



ВСЕРОССИЙСКИЙ  
НАУЧНО-ИССЛЕДОВАТЕЛЬСКИЙ ИНСТИТУТ  
РЫБНОГО ХОЗЯЙСТВА И ОКЕАНОГРАФИИ



# Overview of methodology and high level results of Russian salmon research and comparison with obtained results in 2019 GoA salmon expedition



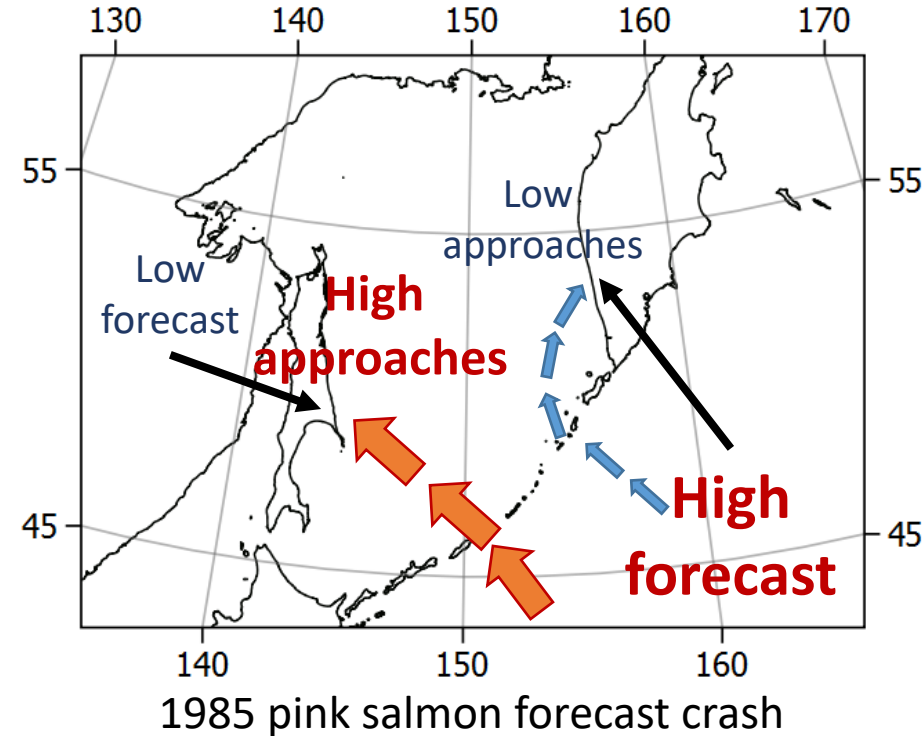
**Alexey A. Somov**, Olga S. Temnykh, Svetlana V. Naidenko,  
Alexander N. Starovoytov, Igor I. Glebov, Vladimir I. Radchenko,  
Aleksandr V. Zavolokin, and Vyacheslav P. Shuntov

# This speech is about:

- Brief history of Russian high seas research on salmon
- Modern Russian survey program overview
- Main results of 3-decades of salmon research in high seas
- 2019 GoA survey in comparison with surveys in the western and central North Pacific

# Stages of high-seas trawl research

- Forecast crash in 1985
- First winter surveys 1986-1992
- Methodology development (1991-2000)
- Modern survey plan (2000-present)



# Modern high-seas surveys

- Focused on **Pink salmon** which is the most abundant and commercially important salmonid species for Russia
- Cover three phases of salmon marine period
  - a) Fall surveys on juveniles (Bering and Okhotsk seas)
  - b) Winter-spring surveys (Northwestern and Central Pacific)
  - c) Early summer surveys on mature salmon (Northwestern Pacific and Bering Sea)

# Total overview

- More than 6500 samples



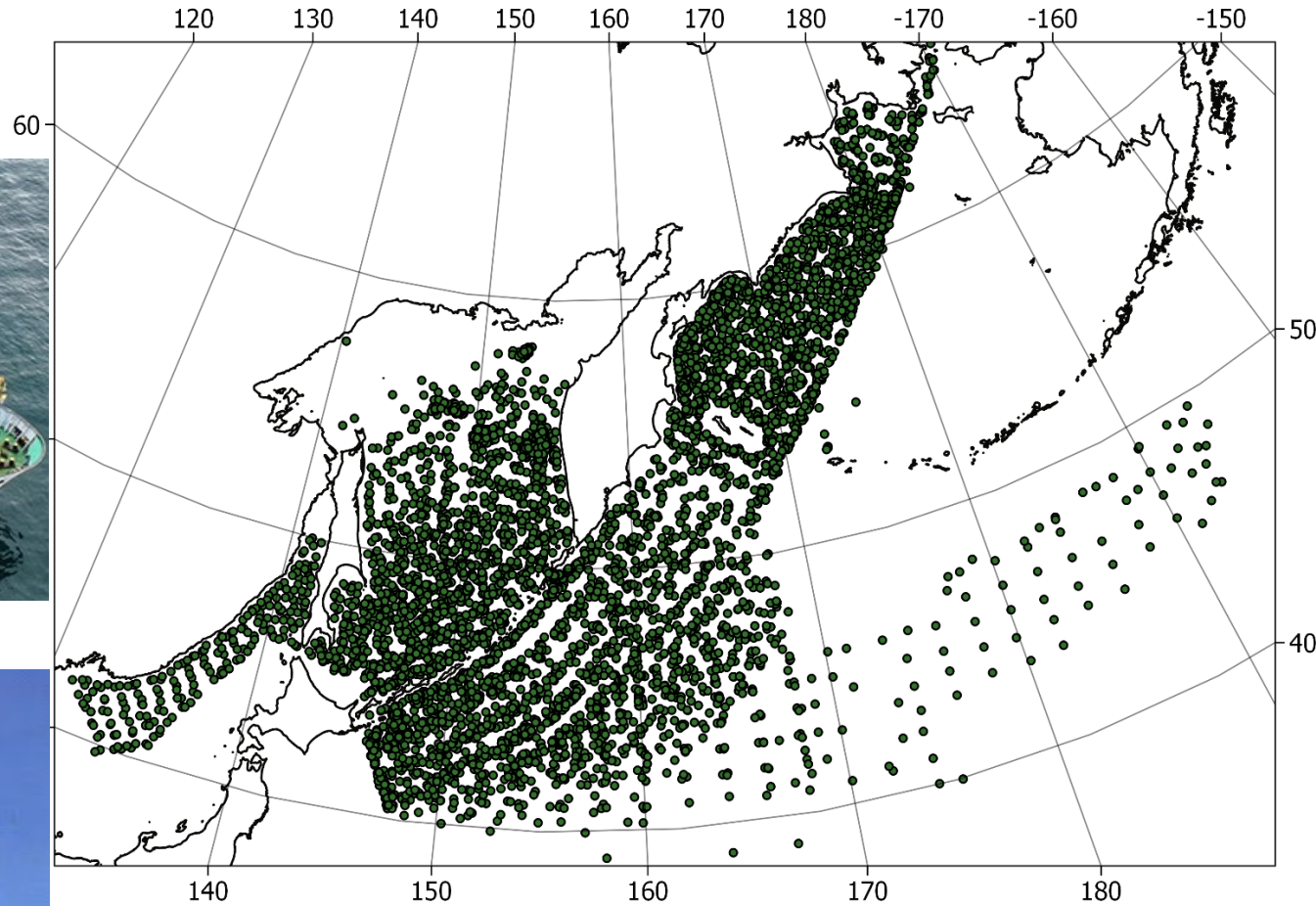
RV «Professor Kaganovsky»



RV «Professor Levanidov»

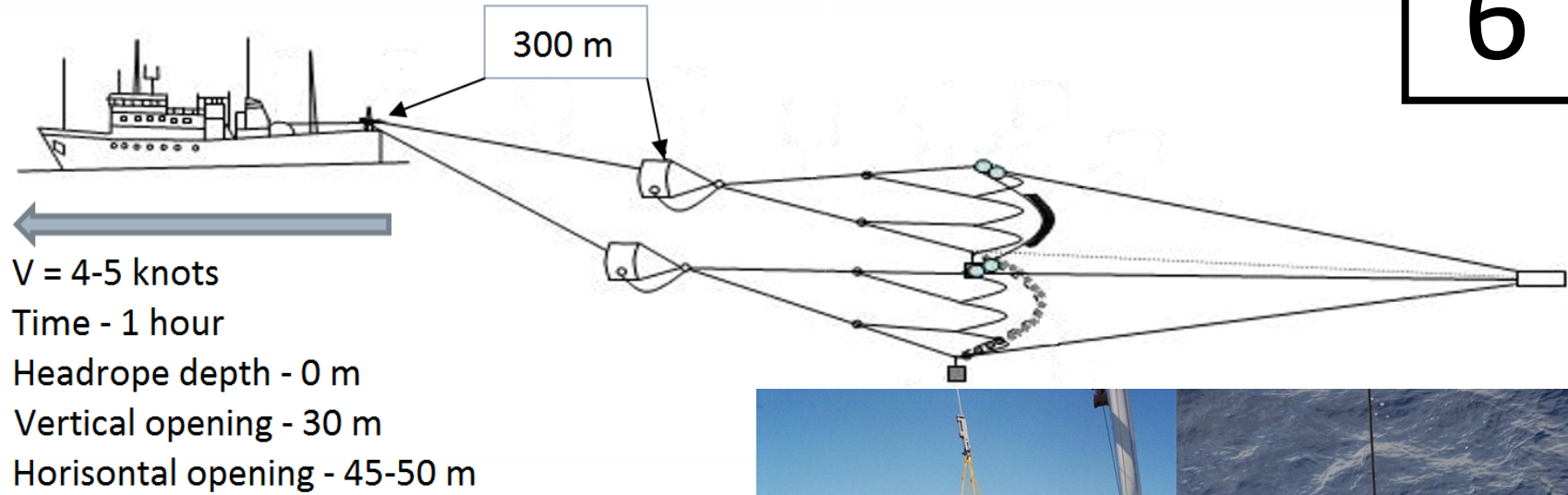


RV «TINRO»



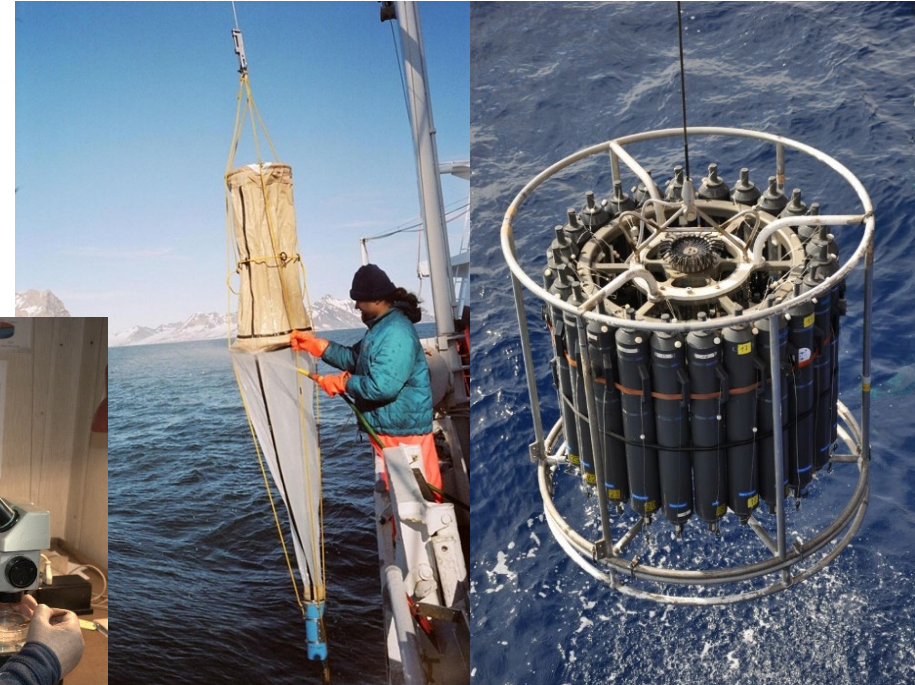
Trawl samples for the period of 1999-2018

