

# Sockeye Salmon Genetics: Applications for Bristol Bay

ADF&G Gene Conservation Laboratory



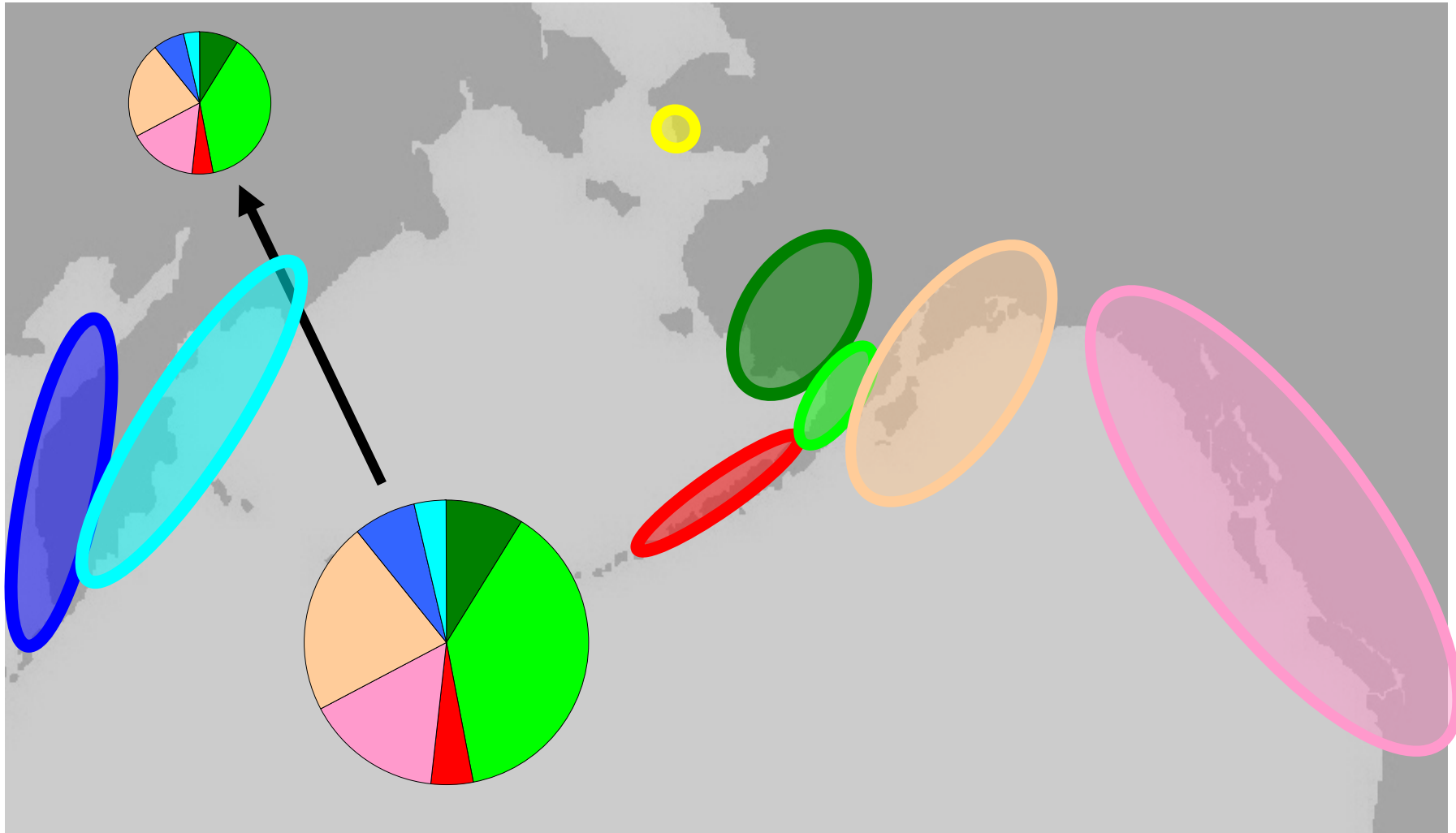
*Oral Report to the Alaska Board of Fisheries  
December 2006, Dillingham, AK*

**Oral Report:  
White Tab 4**

# Outline

- Bering Sea
  - DNA baseline
  - Sea-wide stock distribution
- Port Moller Test Fishery
  - New DNA baseline (SNP)
  - In-season application
- Alagnak Special Harvest Area
  - Informing fishery management
  - Brood table information

# Proportion of Total Bering Sea Run Size by Region



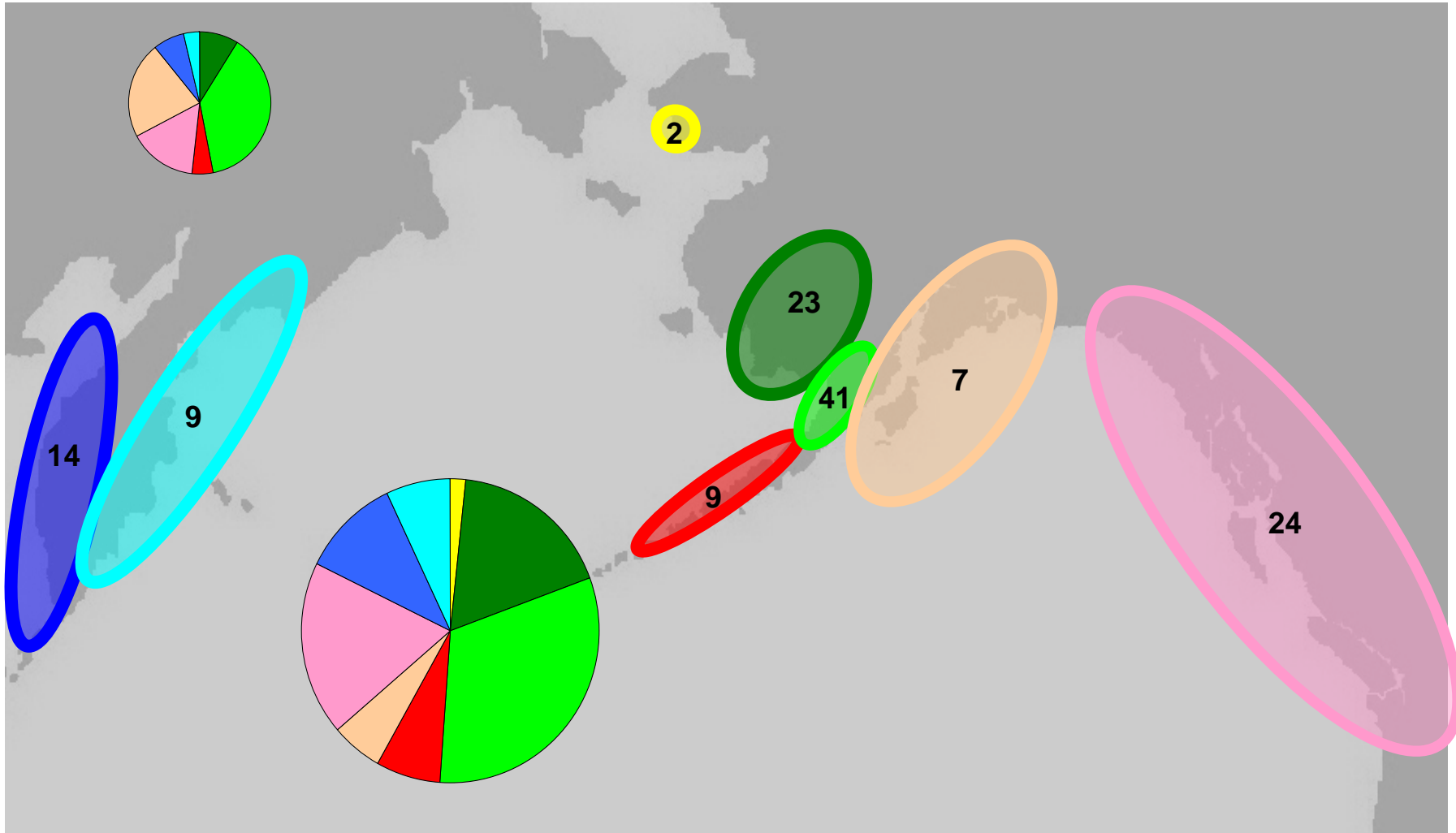
Russian run sizes: Bugaev NPAFC Doc. 763, 2004

