Science, Service, Stewardship

Effects of fishing on availability of Chinook salmon to resident killer whales

Robert Kope
NMFS NW Fishery Science Center

September 25, 2012

NOAA FISHERIES SERVICE

NOAA
FISHERIES
SERVICE

What are the impacts of fisheries on Chinook availability?

- The value of 20% is mentioned in the panel's draft report, both as an average harvest rate on Chinook, and as an expected increase in abundance in the absence of fishing. This value has drawn criticism in the comments submitted.
  - What is the origin of this number?
  - How appropriate is it?

NOAA FISHERIES SERVICE

Where did 20% come from?

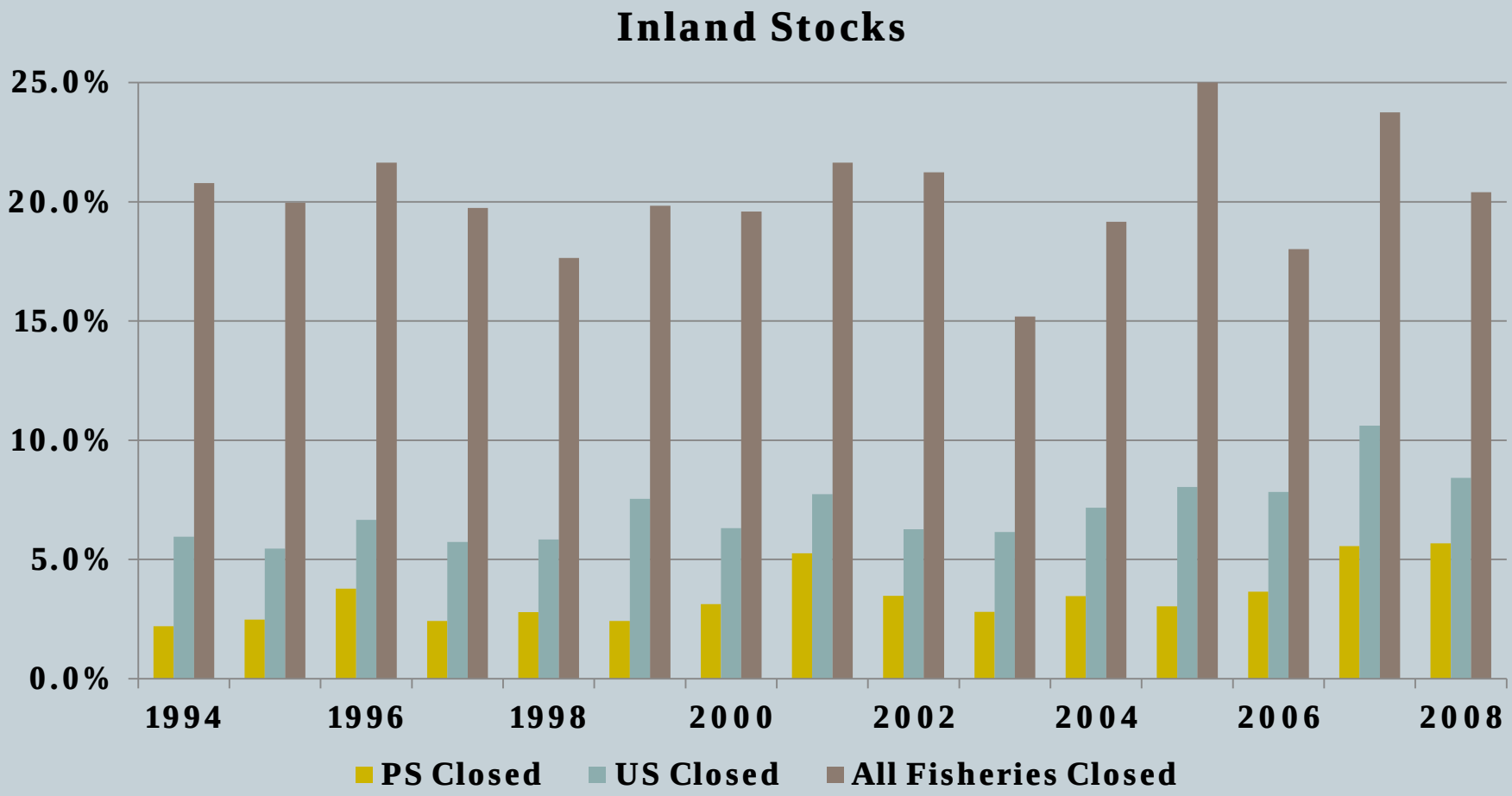
- NMFS Biological Opinion for Puget Sound Chinook Resource Management Plan (May 24, 2011).
  - Used FRAM and average energy content of Chinook to estimate impacts, with no fishing as a baseline.
  - Evaluated the reduction in available “inland origin” Chinook to SRKW during FRAM time periods.
  - From 1994 through 2008, the reduction due to all fisheries in the July-Sept time period ranged from 17.4% to 22.5% with average of 19.8%.

NOAA
FISHERIES
SERVICE

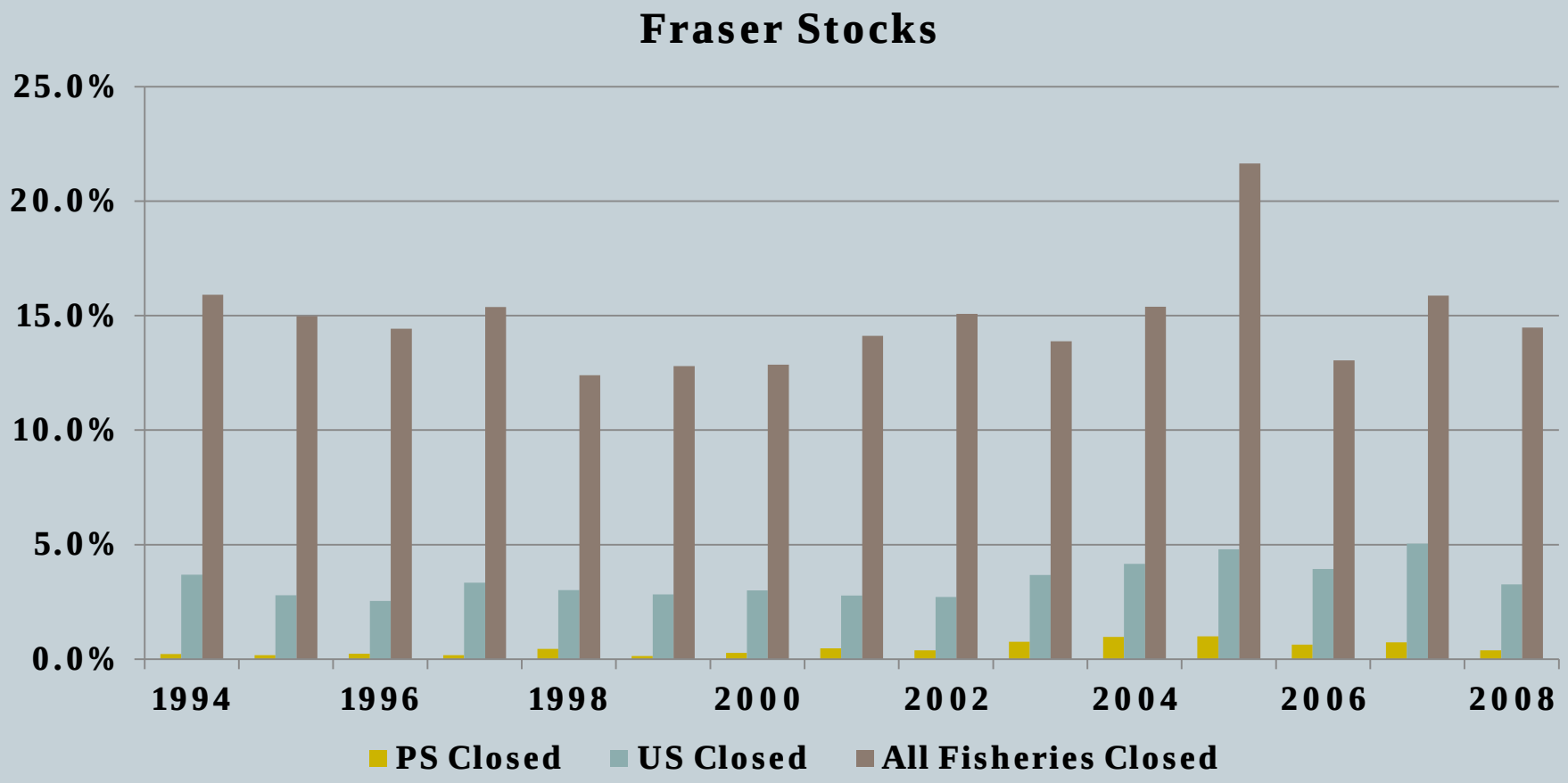
Where did 20% come from?