# Methods



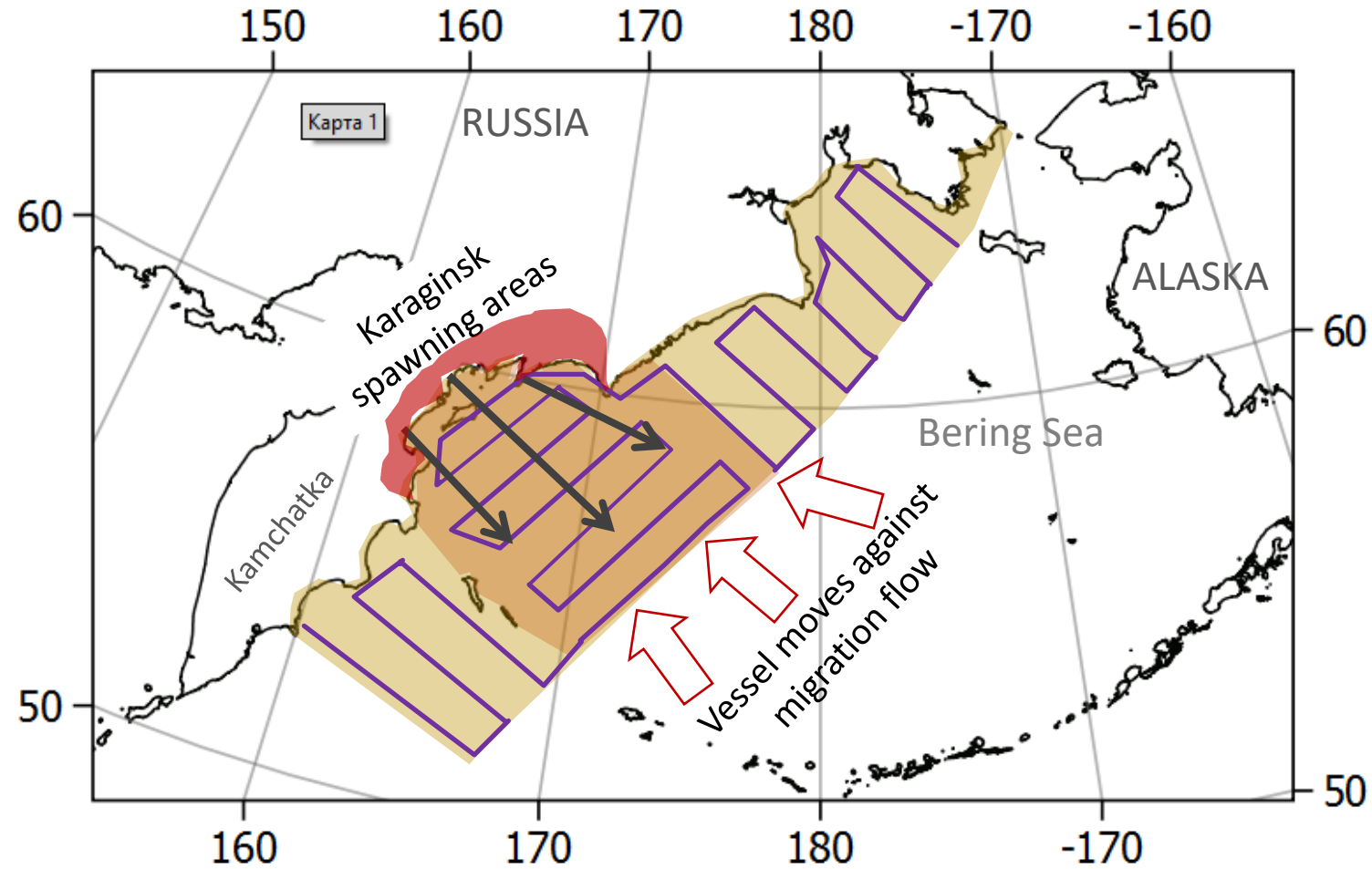
- Trawlings
- Plankton samples
- Oceanographic samples
- Acoustic sounding
- Trophological analysis

Database



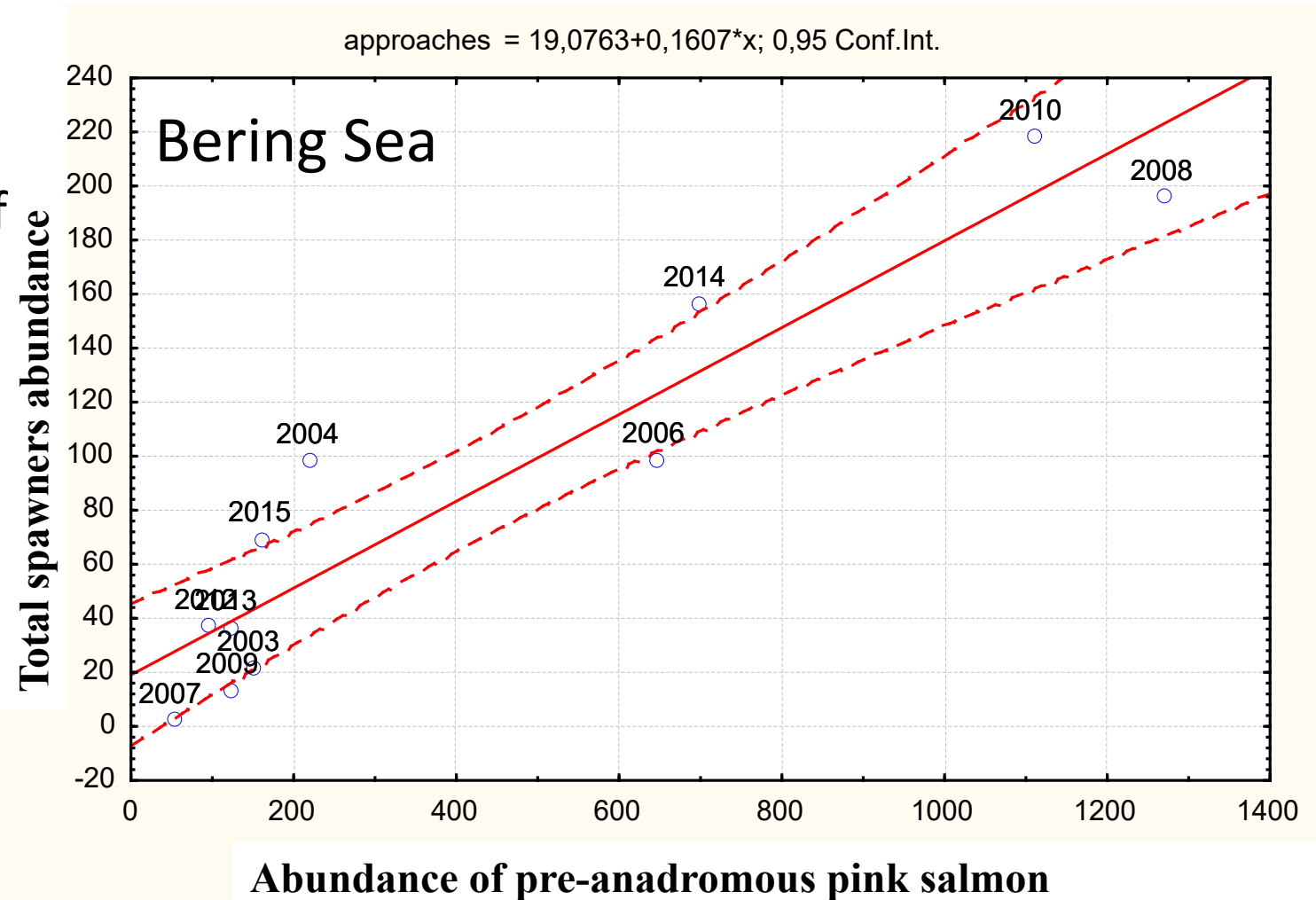
# Fall surveys on juveniles – Bering Sea

- Period:  
End of September-beginning of  
October (30 days)
- Frequency – annually
- One major stock
- Precise forecast