# Pacific Rim Baseline

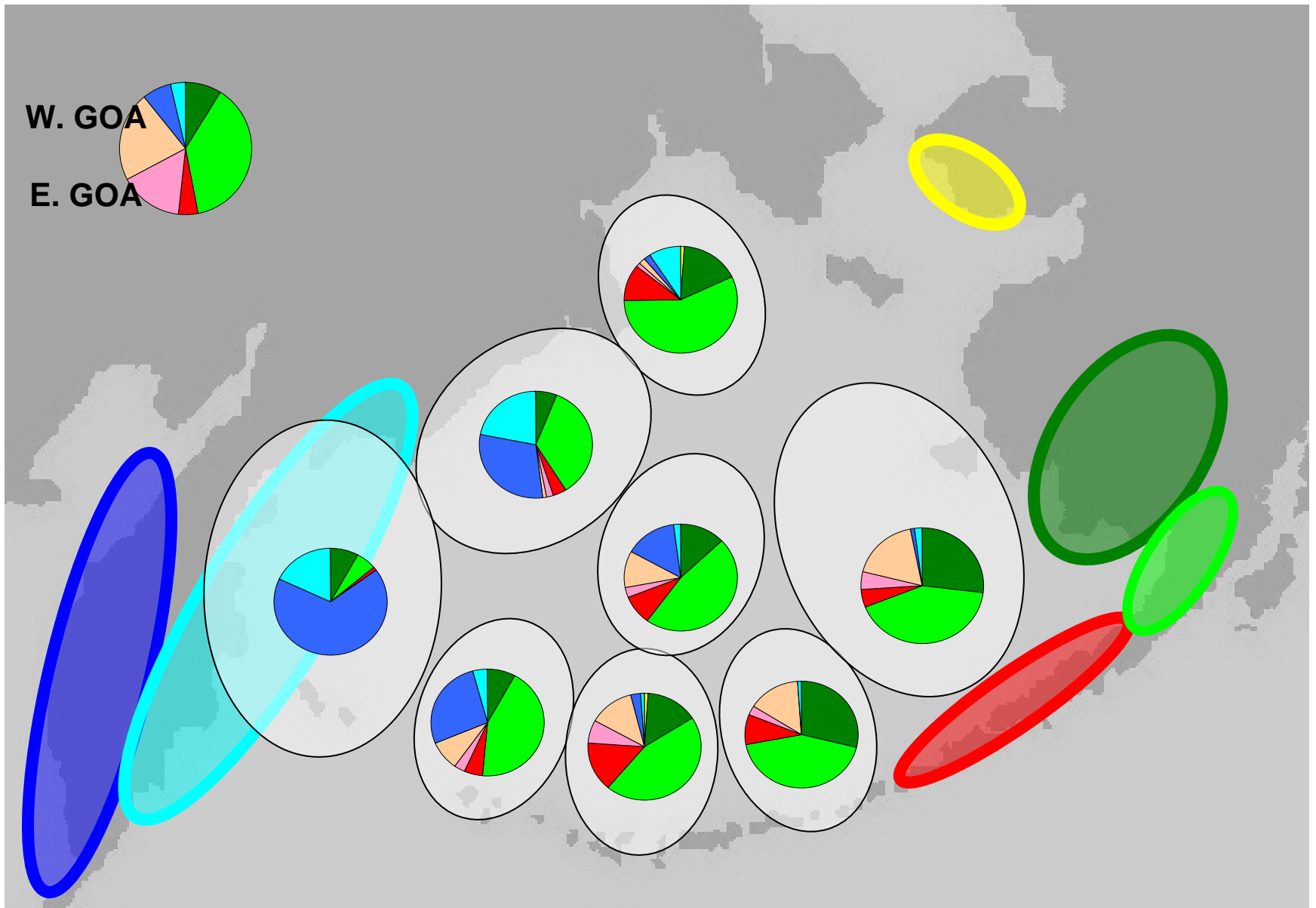
- 129 locations
- 13,000 fish



Baseline collections distributed approximately proportional to run size except W.GOAA



# August Stock Compositions



# Conclusions: Bering Sea

- Alaska fish found in western BS
- Asian fish found in central BS
- Alaska and Asian fish compete for resources



