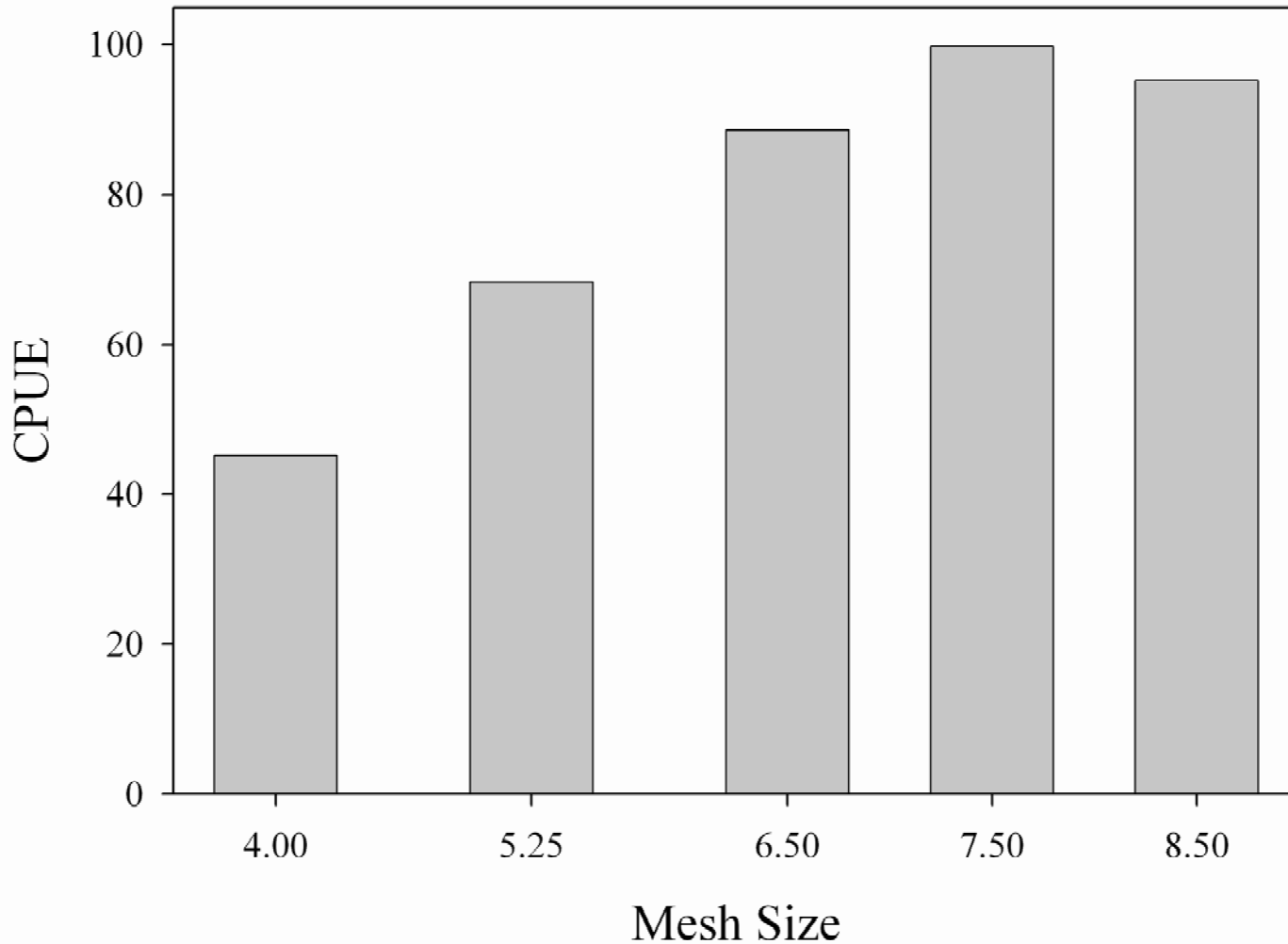
Example 1

Lengths of Chinook Caught by Different Mesh Sizes



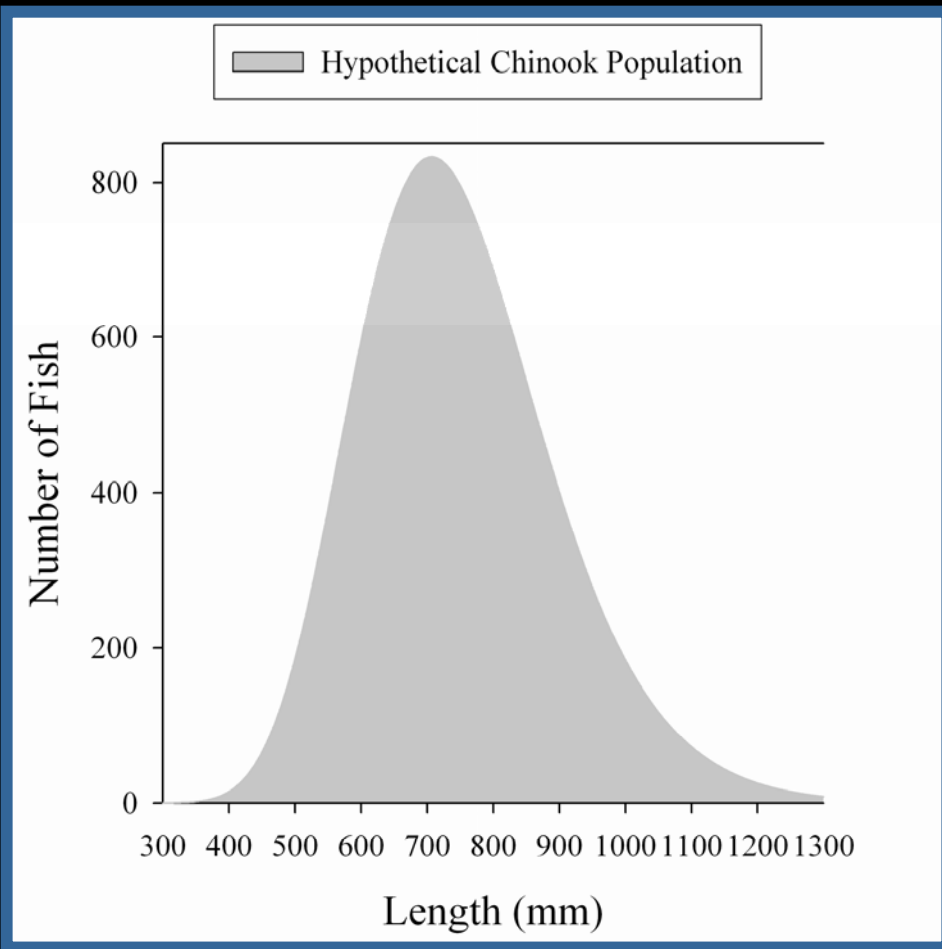
Example 2

Chinook CPUE by Mesh



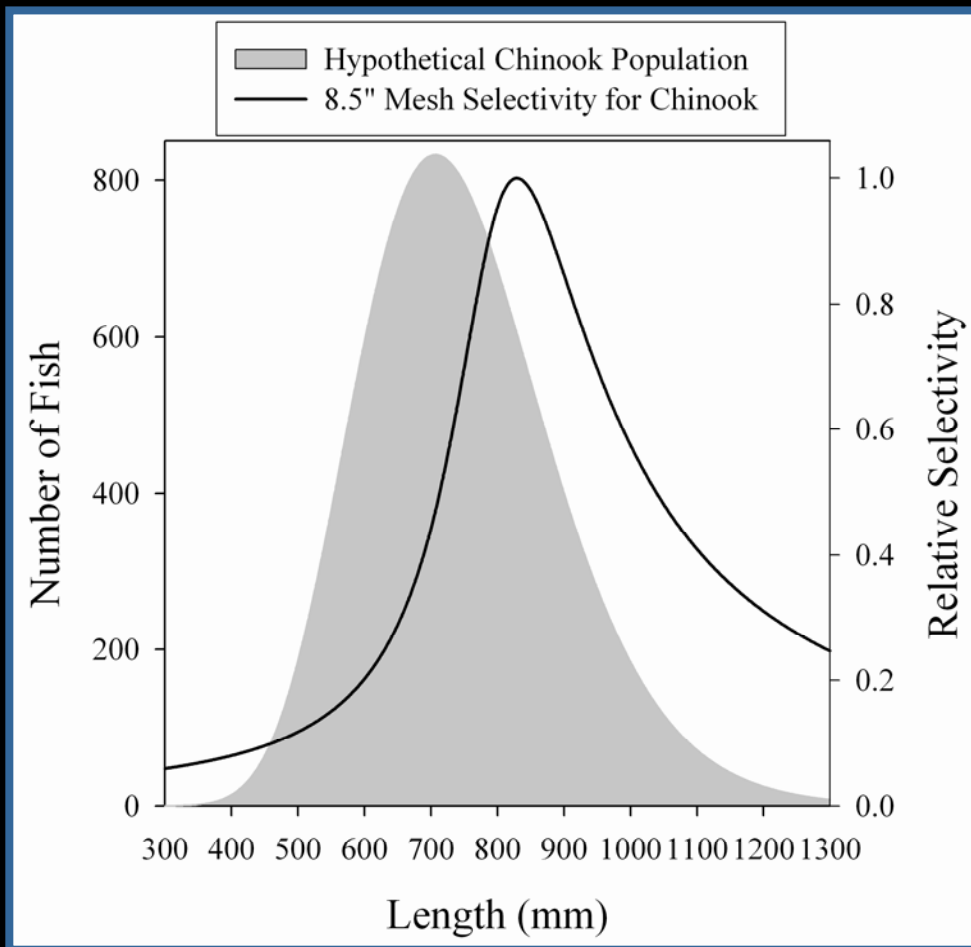
Example 3

Hypothetical Chinook Population



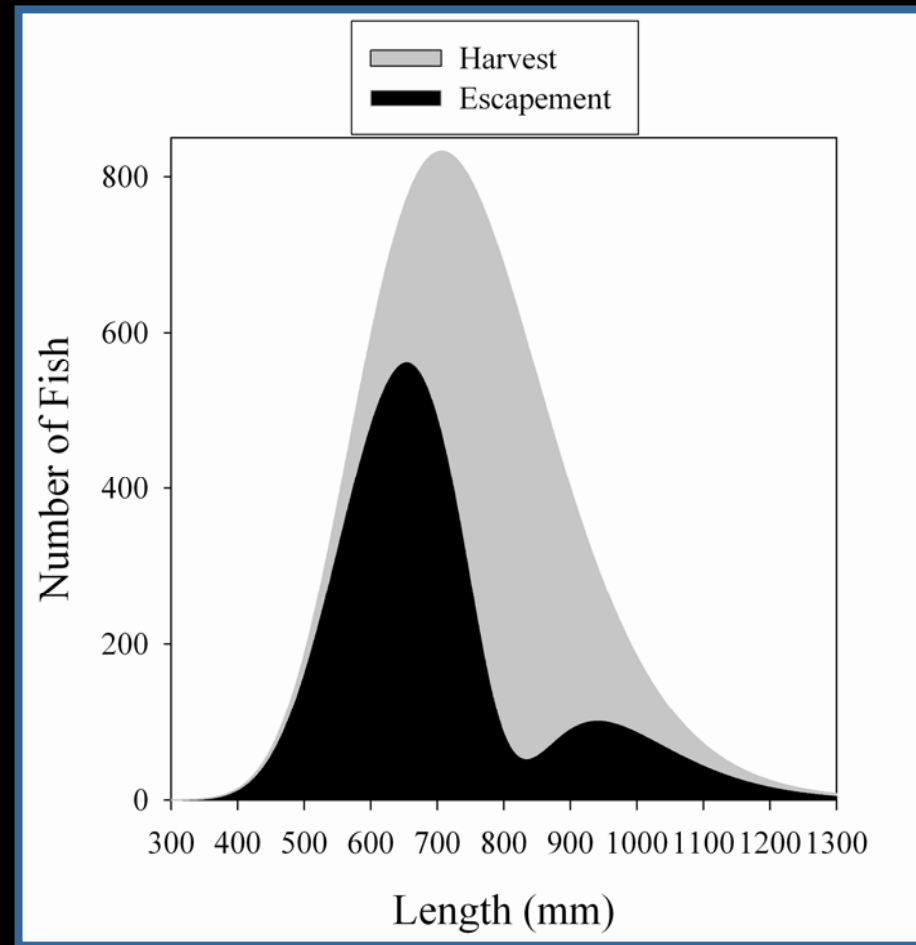