# Fall surveys on juveniles – Bering Sea

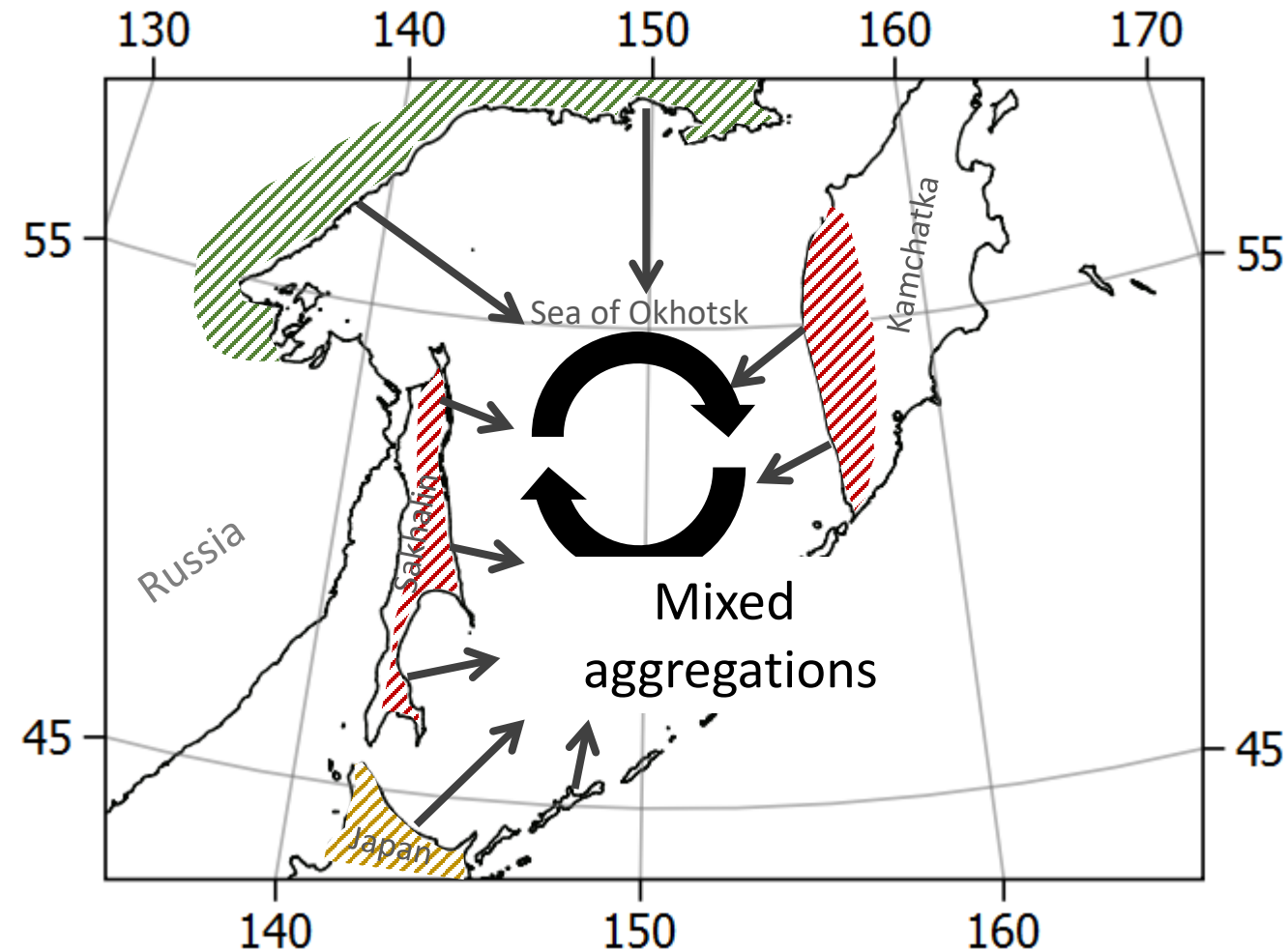
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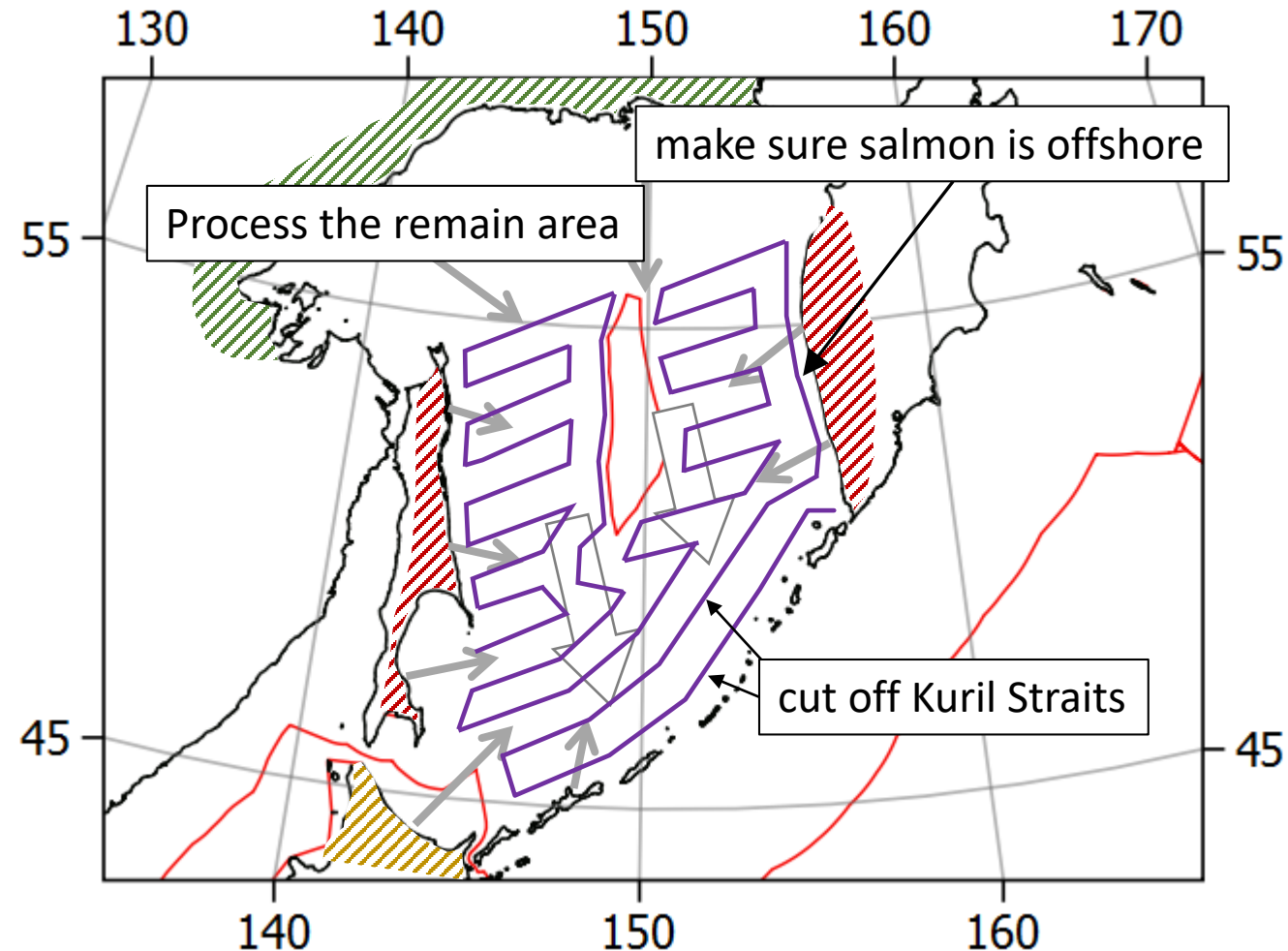
# Fall surveys on juveniles – Okhotsk Sea

- Period:  
End of October-beginning of November (40-45 days)
- Frequency – annually
- Mixed stocks
- Needs genetic differentiation
- Forecast is not very precise



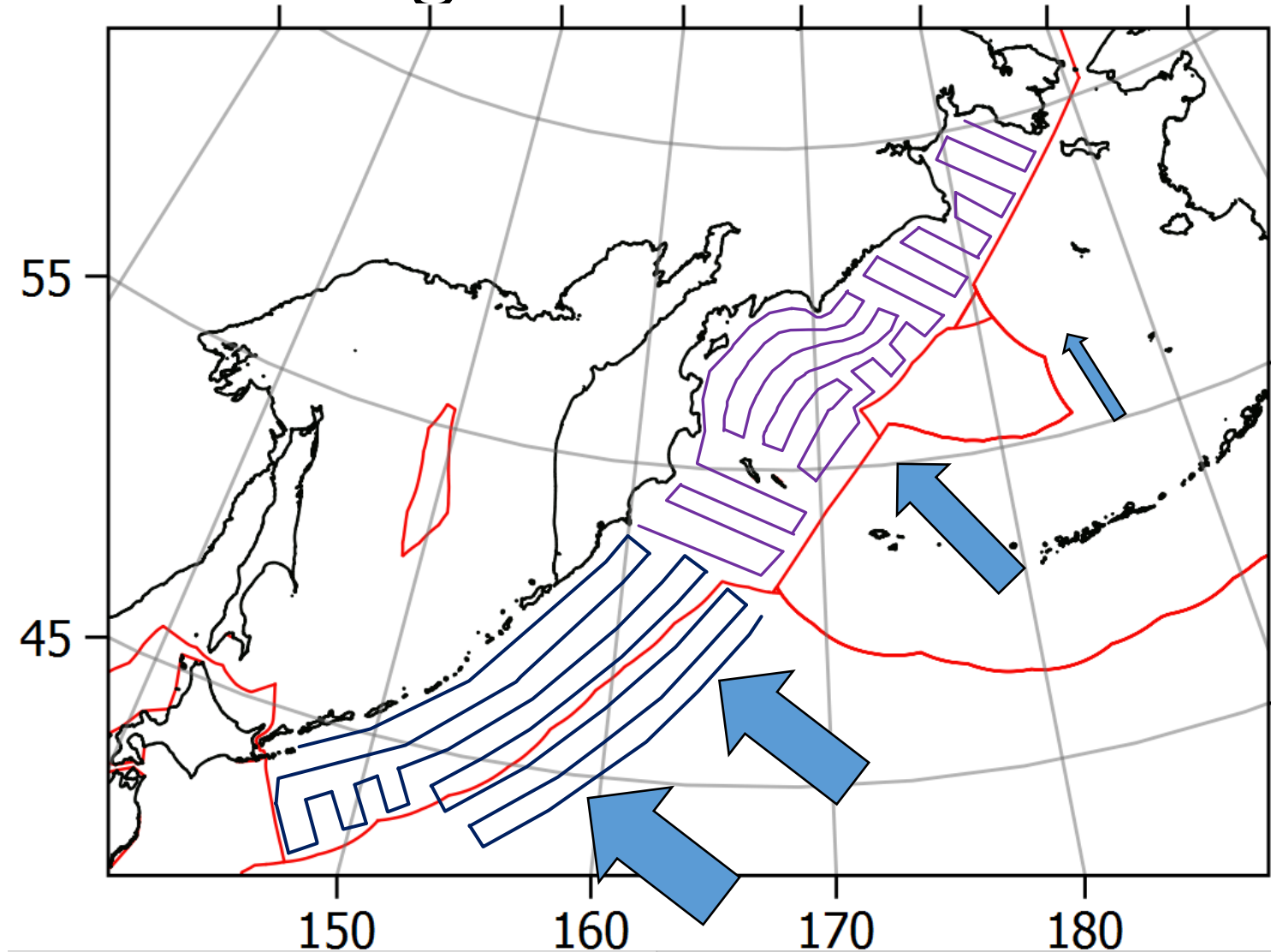
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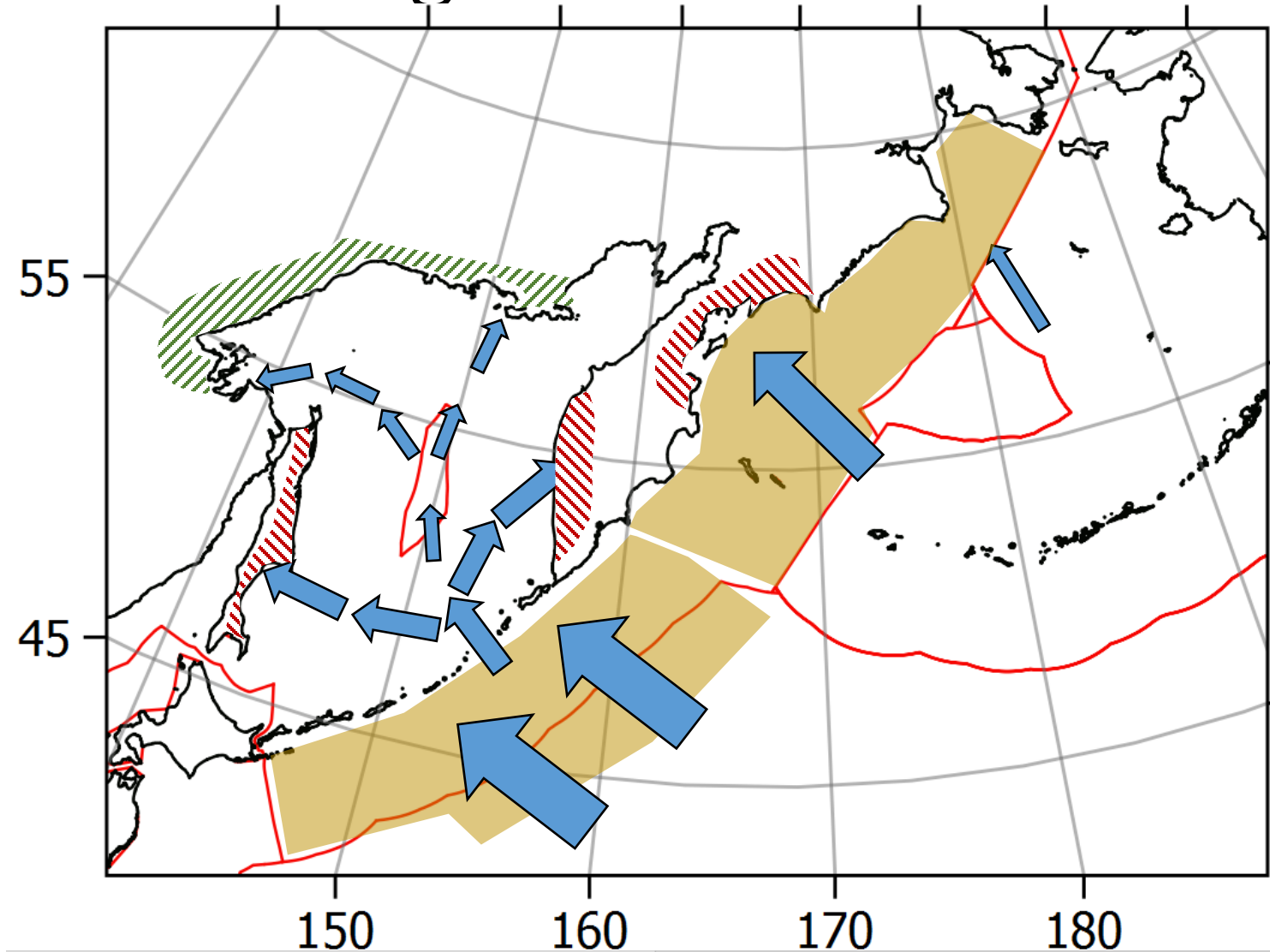
# Summer surveys on maturing salmon