# Port Moller Test Fishery

- New Baseline
  - Collections
  - Testing
- In-season analysis
- Results





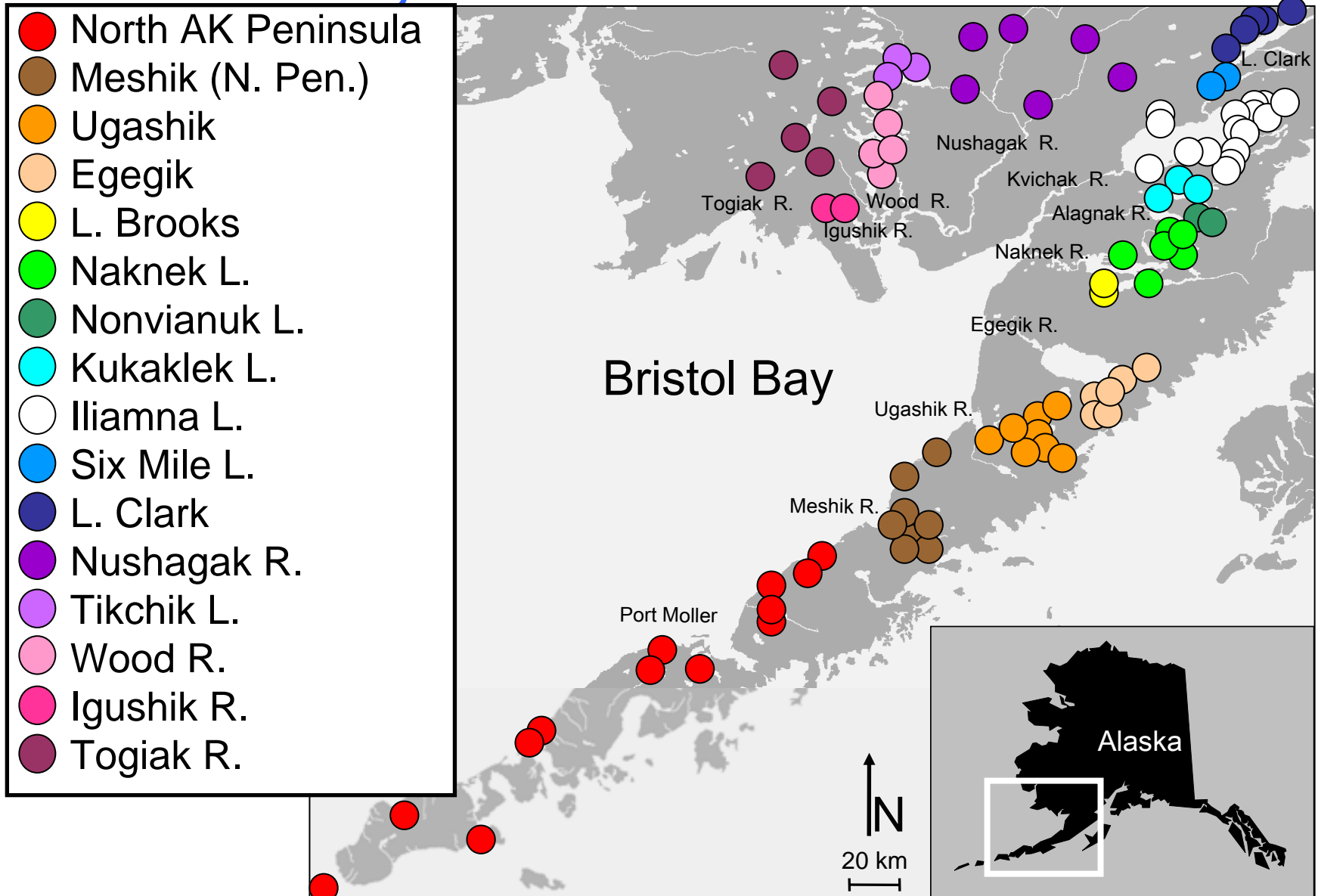