- Hagen-Breaux – Workshop II
  - Used FRAM with Puget Sound, Fraser River and Lower Georgia Strait stocks.
  - Evaluated the increase in numbers of mature age 4 and age 5 fish resulting from closure of fisheries.
  - Included all marine area fisheries including most Puget Sound fisheries

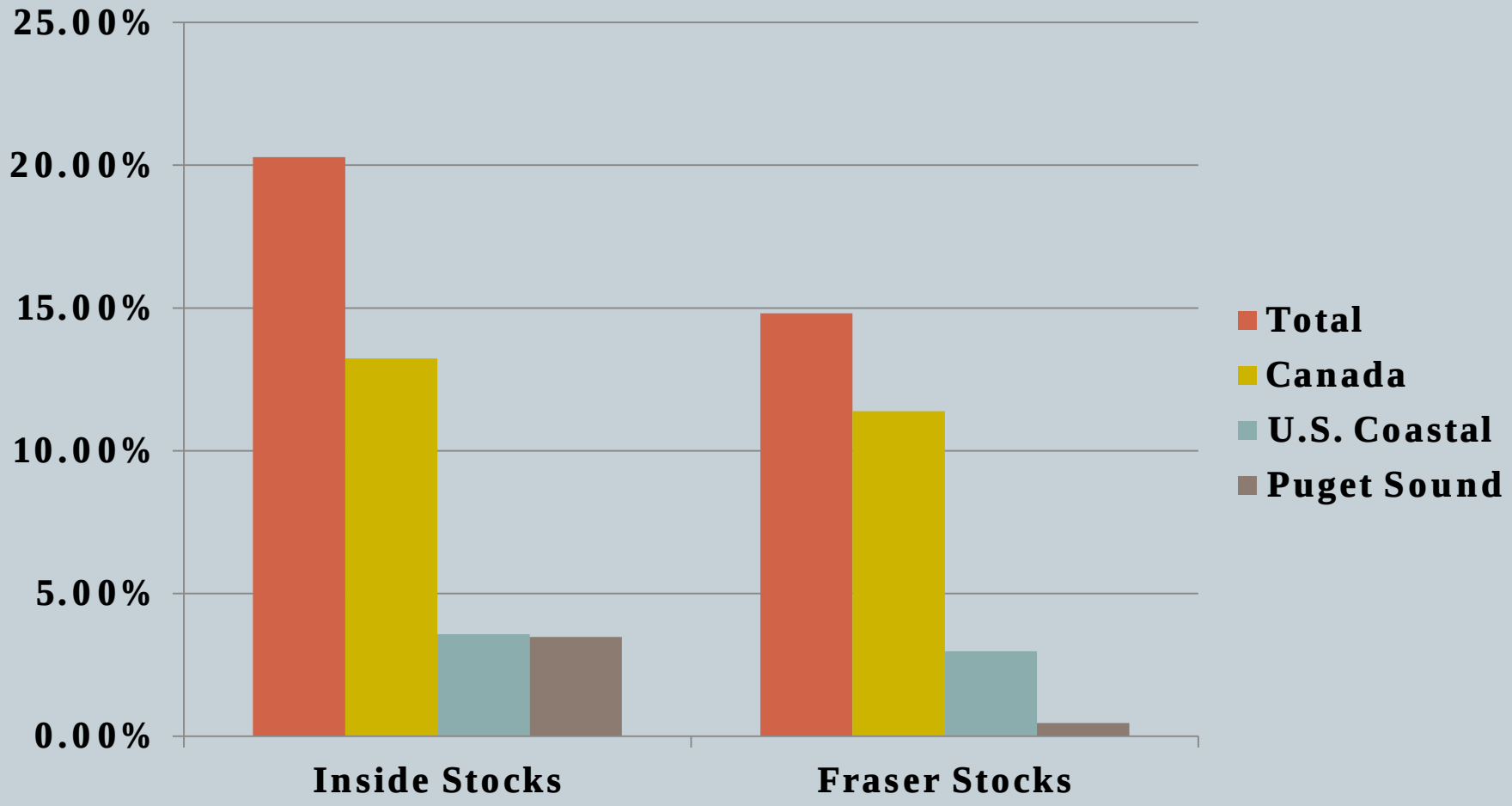
% Increase of Mature Four and Five Year Old Chinook from Marine Fisheries Closures