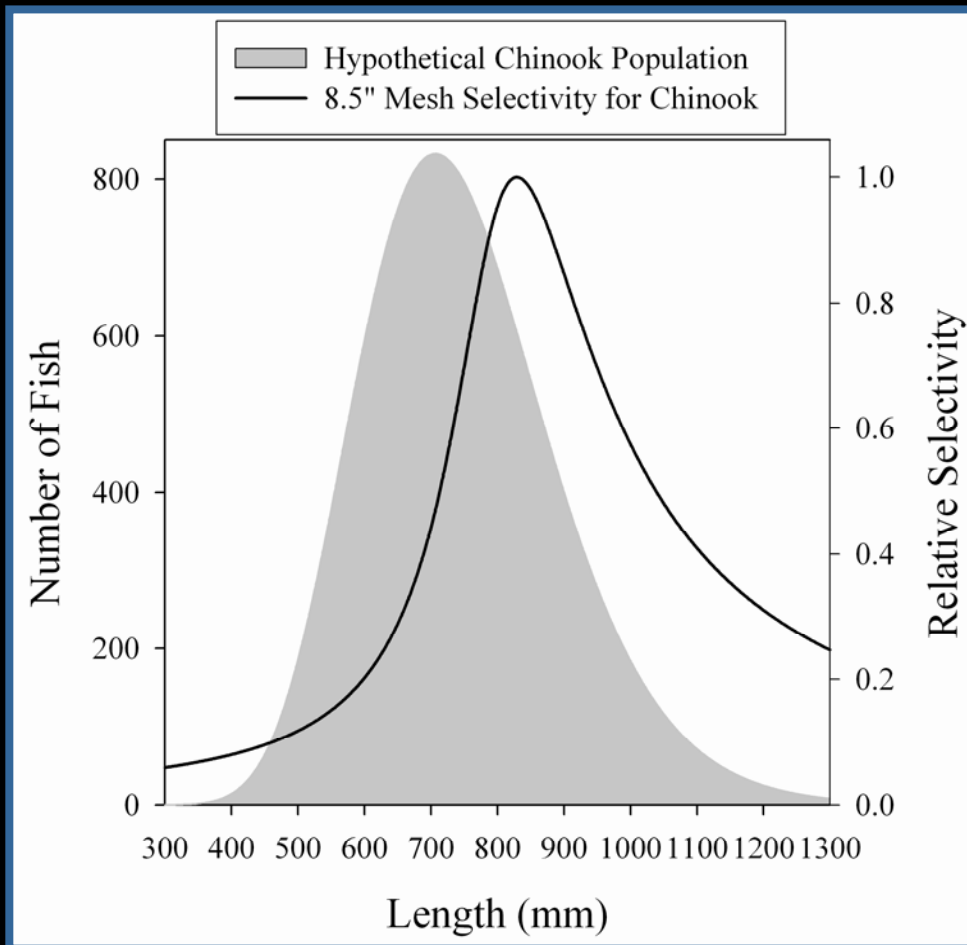
Example 3

Hypothetical Chinook Population



Example 3

Effect of 50% Exploitation



Heritability



Heritability

- Heritability measures the degree to which traits pass from one generation to the next
- Fish traits documented to be heritable
 - Body size and shape
 - Age of return
 - Gender
 - Run-timing
 - Resistance to disease
 - Ability to home



Ocean



Ocean

- Potential oceanic influences
 - Nutrient mixing by winter storms
 - Timing of ice-out
 - Water temperature
 - Availability of prey
 - Competition (hatchery)
 - Timing of entry to sea
 - By-catch



Summary



Summary

- Cause of change difficult to prove
- Management may need to be more precautionary and remain flexible
 - Balance short and long term benefits, uncertainty, and risk

Next Steps

- Develop a set of hypotheses

Thank You!