# Bristol Bay/N. Peninsula Baseline

- 100 locations
- 10,000 fish
- 39 SNPs new in 2006



# Collections:

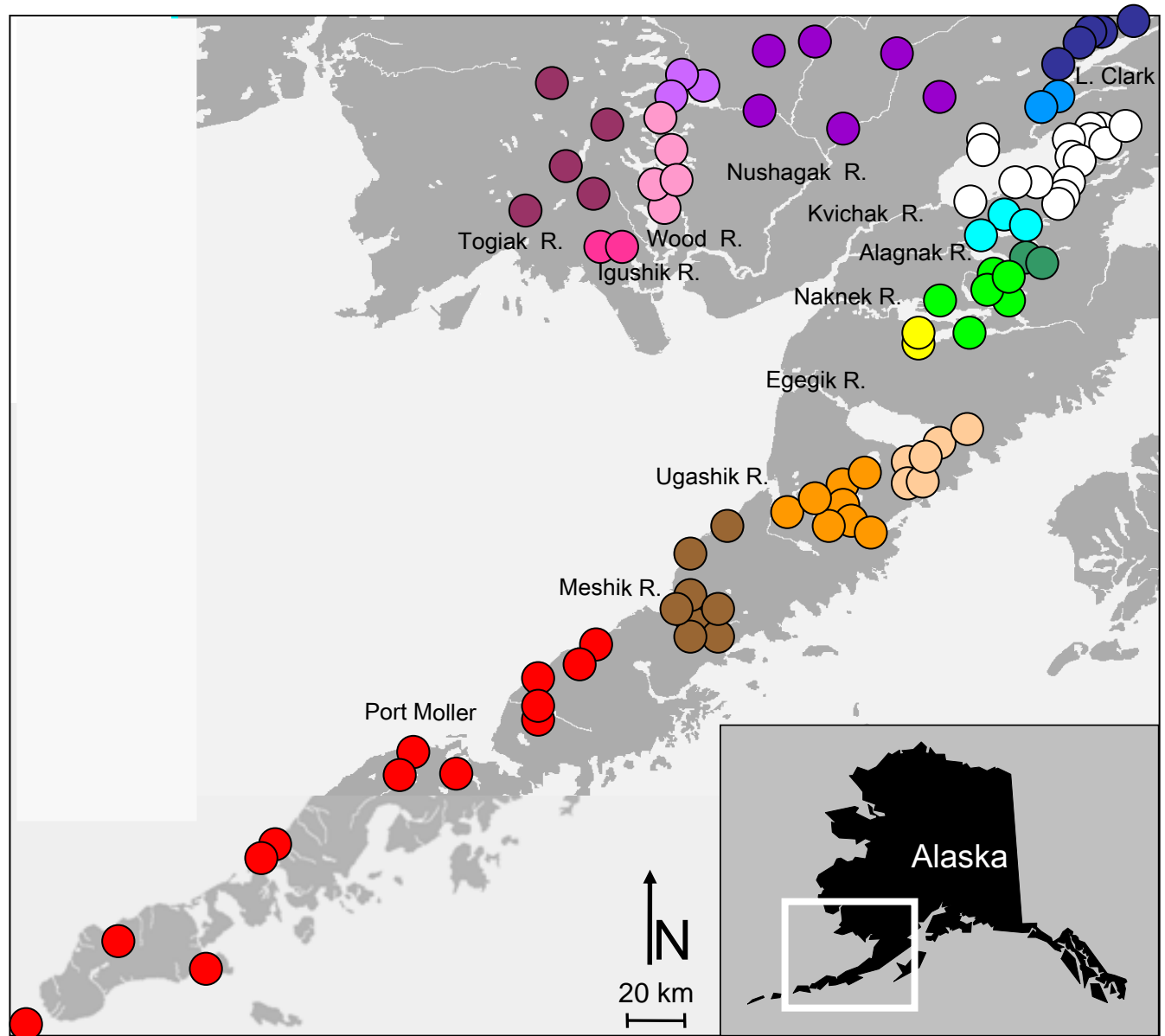