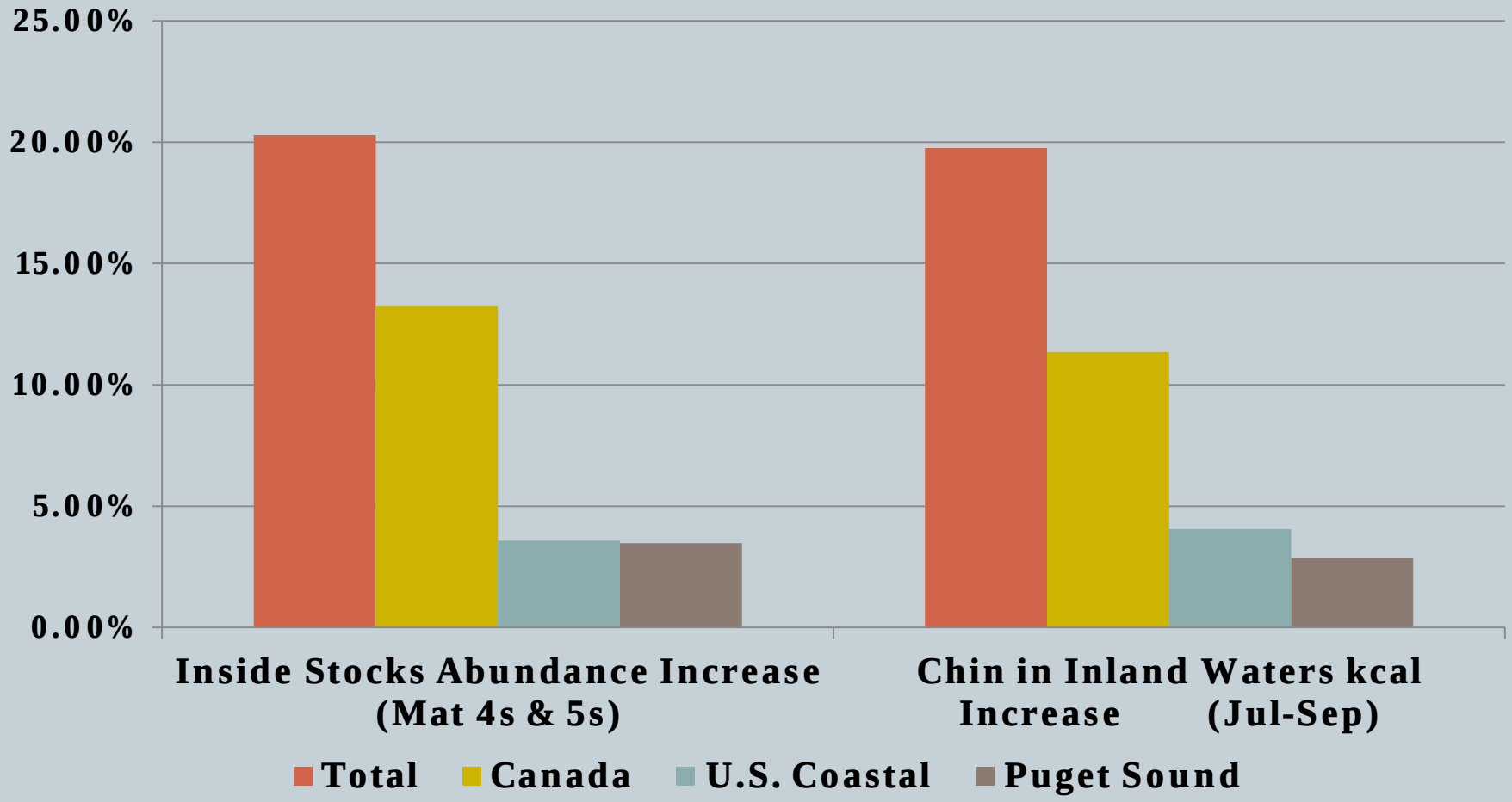
% Increase of Mature Four and Five Year Old Chinook from Marine Fisheries Closures



Average % Increase of Mature Four and Five Year Old Chinook from Marine Fisheries Closures



Comparison of Increases from Fisheries Closures between Mature Run Analysis and kcal Analysis



NOAA
FISHERIES
SERVICE

Where did 20% come from?

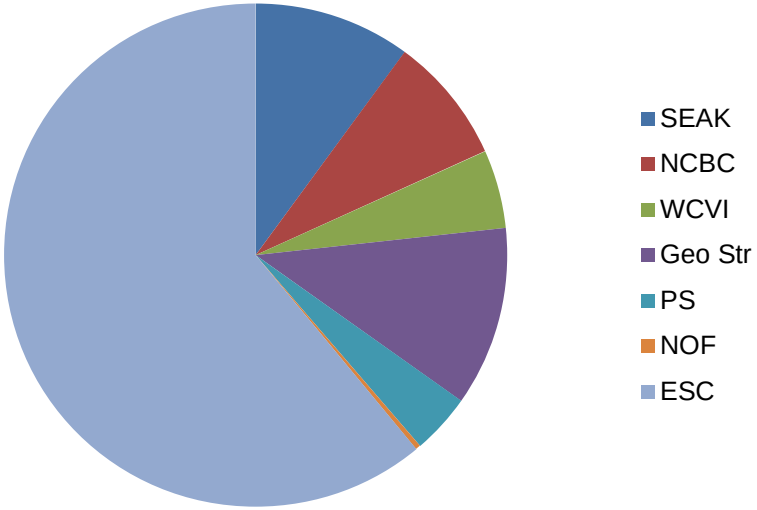
- Ward Workshop II - Quantifying fishing impacts on past and future killer whale growth rates.
  - Used 20% increase in Chinook abundance as an example for demonstration purposes.
  - This increase was applied to aggregate of fall runs (without California stocks) using “Parken-Kope” indices

NOAA
FISHERIES
SERVICE

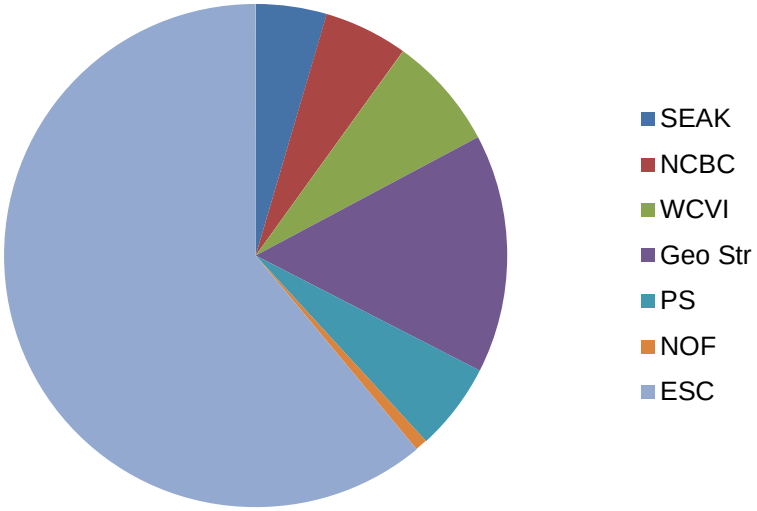
How appropriate is 20%?

- Harvest impacts make up more than 20% of the "Parken-Kope" indices for these stocks, and of the distribution of impacts in the CTC exploitation rate analysis.