- Period:  
June-July (40-45 days)
- Frequency
  - annually in Kuril waters
  - odd years in Bering sea
- Vessels predominantly move against the migration flow



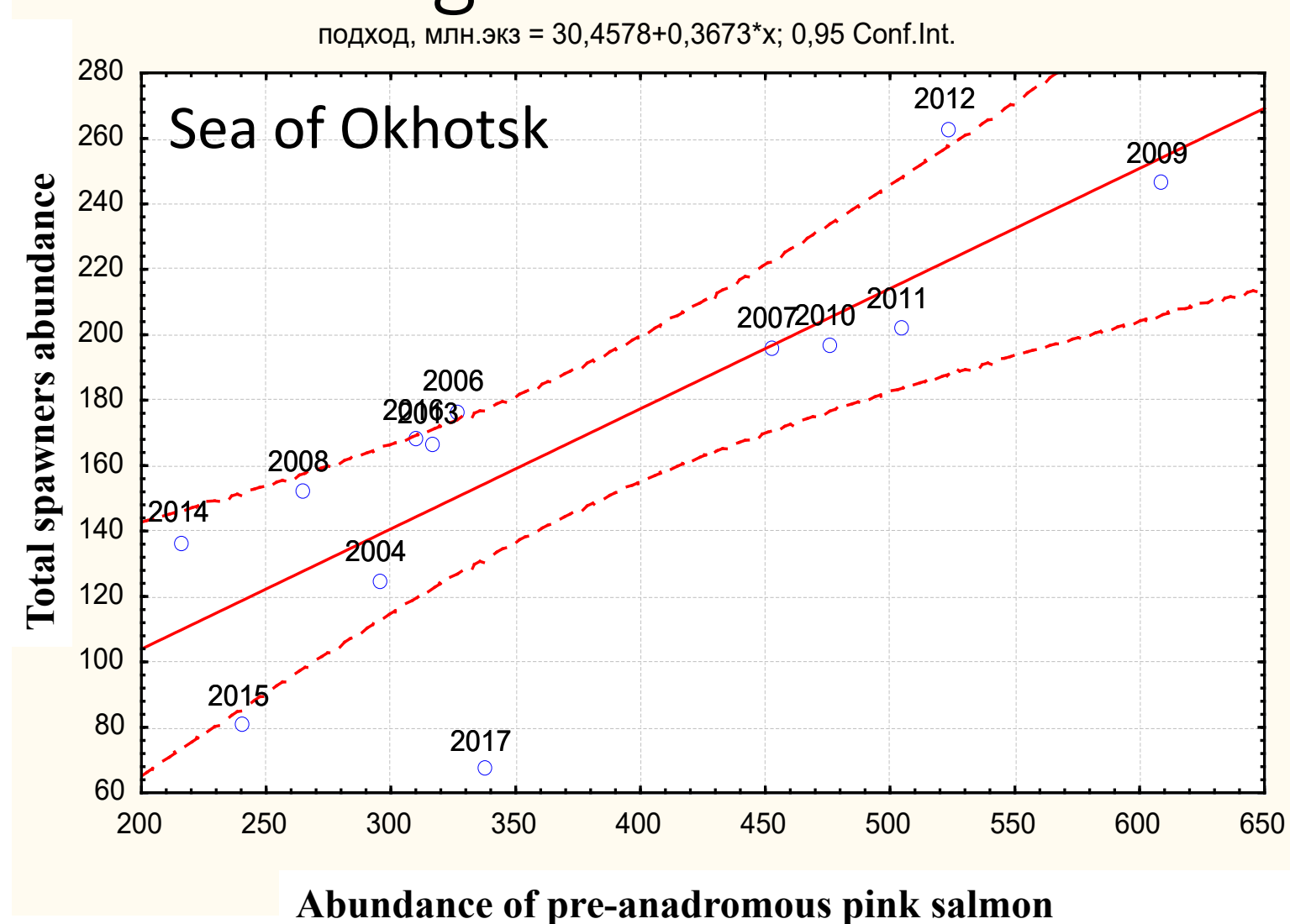
# Summer surveys on maturing salmon

- No problem for Bering Sea
  - One major stock
  - Precise estimation
- Problems for Kuril waters
  - Mixed stocks
  - Precise estimations but for the whole basin
  - Express differentiation is needed



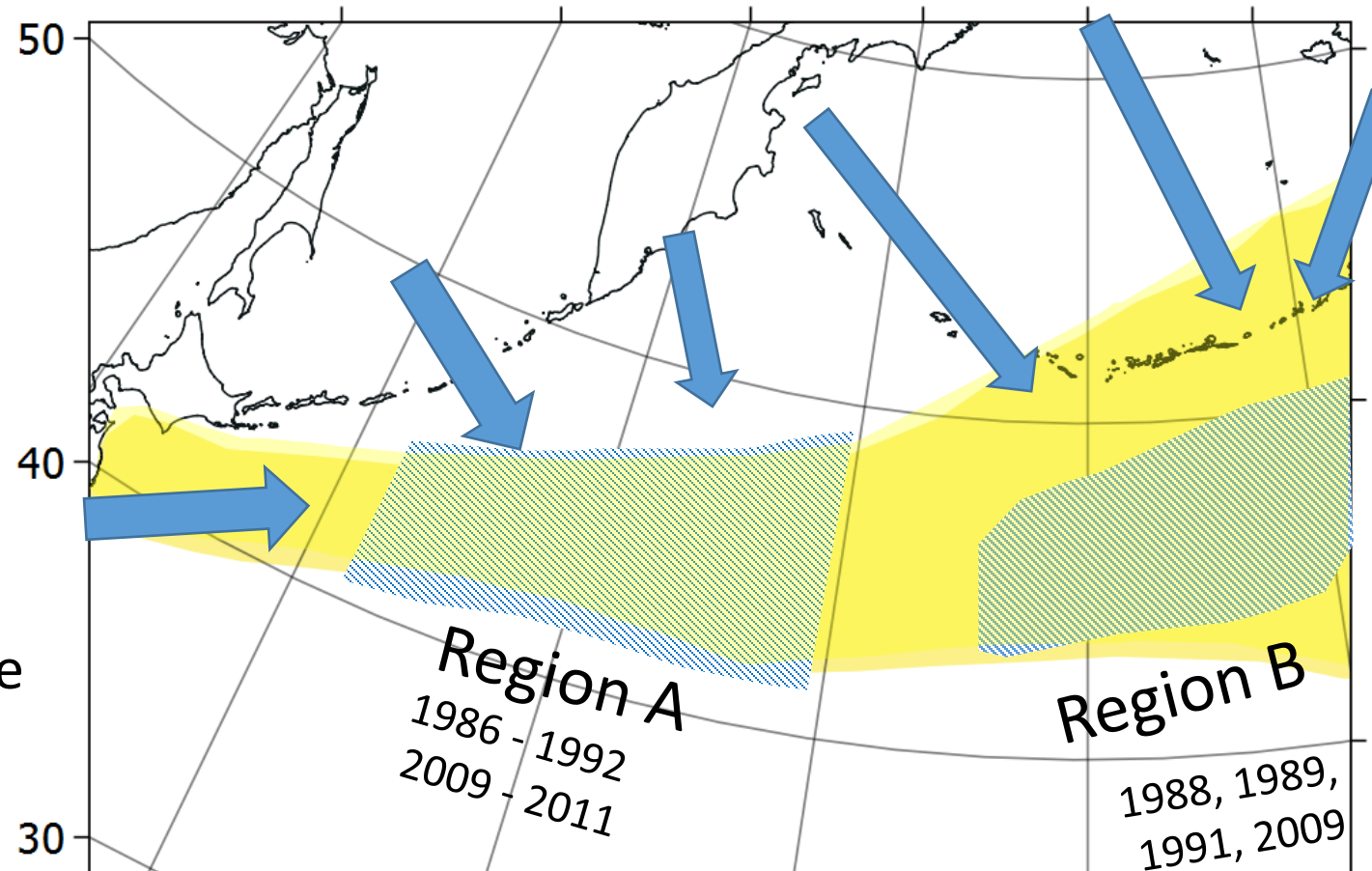
# Summer surveys on maturing salmon

- No problem for Bering Sea
  - One major stock
  - Precise forecast
- Problems for Kuril waters
  - Mixed stocks
  - Forecast only for the whole basin
  - Express differentiation is needed



# Winter surveys

- Period:  
February-April (30 days)
- Frequency – occasionally
- Cons:
  - Mixed stocks
  - Salmon spread spatially and vertically
  - Hard to estimate total abundance
  - Not applicable for the forecast
- Pros:
  - winter environment
  - biological condition
  - survival



Reliable abundance estimations are possible if the whole winter habitat is covered by several vessels

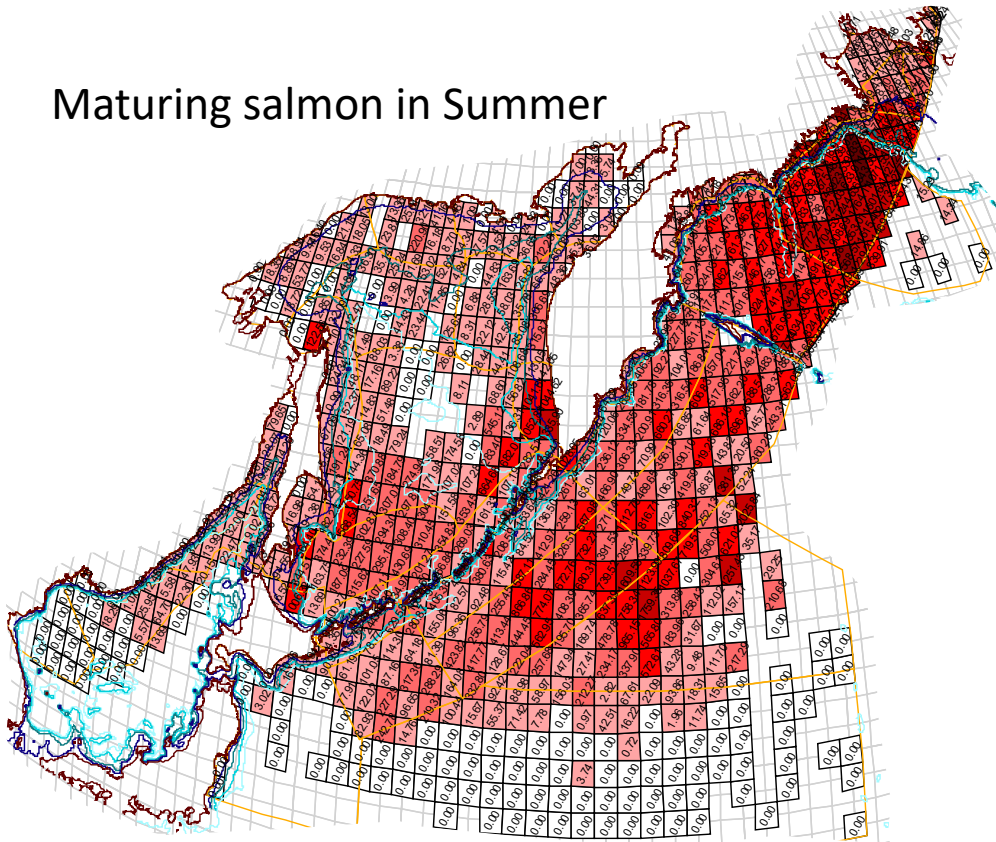
# Surveys comparison

- Fall and Summer surveys (migration)
  - Salmon are more aggregated (spatially – within basin, vertically – within 30 m)
  - Total abundance estimations (survey covers almost all salmon concentrations of pink salmon)
  - Applicable for the **forecast**
  - Require precise time period as the salmon migrates rapidly
- Winter surveys (quasi-stable)
  - Salmon are mixed and distributed spatially and vertically (down to 100 m and deeper)
  - Abundance estimations are not reliable
  - Not applicable for the forecast
  - More appropriate to study fundamental issues
    - Distribution patterns
    - Food supply and feeding condition
    - Biological condition
    - Survival