## Bristol Bay and North AK Peninsula



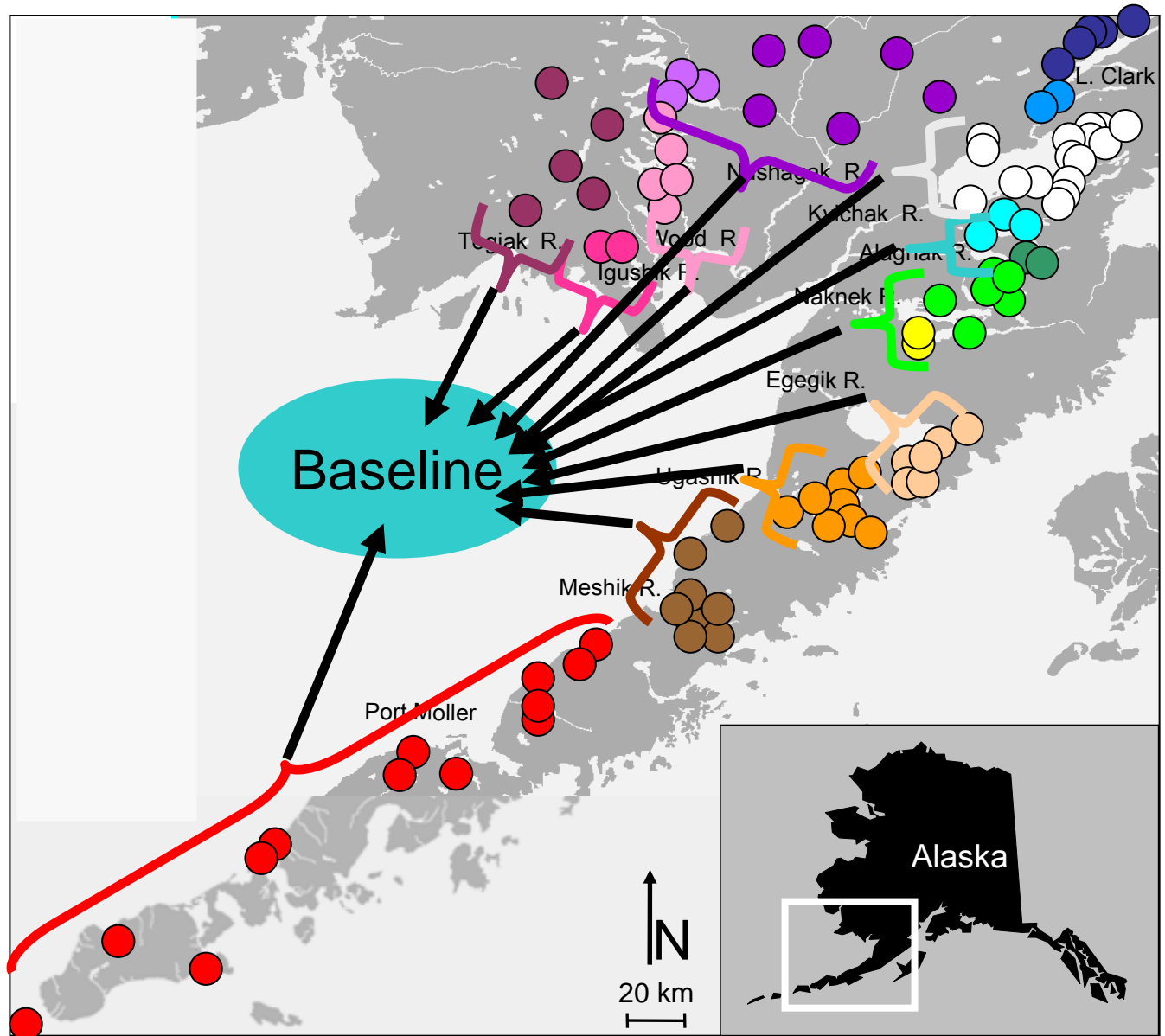
# Testing the Baseline

- 100% Simulations
- Proof tests