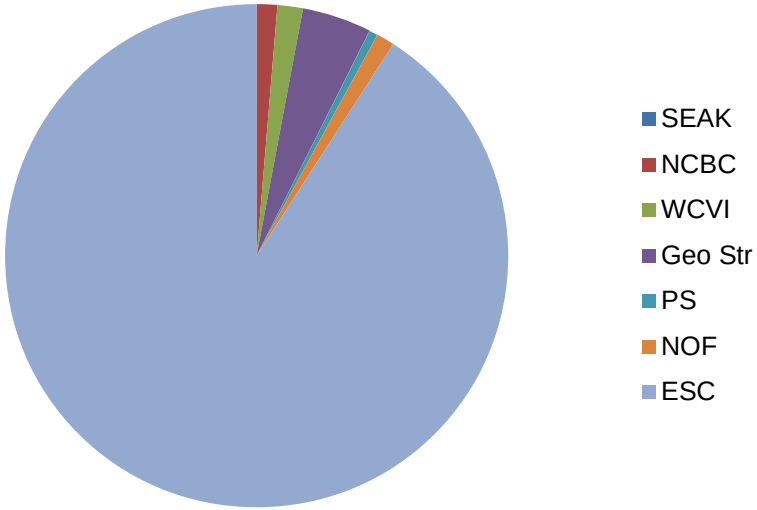
Georgia Strait



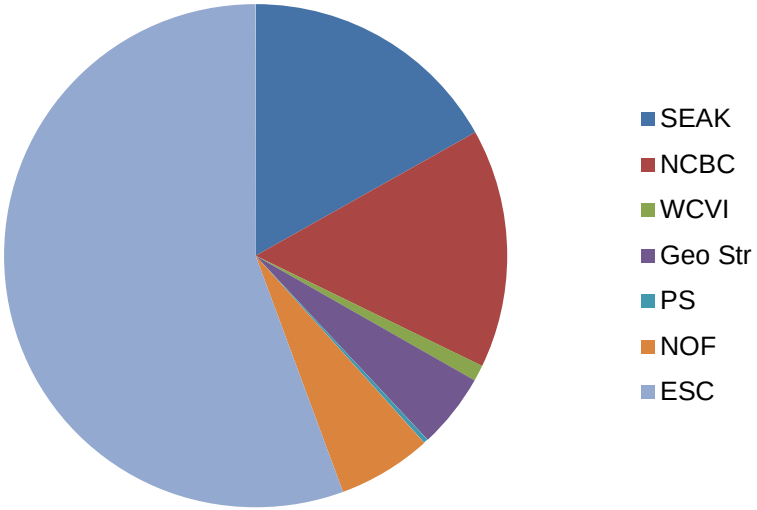
Lower Georgia Strait



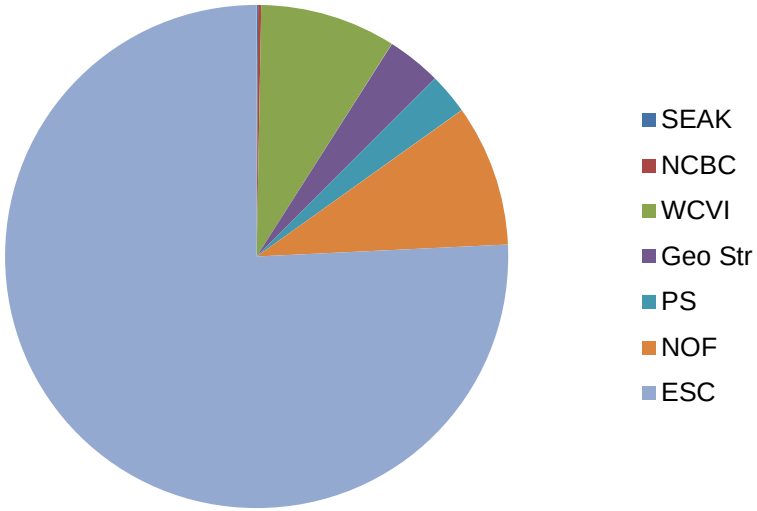
Fraser spring (stream)



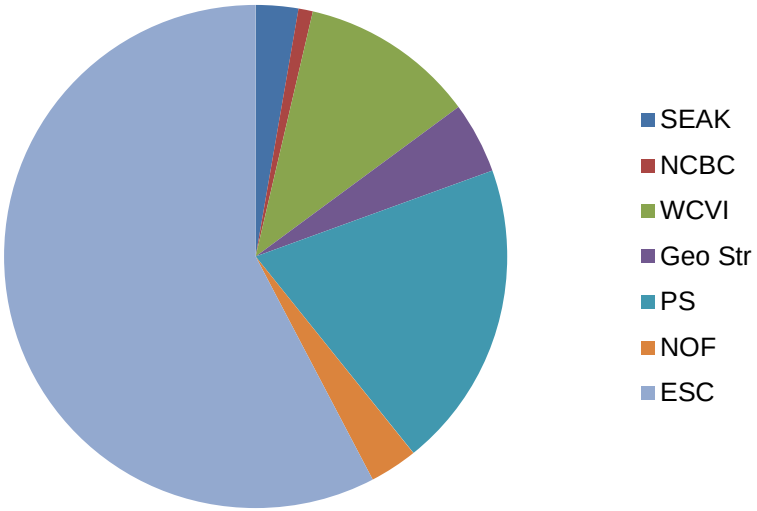
Fraser summer (ocean)