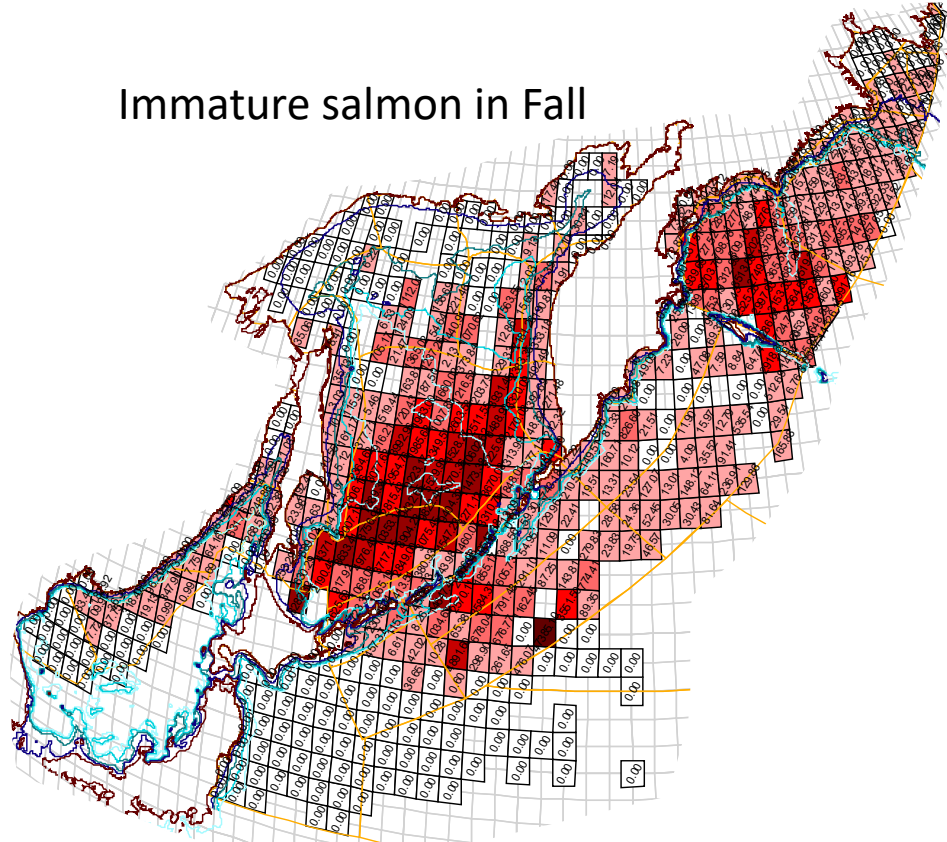
# Main results of Russia's high-seas research

- Distribution patterns and abundance estimations

Maturing salmon in Summer



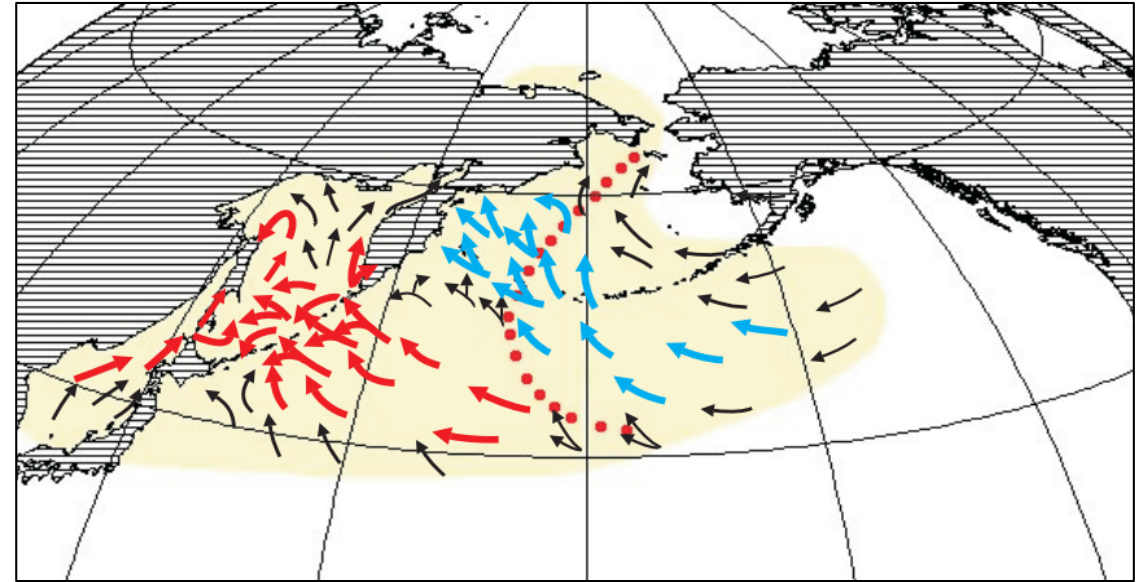
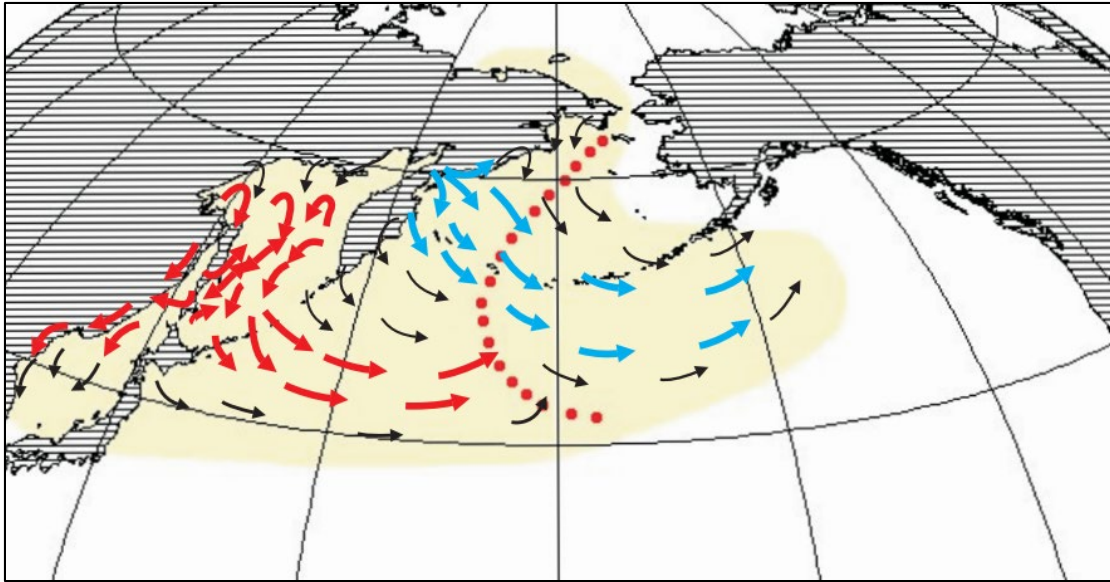
Immature salmon in Fall





# Main results of Russia's high-seas research

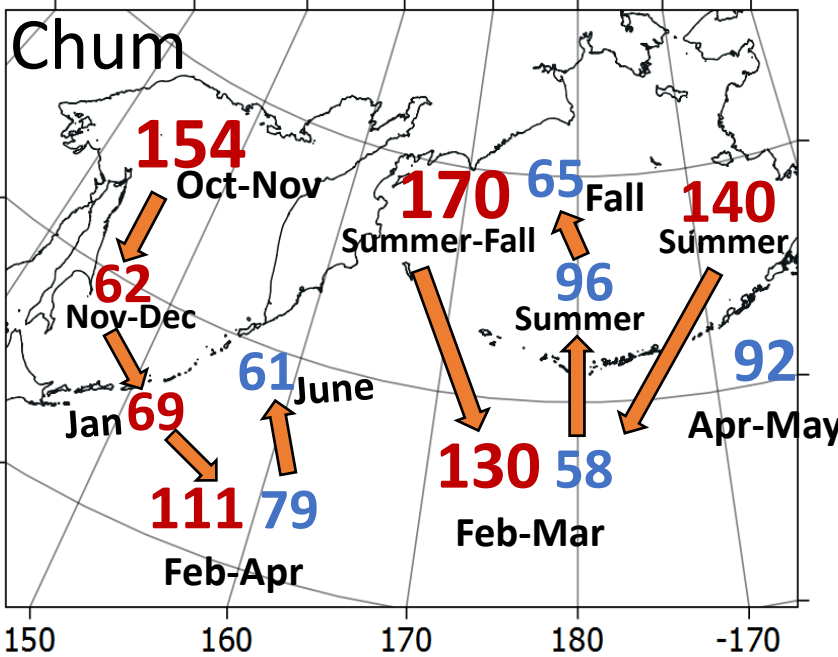
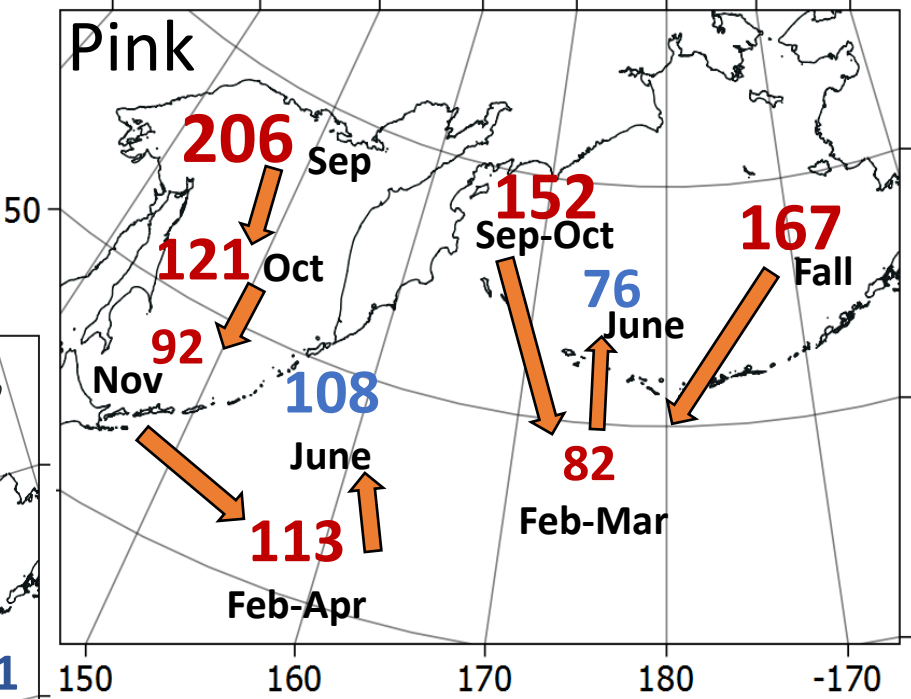
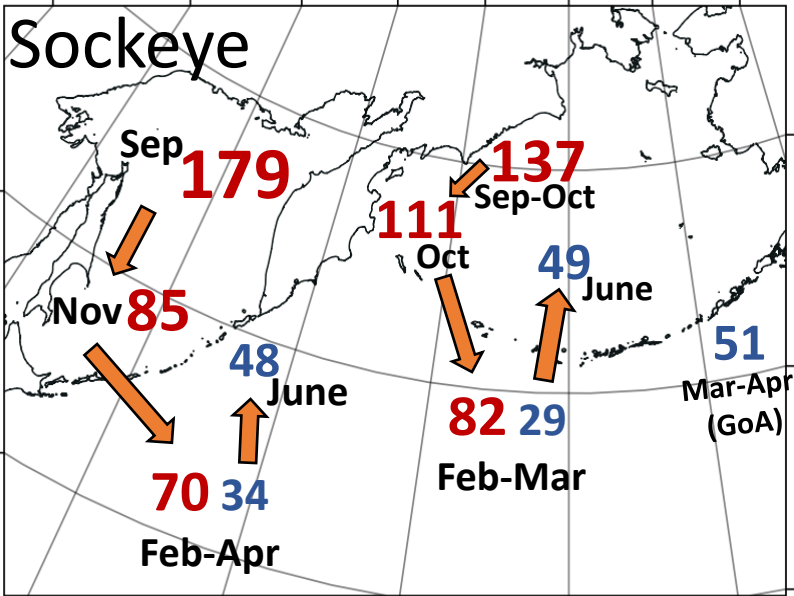
- Wide-front migrations