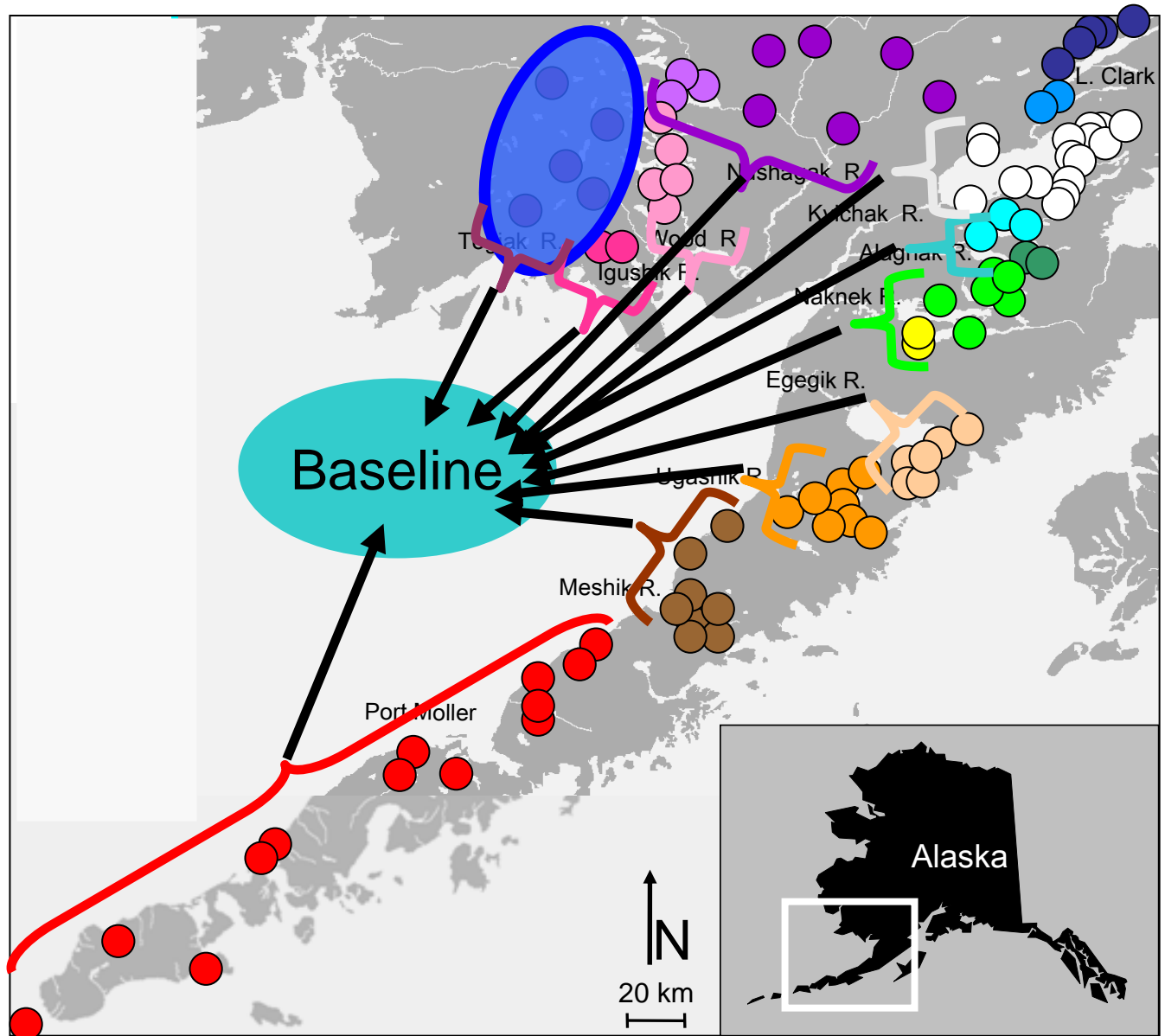
# 100% Simulations



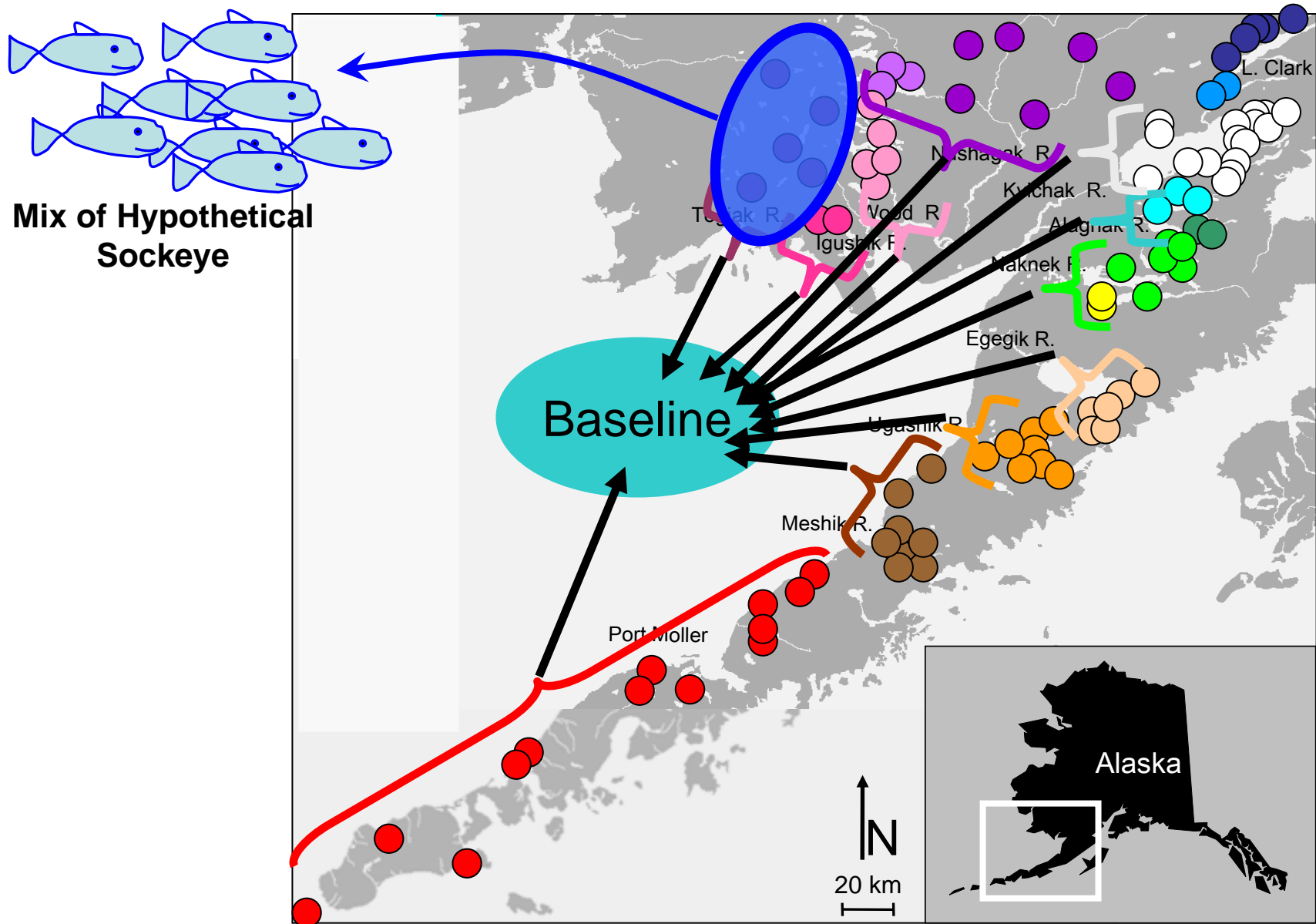
# 100% Simulations



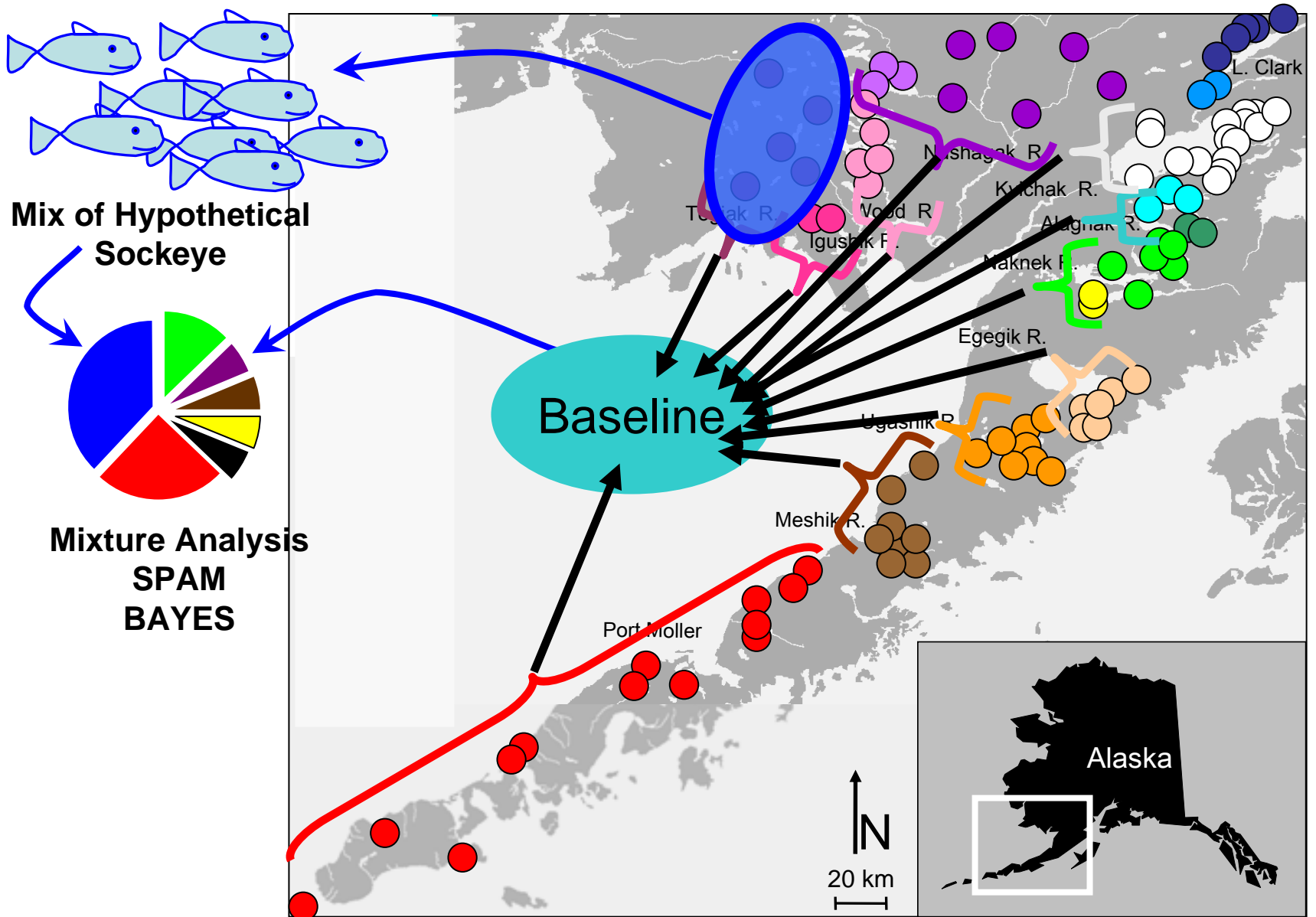