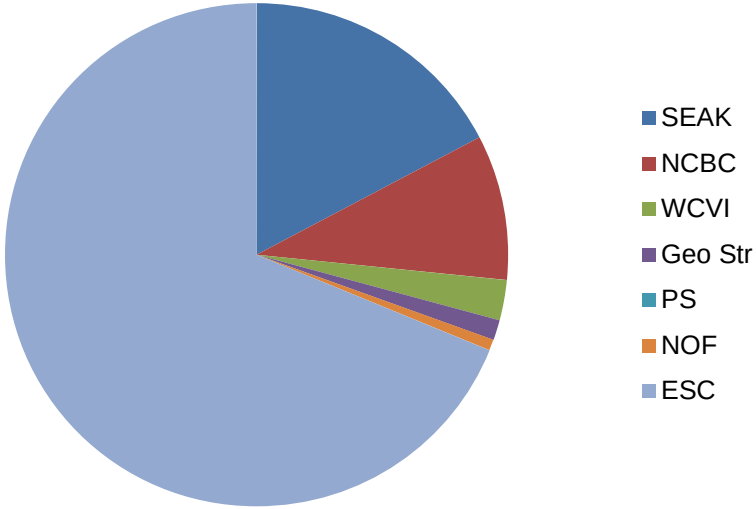
Fraser late



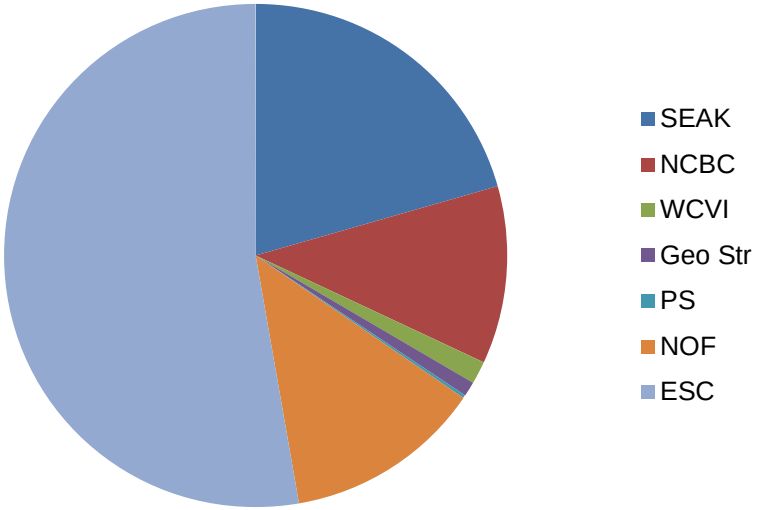
Puget Sound summer/fall



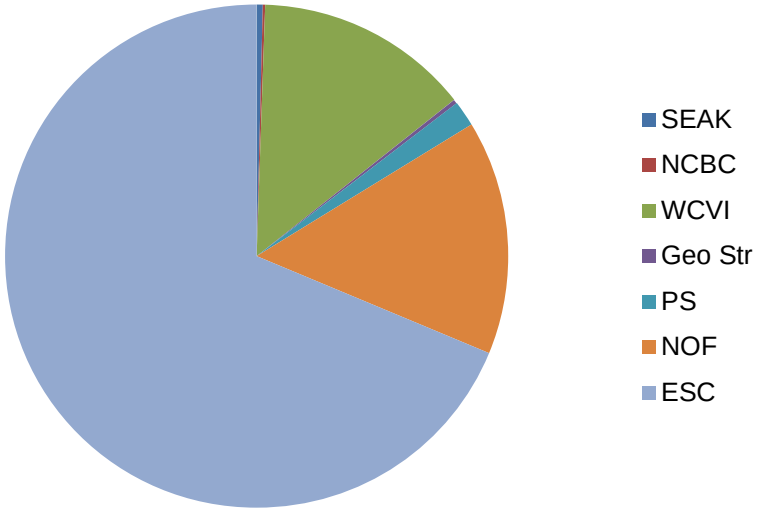
West Coast Vancouver Island



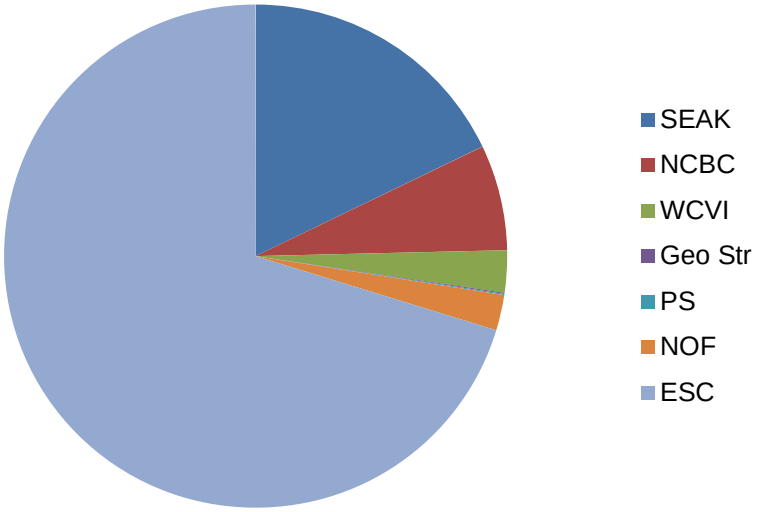
Washington Coast



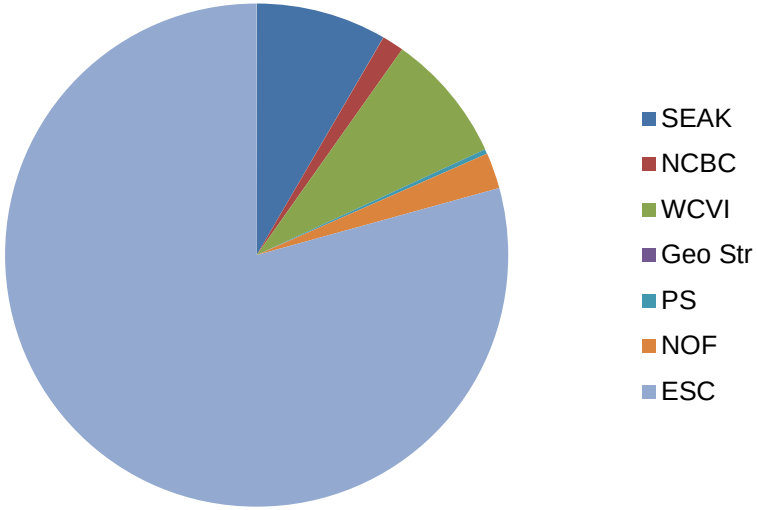
Columbia River tule fall



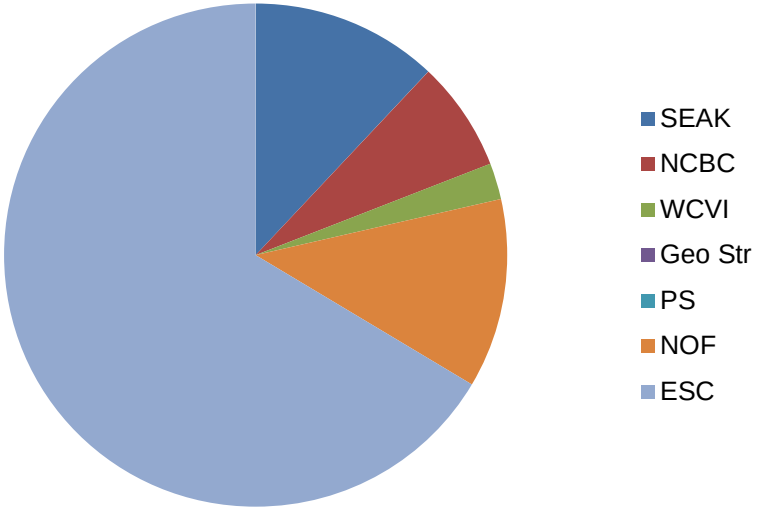
Upper River Bright fall



Columbia River summer



Oregon Coast fall

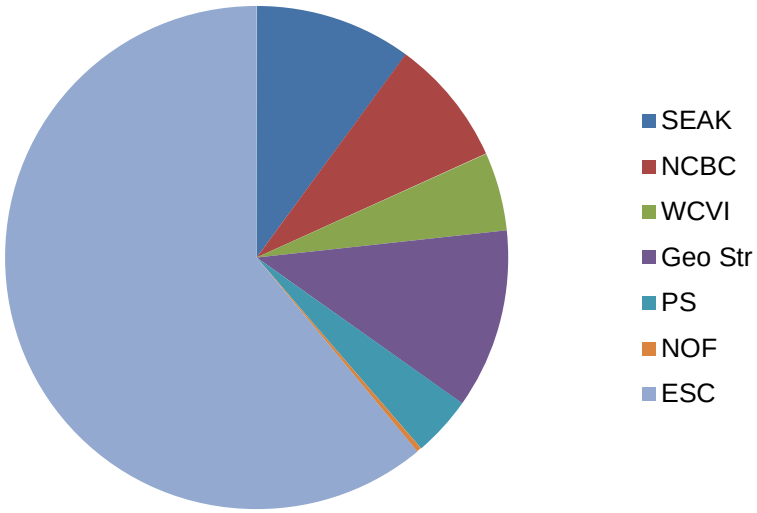


NOAA
FISHERIES
SERVICE

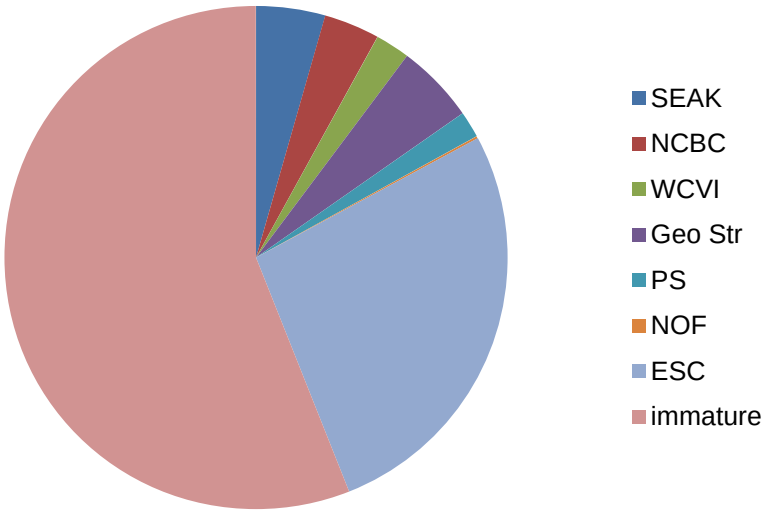
How appropriate is 20%?