# Main results of Russia's high-seas research

- Seasonal changes in feeding intensity (ISF ‰) - stomach content/fish weight ratio

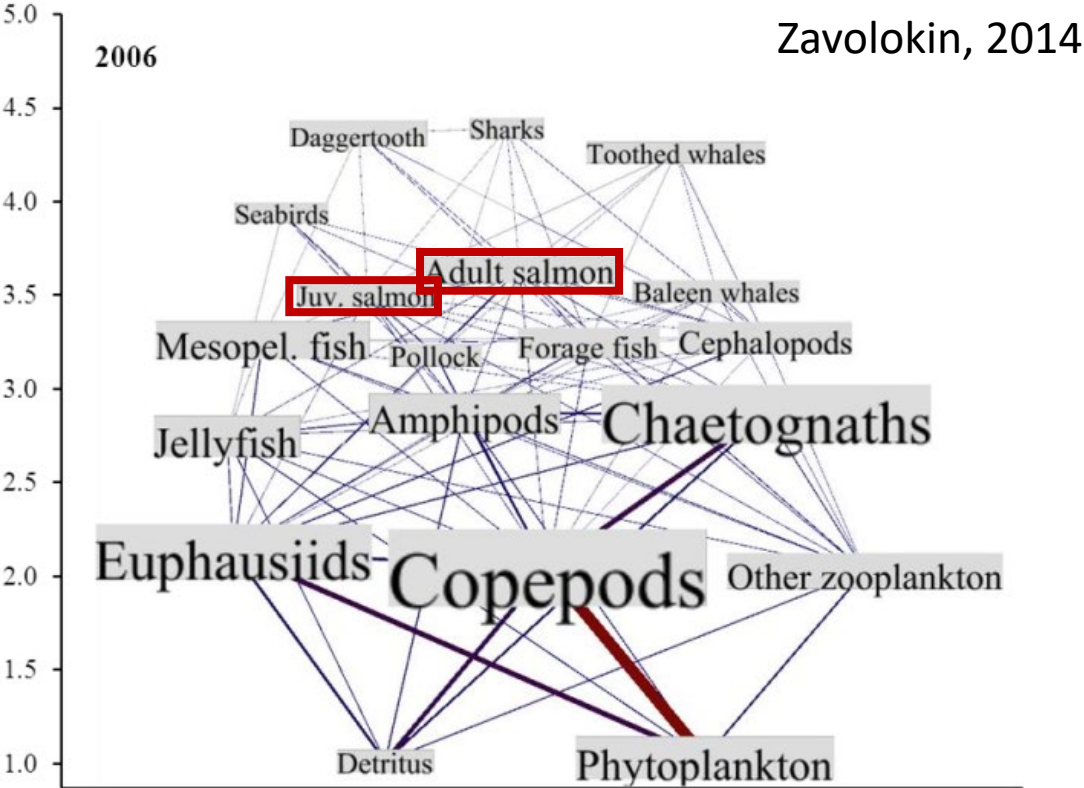
Blue – 30-50 cm  
 Red – 10-30 cm



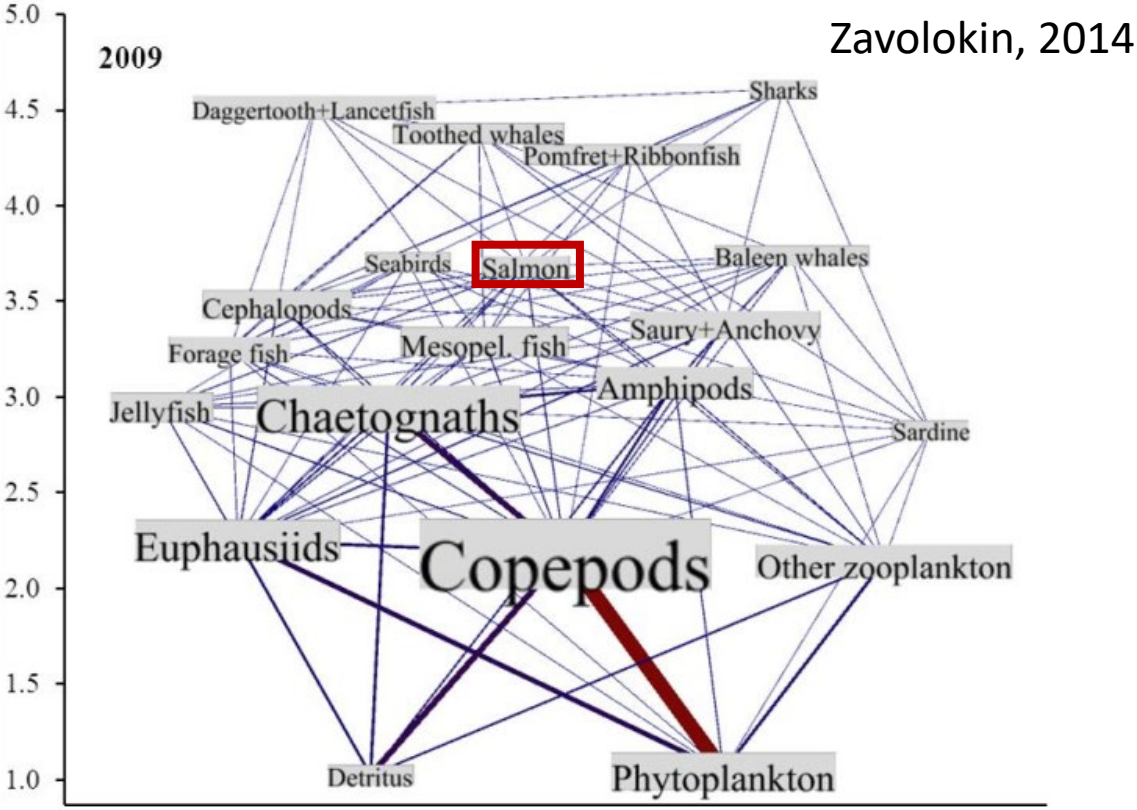
Salmon/zooplankton abundance ratio is very low for every season

# Main results of Russia's high-seas research

- Ecosystem role and trophic interactions of salmon and other ecosystem components



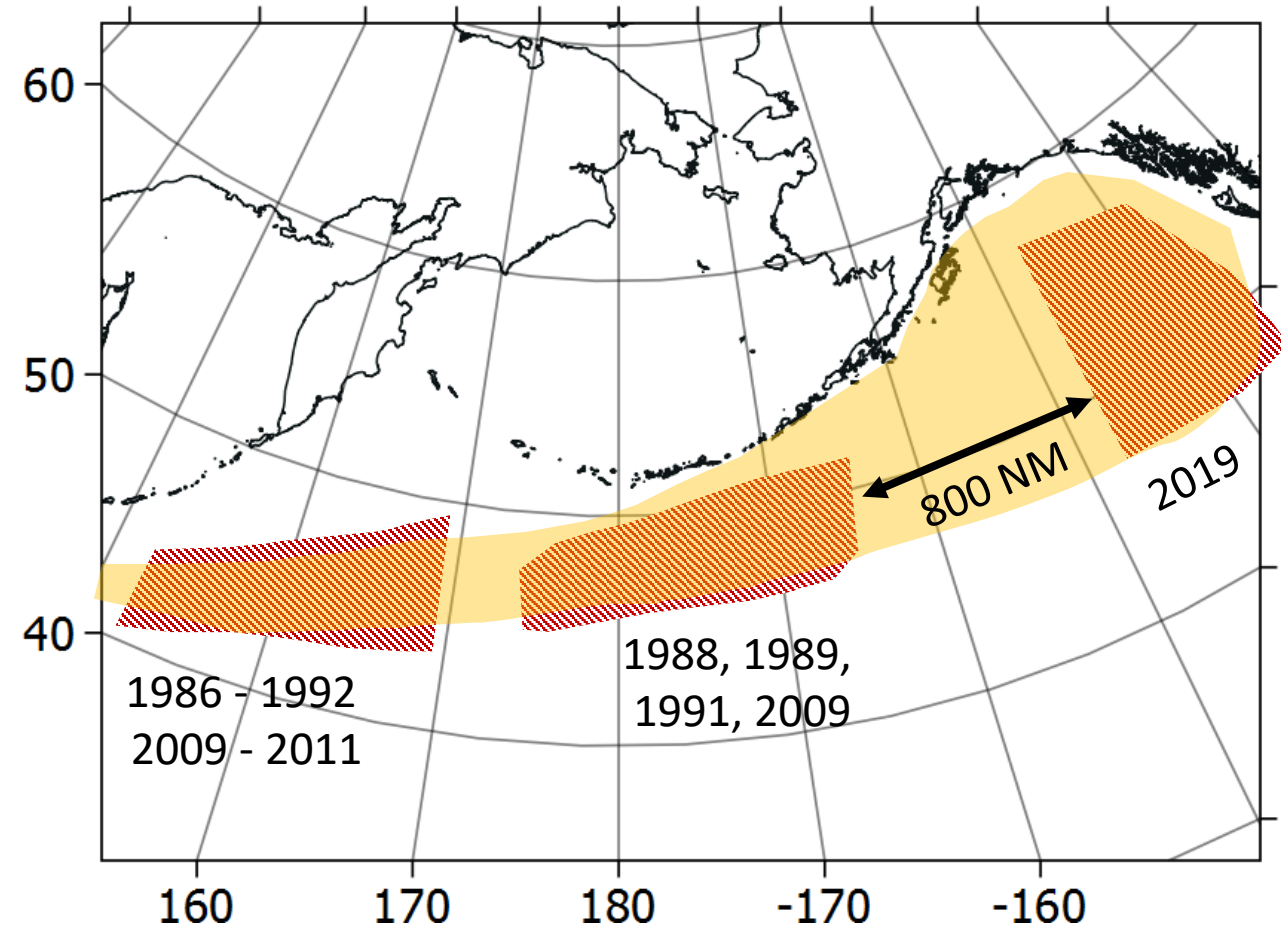
Food web model of pelagic community in western Bering Sea