# 100% Simulations



# 100% Simulations

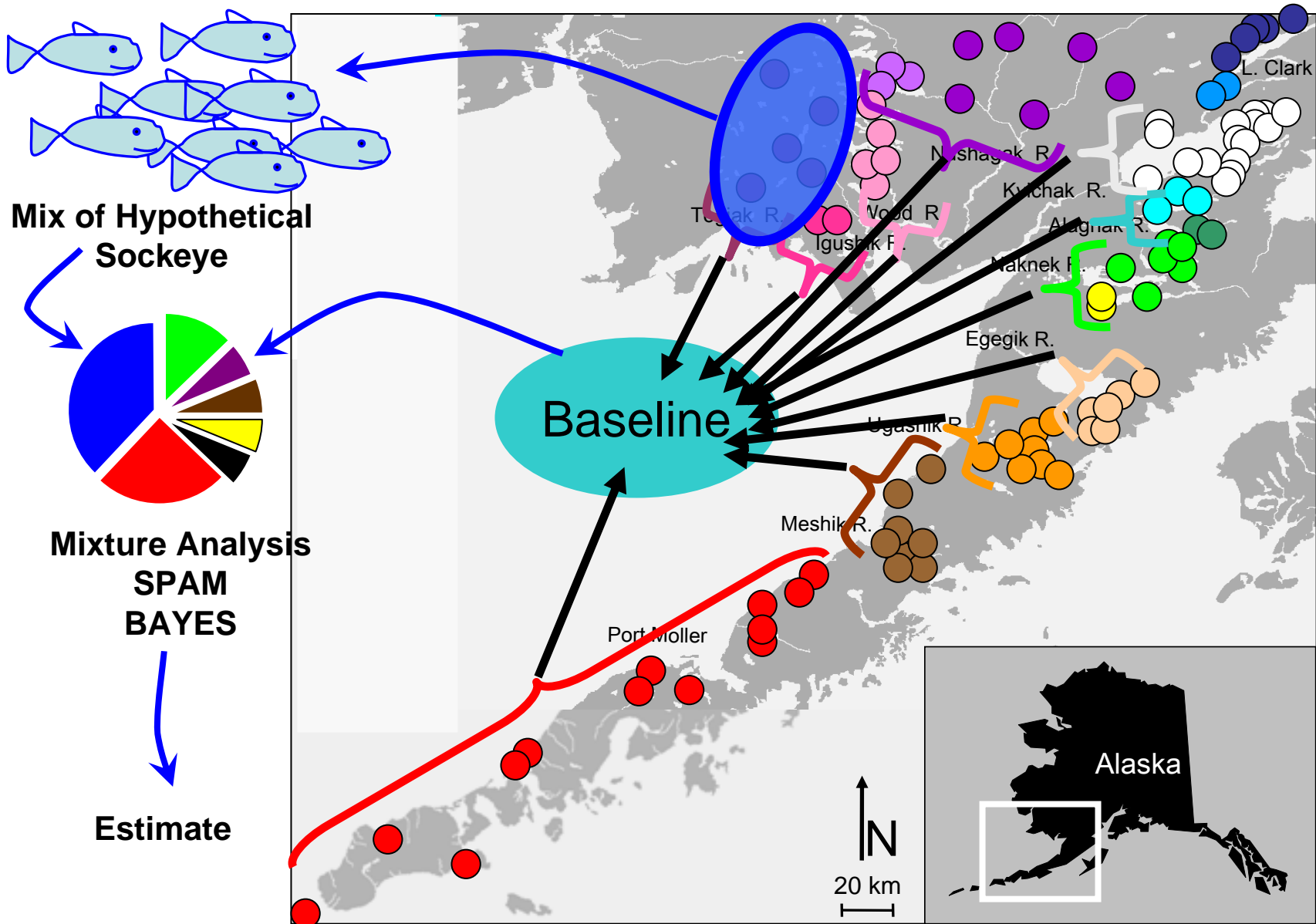


# 100% Simulations

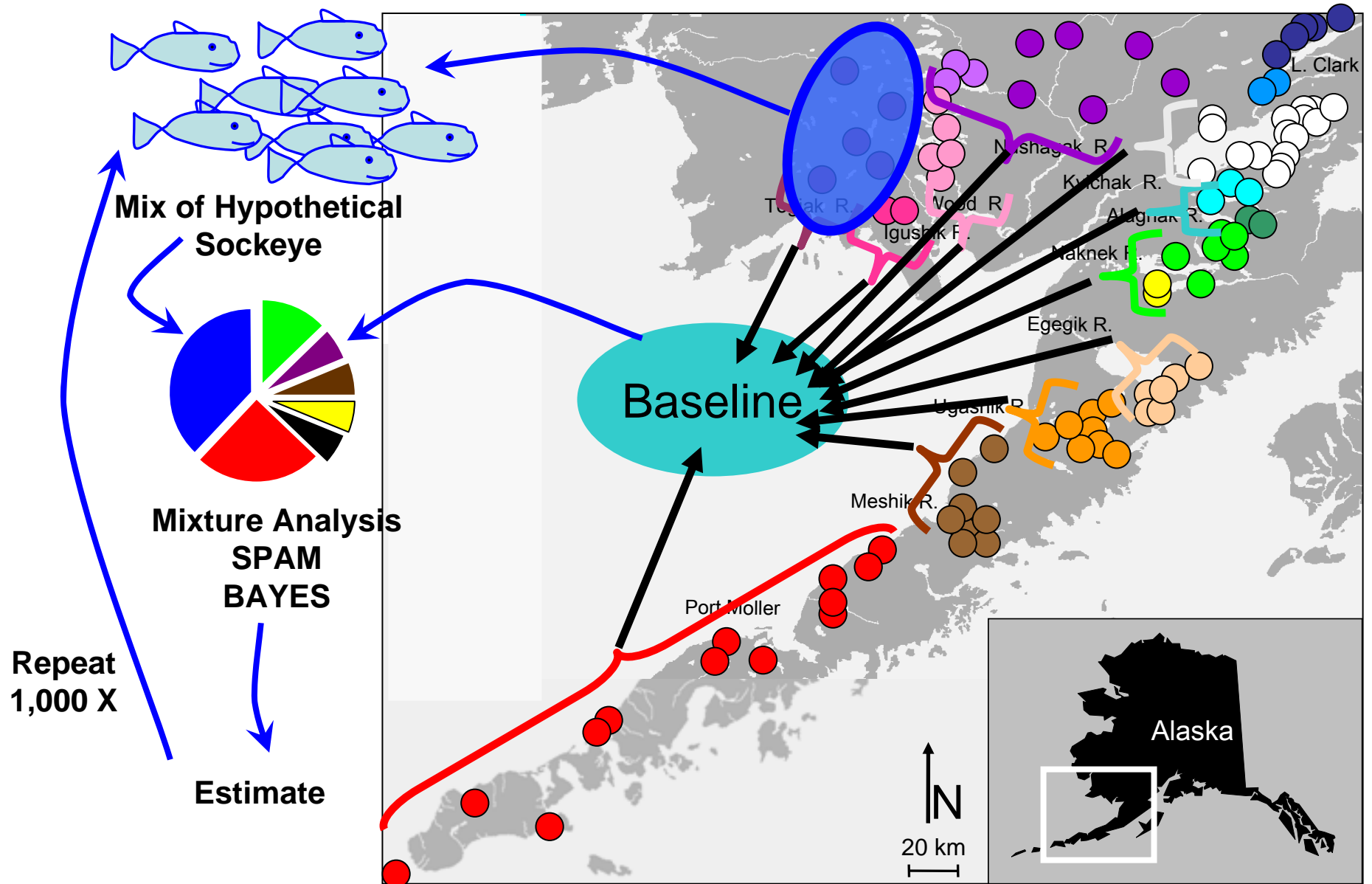