- Harvest impacts make up more than 20% of the “Parken-Kope” indices, and the CTC “distribution tables” for these stocks.
- For the “fall-California” group, harvest impacts account for 33% of the aggregate index for both the “Parken-Kope” index and for the CTC exploitation rate analysis.
- These abundance indices are just that: indices
  - Include ocean harvest impacts and terminal runs by calendar year
  - Ocean harvest impacts include impacts to immature fish that would not have spawned in the absence of fishing
  - Terminal runs do not include immature fish
  - Immature fish not killed by fisheries are not accounted for at all
- “Harvest rates” based on these indices have numerators too large or denominators too small

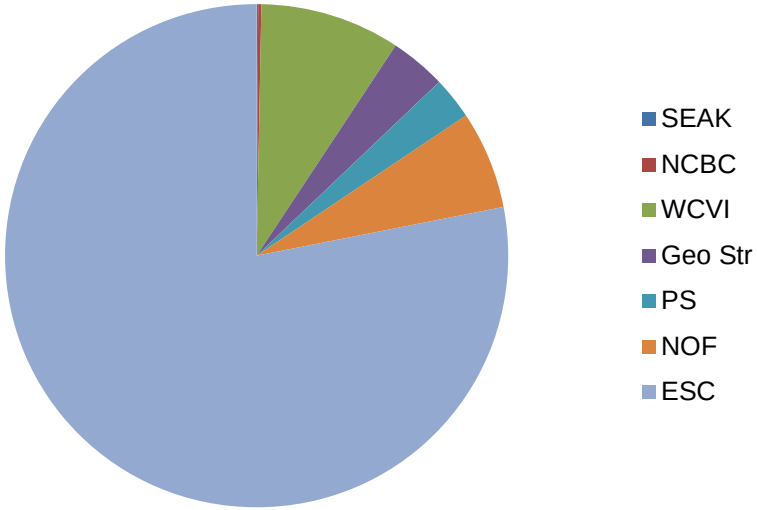
Georgia Strait



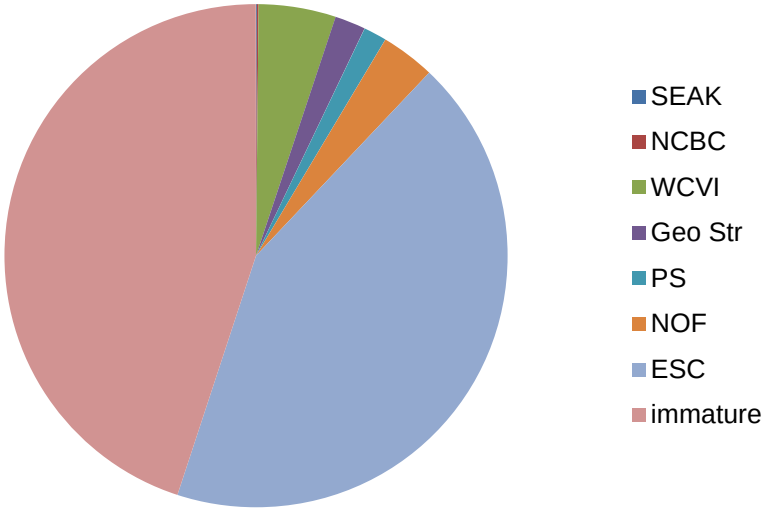
Georgia Strait



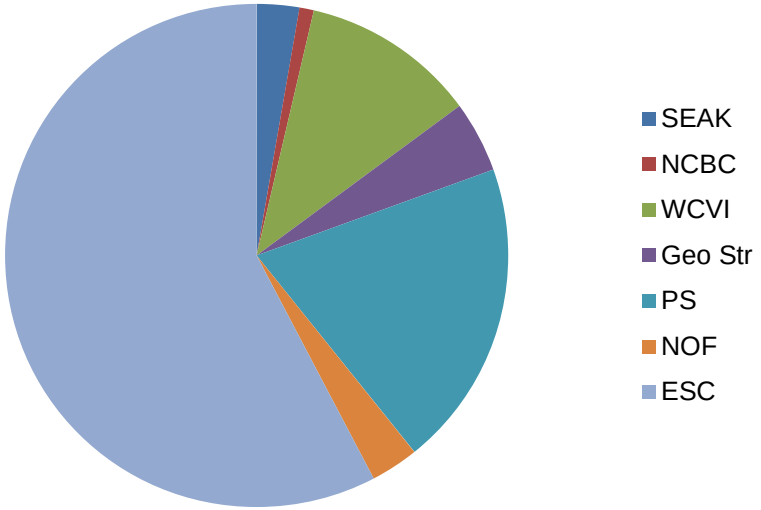
Fraser late



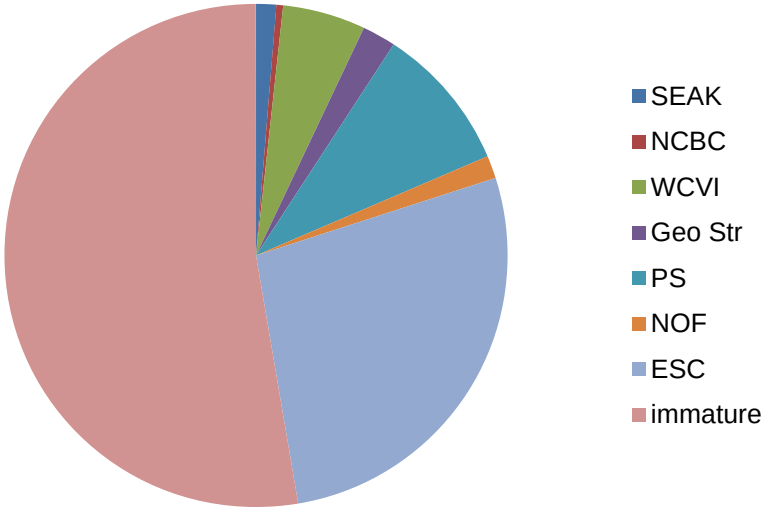
Fraser late