Food web model of pelagic community in Northwestern Pacific

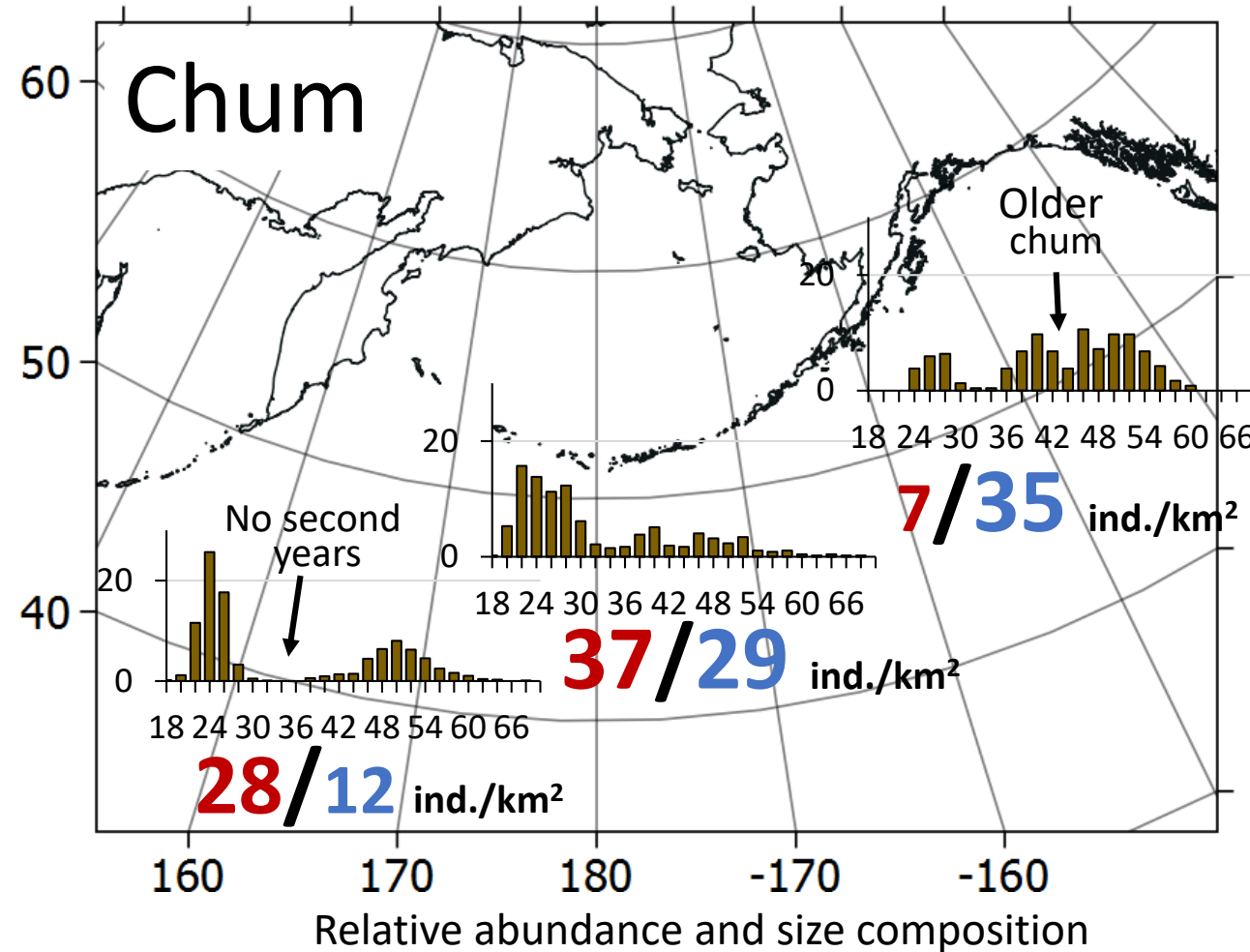
# 2019 GoA IYS Survey

- Partially filled the spatial gap in salmon winter ecology study
- Gave comparable data on:
  - zooplankton abundance and composition
  - pelagic nektonic community
  - abundance, distribution and biological information on salmon



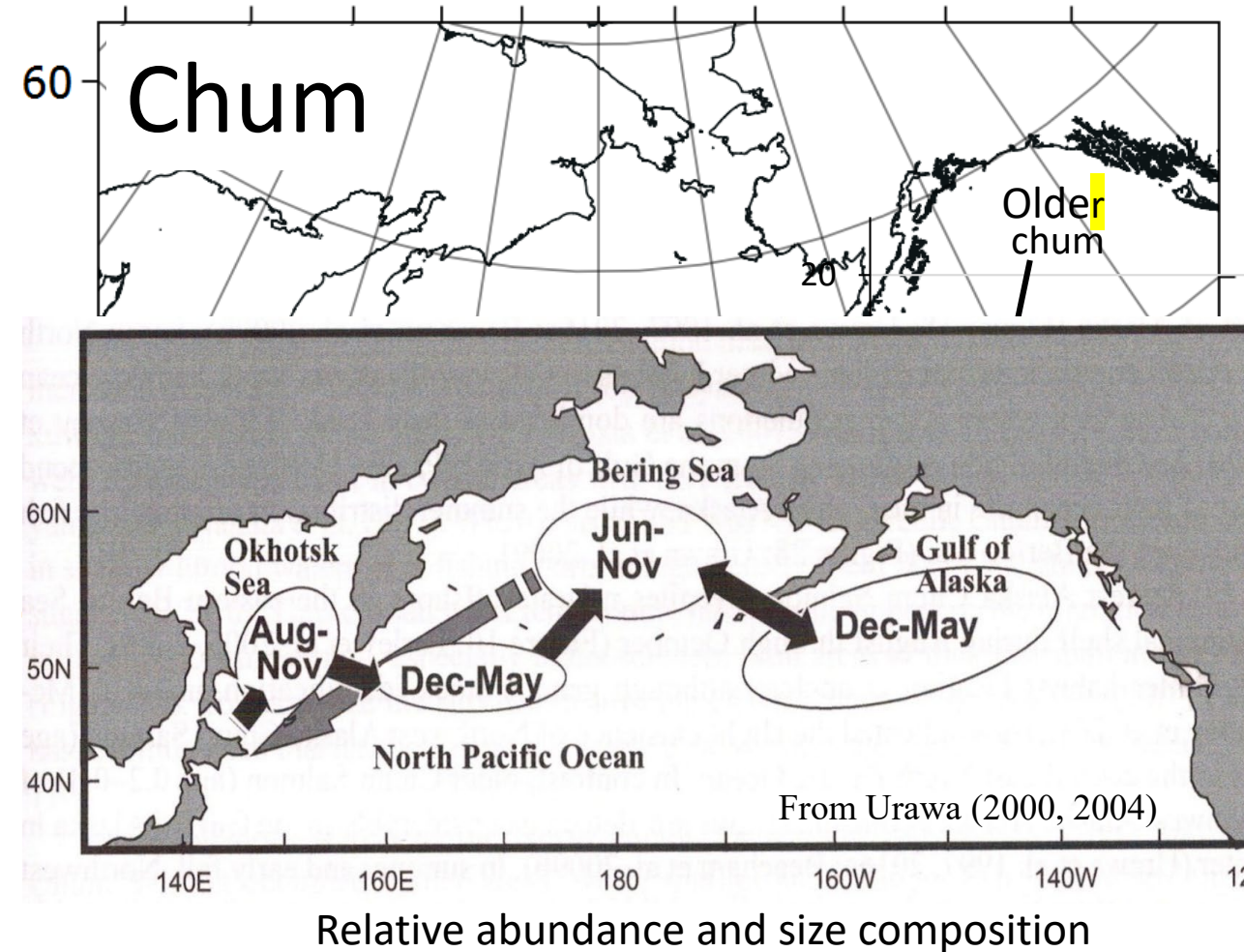
# 2019 GoA IYS Survey

- Chum salmon:
  - Abundance of 1<sup>st</sup> winter individuals decreased eastward. The highest abundance was in the Central Pacific
  - Abundance of 2<sup>nd</sup> winter and older individuals increased eastward
  - Size (age) structure changed eastward:
    - No second years in WP
    - Older individuals in GoA



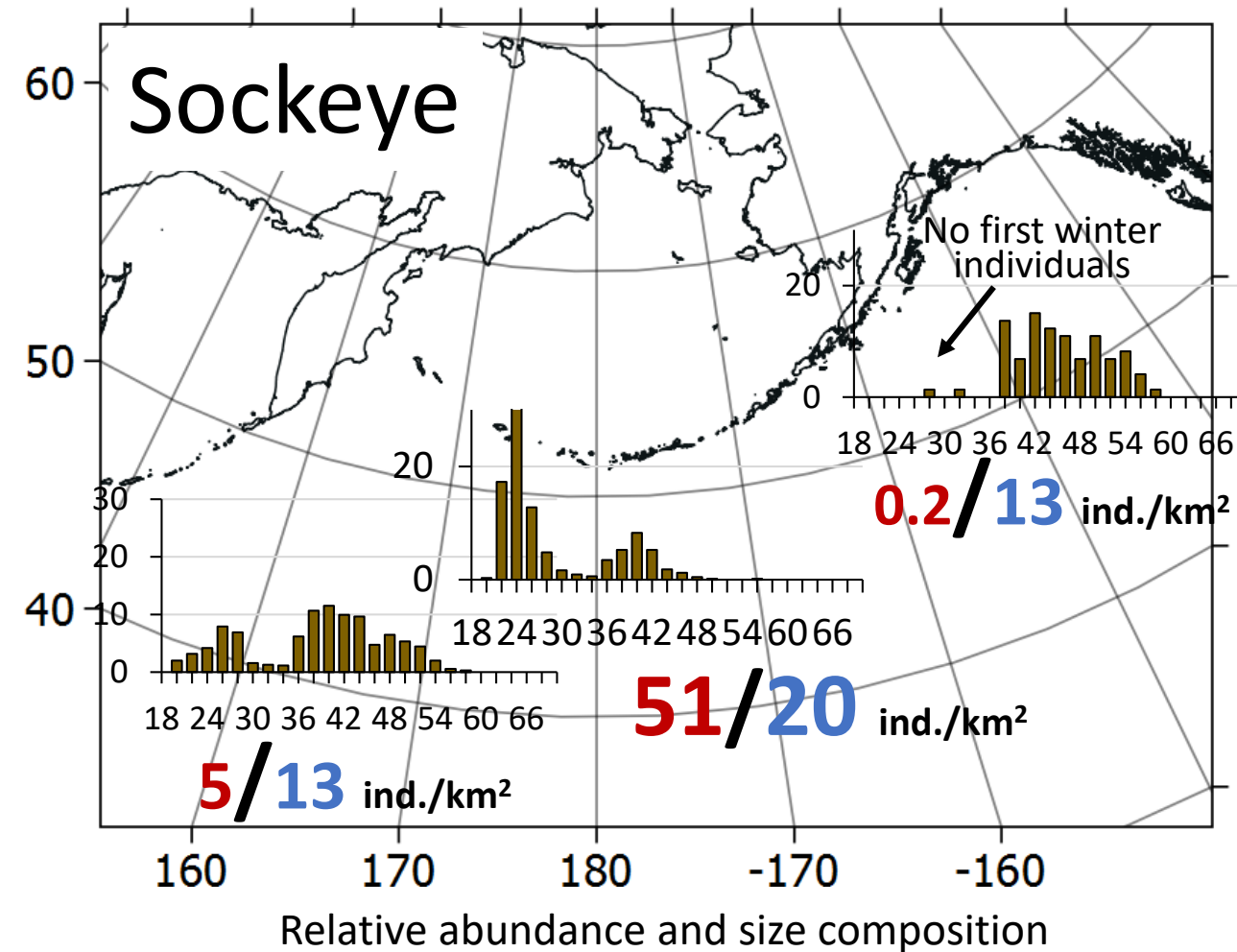
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  - Size (age) structure changed eastward:
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    - Older individuals in GoA
- In agreement with migration model (Urawa 2000, 2004)



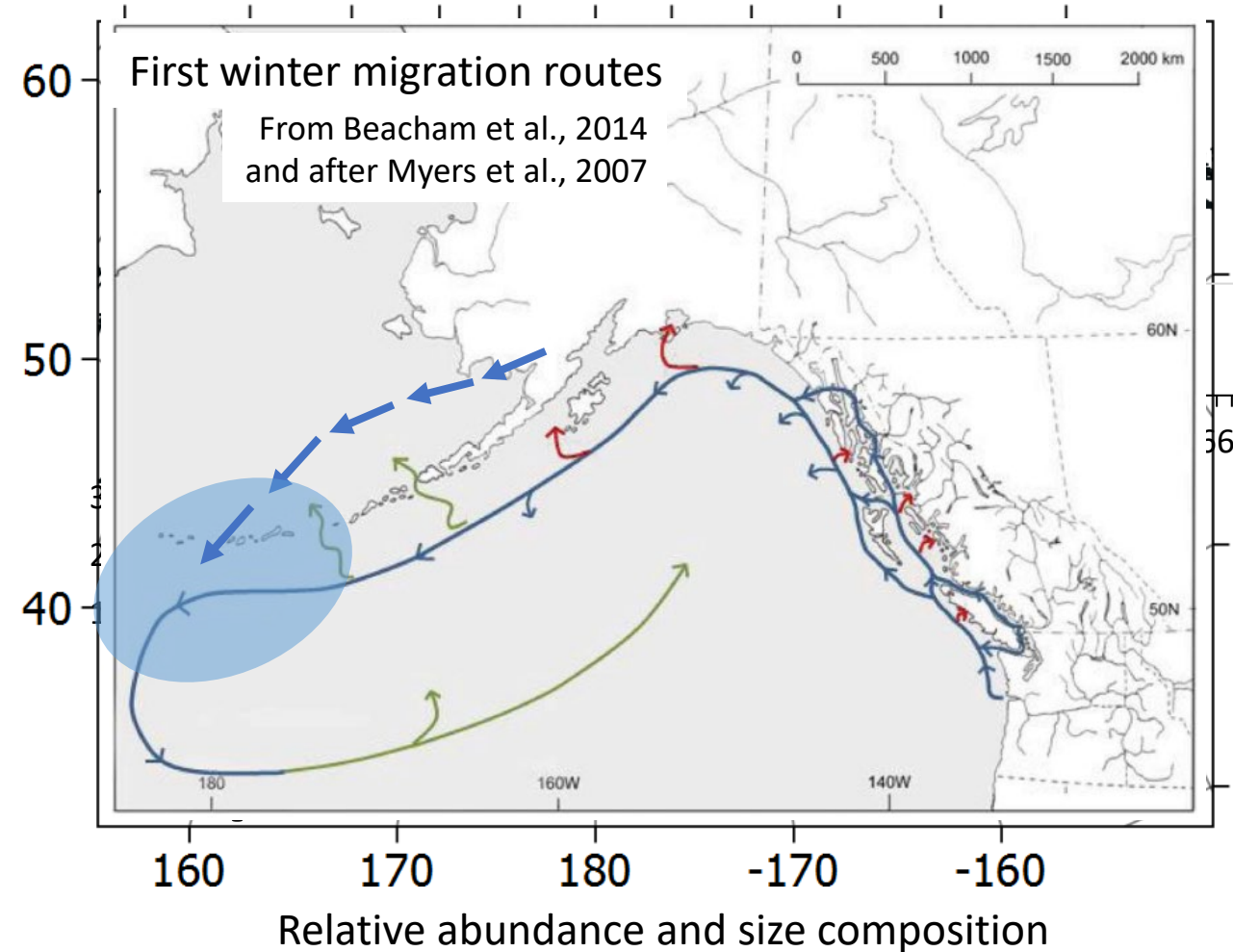
# 2019 GoA IYS Survey

- Sockeye salmon:
  - 1<sup>st</sup> winter individuals were abundant in CP, less in WP and rare in GoA
  - 2<sup>nd</sup> winter and older individuals distributed more smooth with the highest abundance in CP
  - Habitat differentiation:
    - Early-years mostly in CP
    - Older-years in WP and GoA



# 2019 GoA IYS Survey

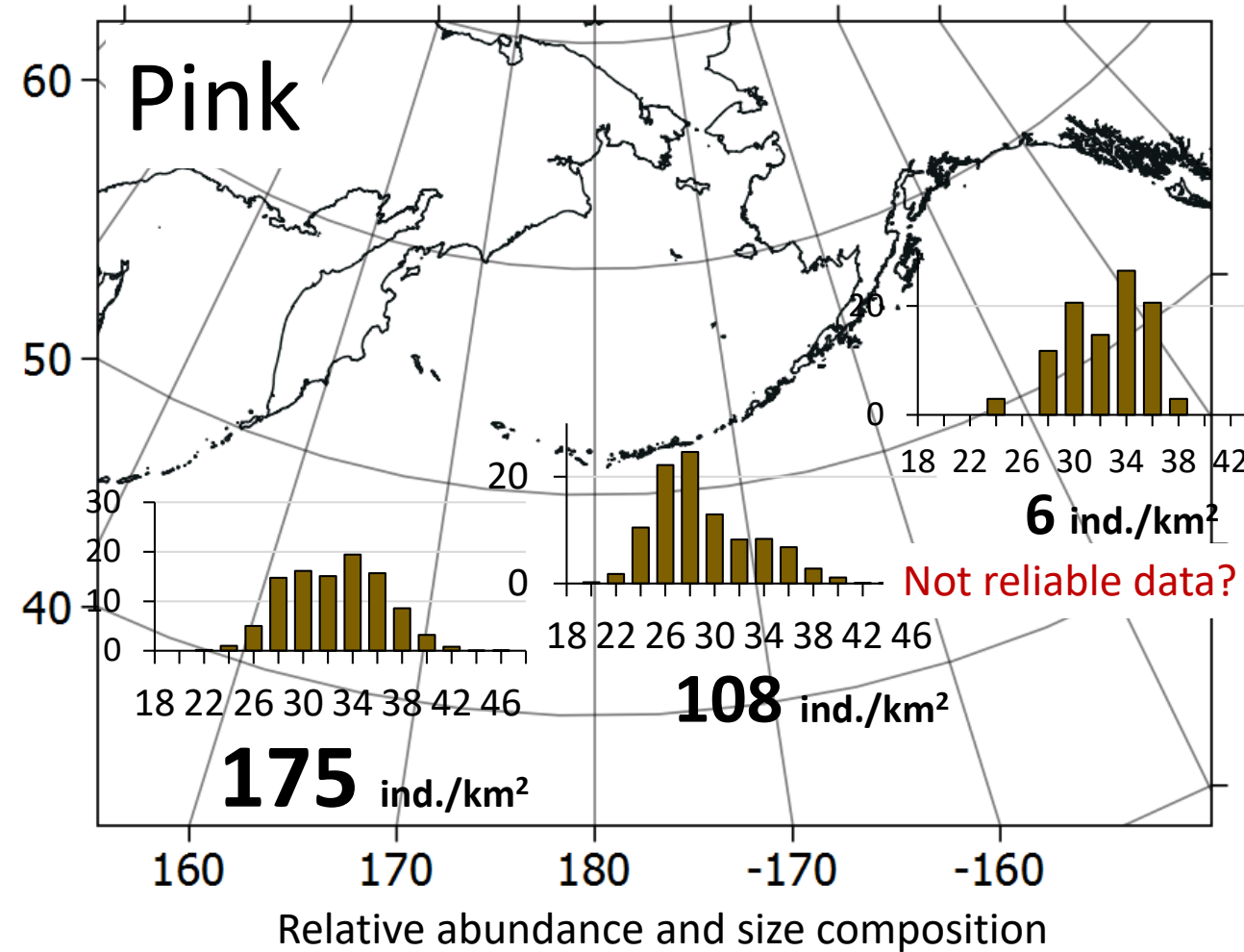
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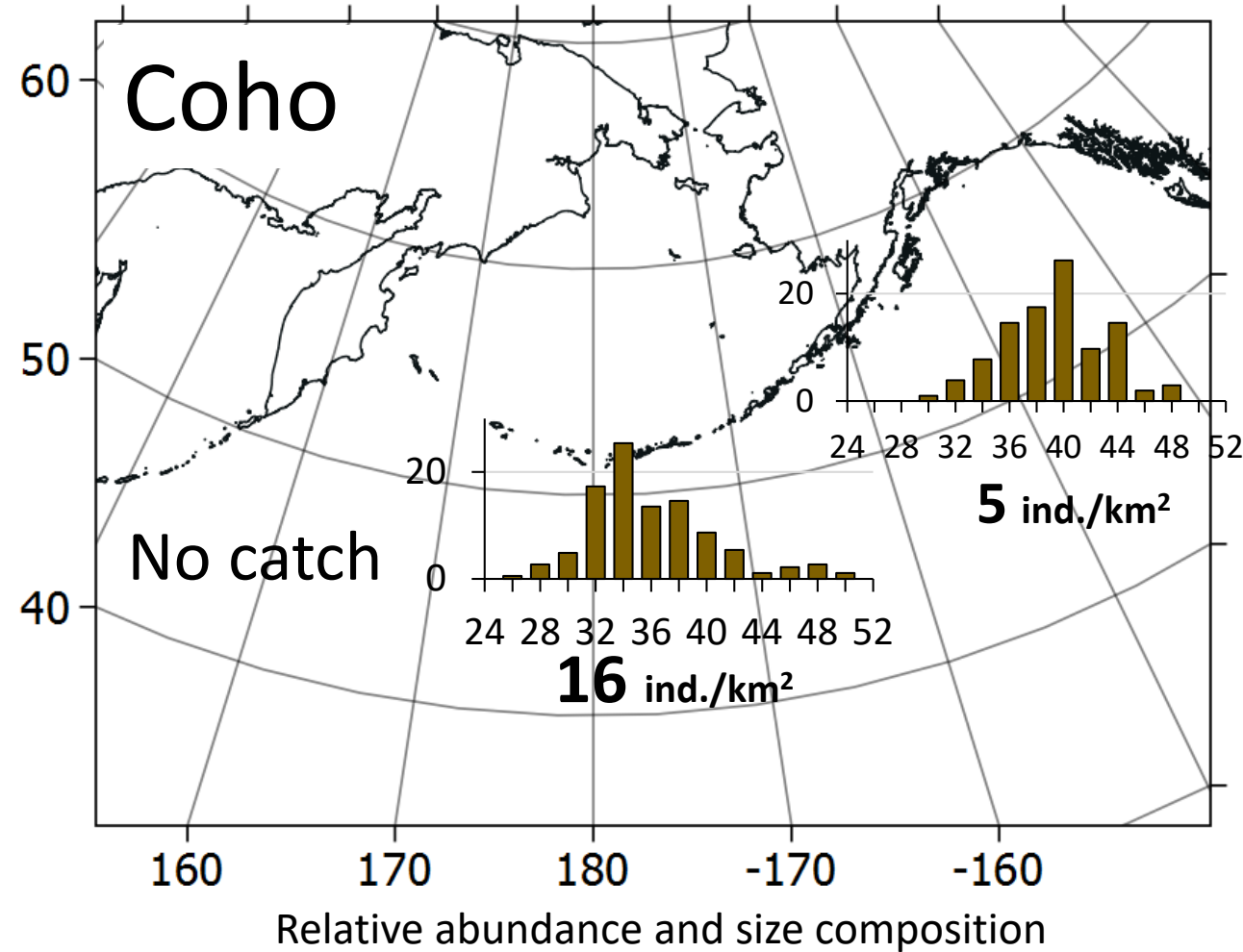
# 2019 GoA IYS Survey

- Pink salmon:
  - Abundance decreased eastward (but we do not know reliability of data in GoA)
  - Similar size structure



# 2019 GoA IYS Survey

- Coho salmon:
  - More abundant in central pacific
  - Average size is higher in GoA



# Conclusion

- Forecast crash in 1985 was a trigger of high-seas research development
- Modern Russia's research program aims at Pink salmon forecasting
- Fall and Summer surveys are good for forecast while winter ones are more appropriate to study fundamental issues
- Russia made a great contribution into salmon ocean research=)
- 2019 GoA survey gave interesting and comparable data showing spatial differentiation in winter habitat

Thank you!!



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