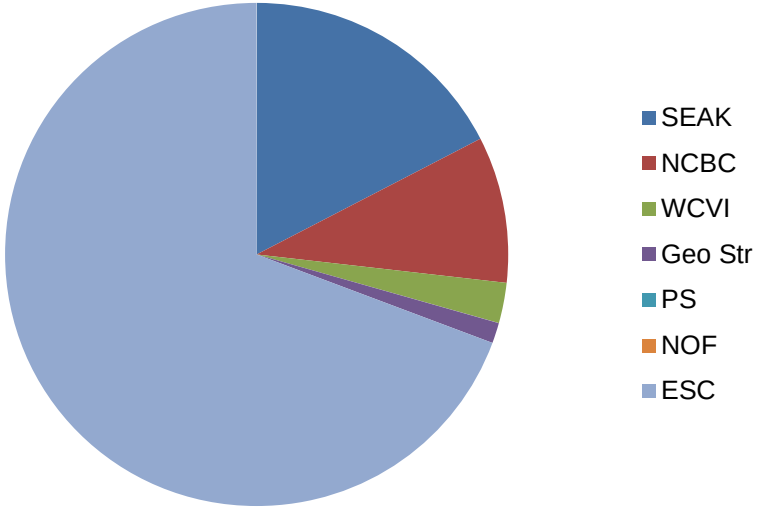
Puget Sound summer/fall



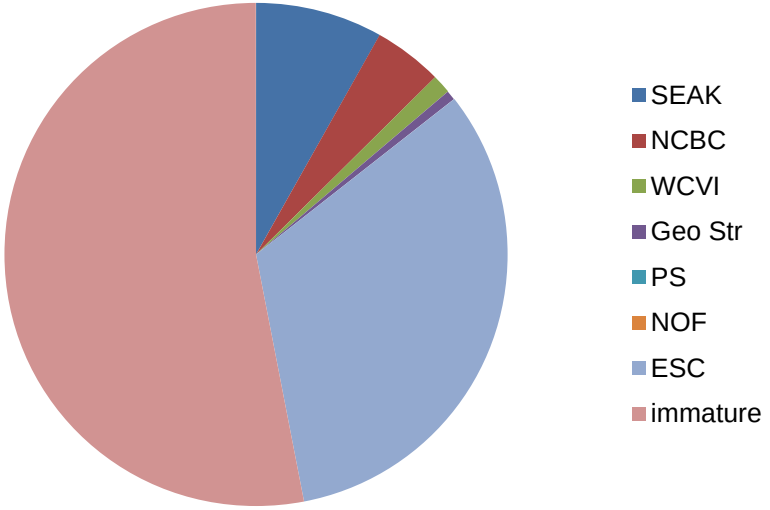
Puget Sound summer/fall



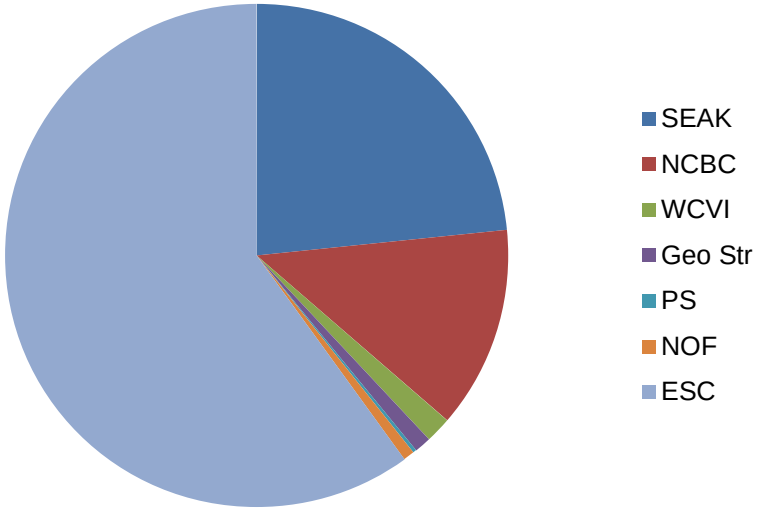
West Coast Vancouver Island



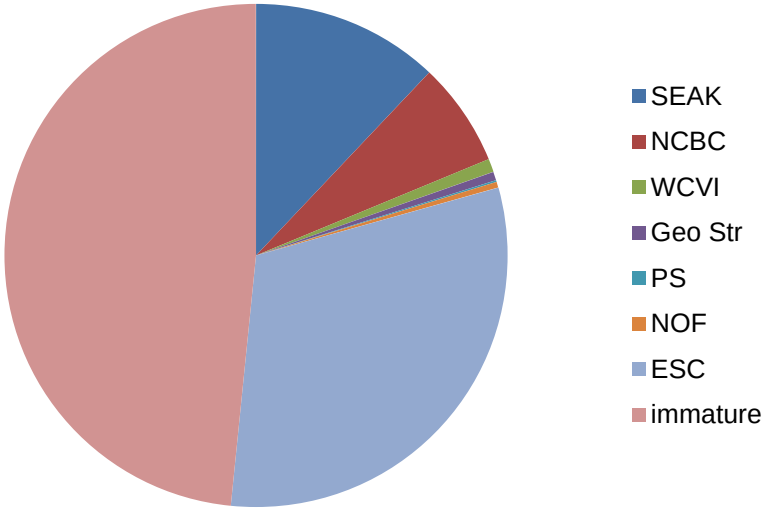
West Coast Vancouver Island



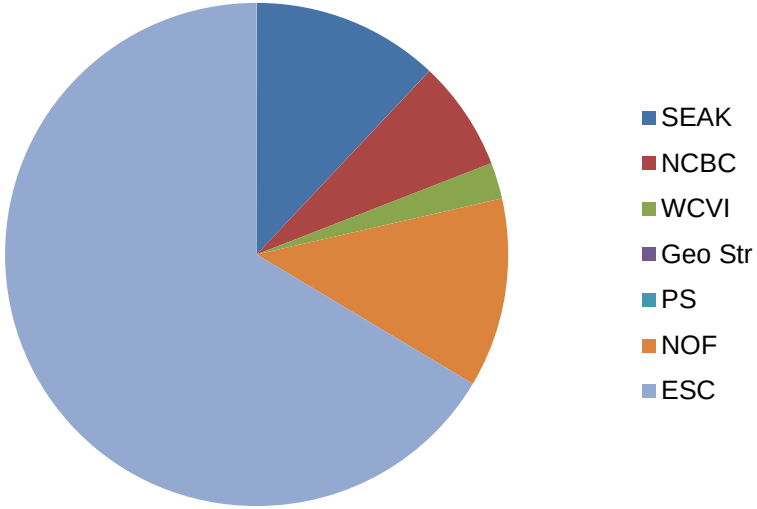
Washington Coast



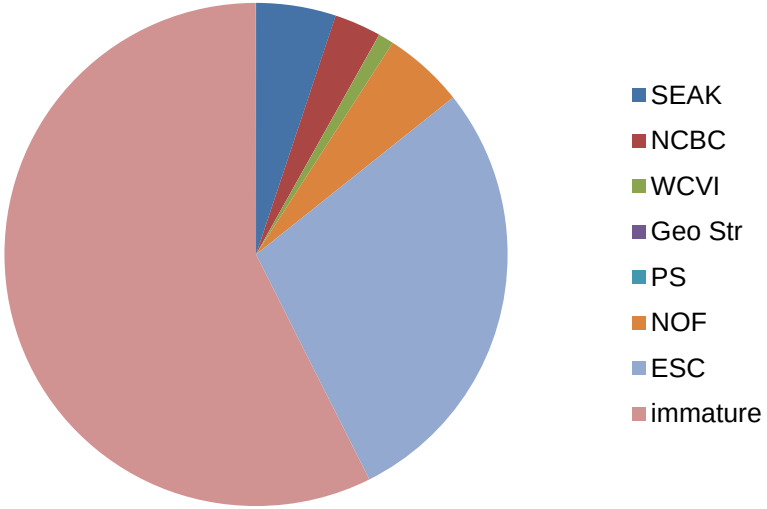
Washington Coast



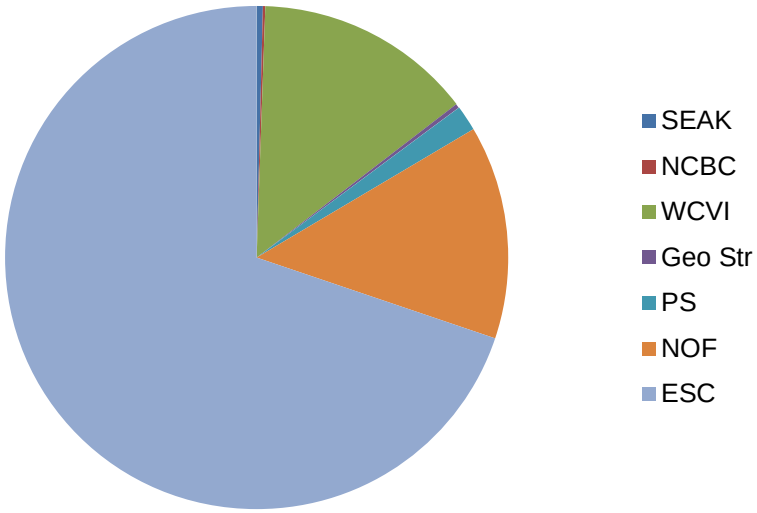
Oregon Coast fall



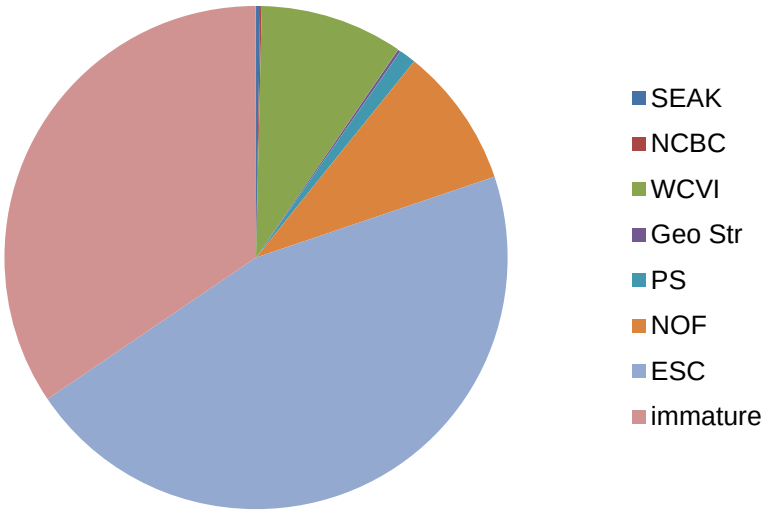
Oregon Coast fall



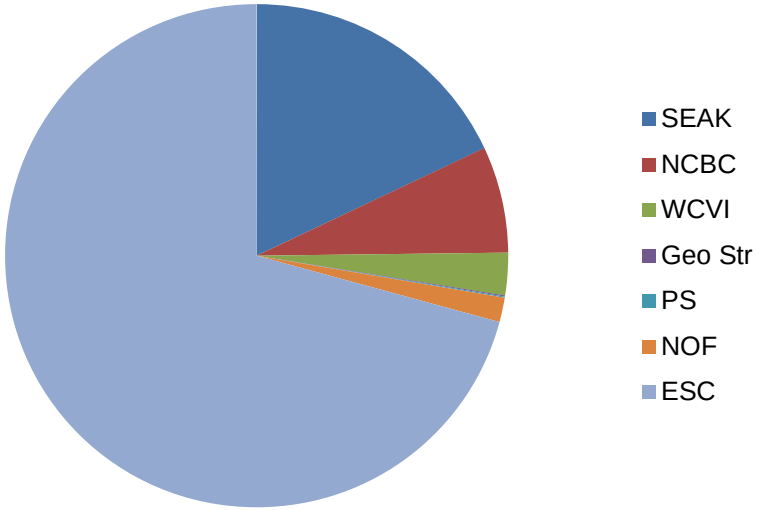
Columbia River tule fall



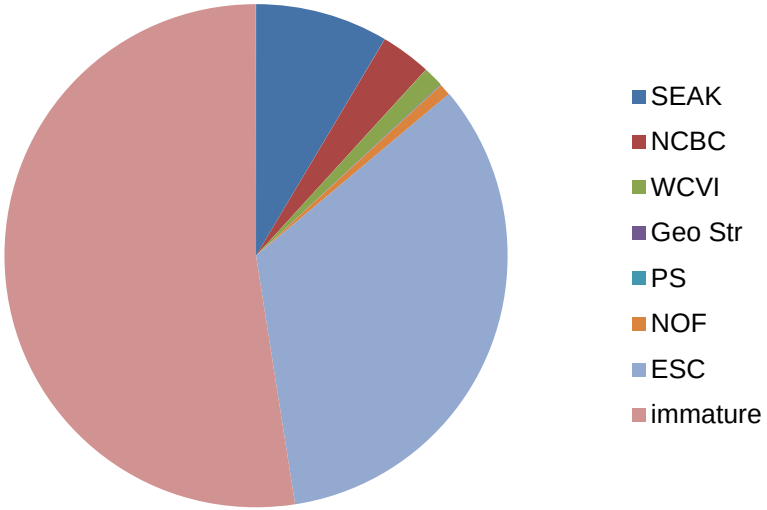
Columbia River tule fall



Upper River Bright fall



Upper River Bright fall



NOAA
FISHERIES
SERVICE

How appropriate is 20%?

- Harvest impacts account for 33% of the aggregate "Parken-Kope index" for the fall Chinook – California grouping on average (1999-2009).
- They also account for 33% of the total expanded recoveries in the CTC exploitation rate analysis over the same period.
- When immature fish are accounted for, this translates into an average exploitation rate of 16% in pre-terminal ocean fisheries.
- This translates into a 19.2% increase in abundance if all fisheries were closed.

NOAA FISHERIES SERVICE

How appropriate is 20%? -parting thoughts

- FRAM is a single-season model
  - Estimates of reductions or increases resulting from changes in fishing do not include carry-over effects from multiple years.
- A 20% reduction caused by fishing does not equate to a 20% increase if fishing is halted.
  - 20% decrease = 25% increase.
- FRAM analyses focused on “inland origin” Chinook (Fraser River, Puget Sound, Georgia Strait); the “fall-California” aggregate includes more outside stocks.
  - Because of run timing, and spatial distributions, not all of these fish are available to RKW

NOAA
FISHERIES
SERVICE

How appropriate is 20%?

All in all, 20% seems like a reasonable ball-park number.