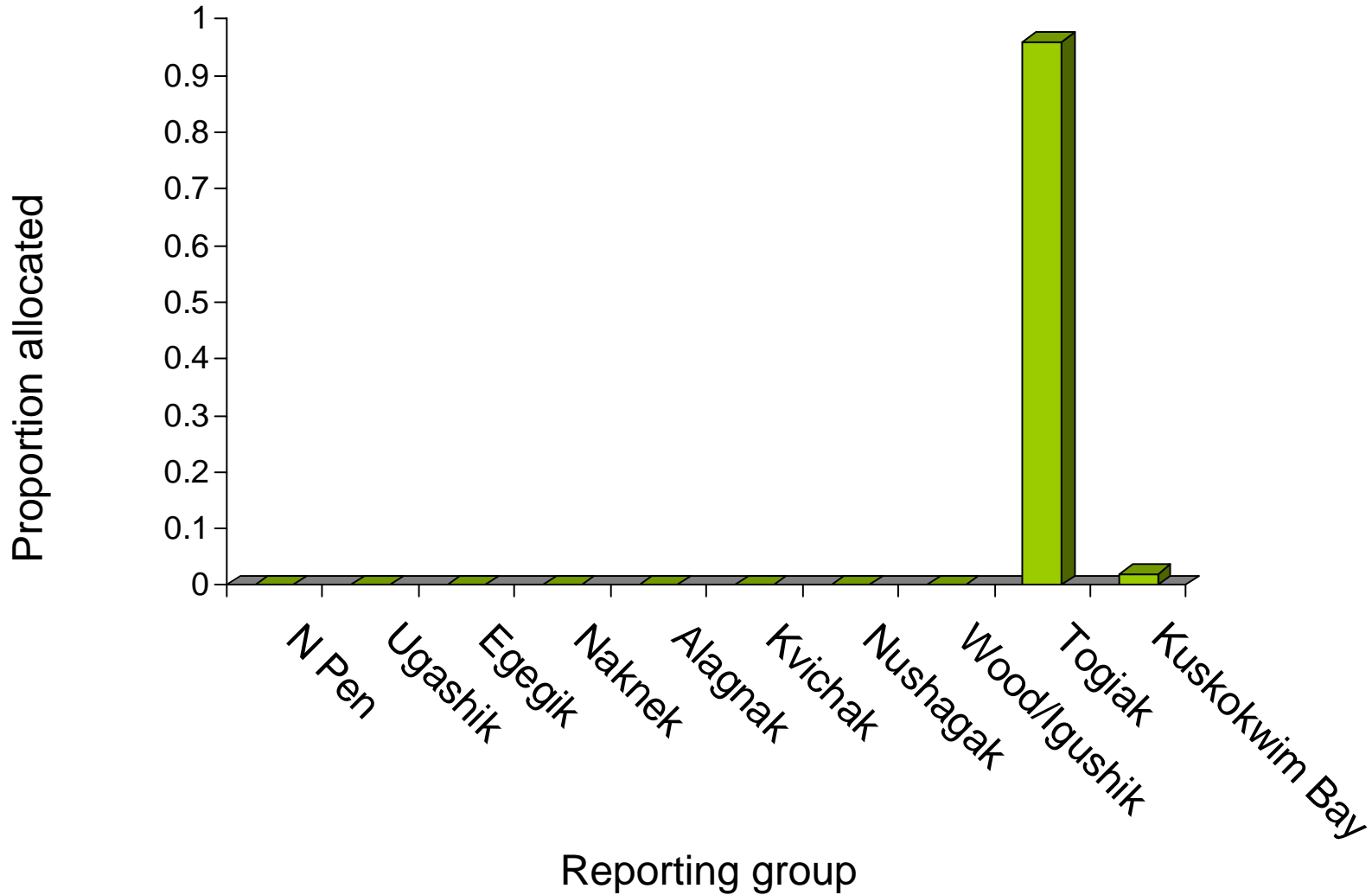
# 100% Simulations



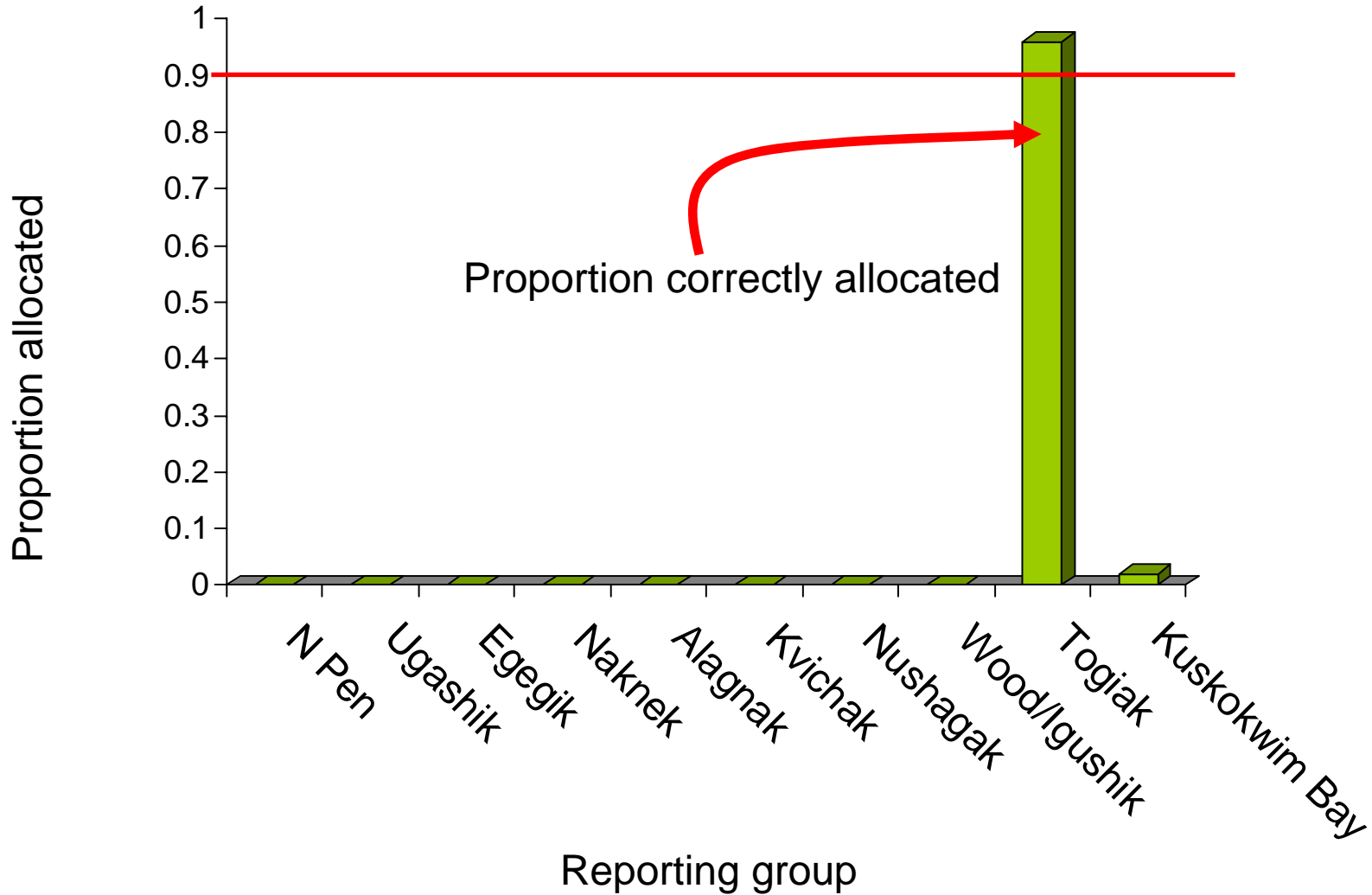
# 100% Simulations



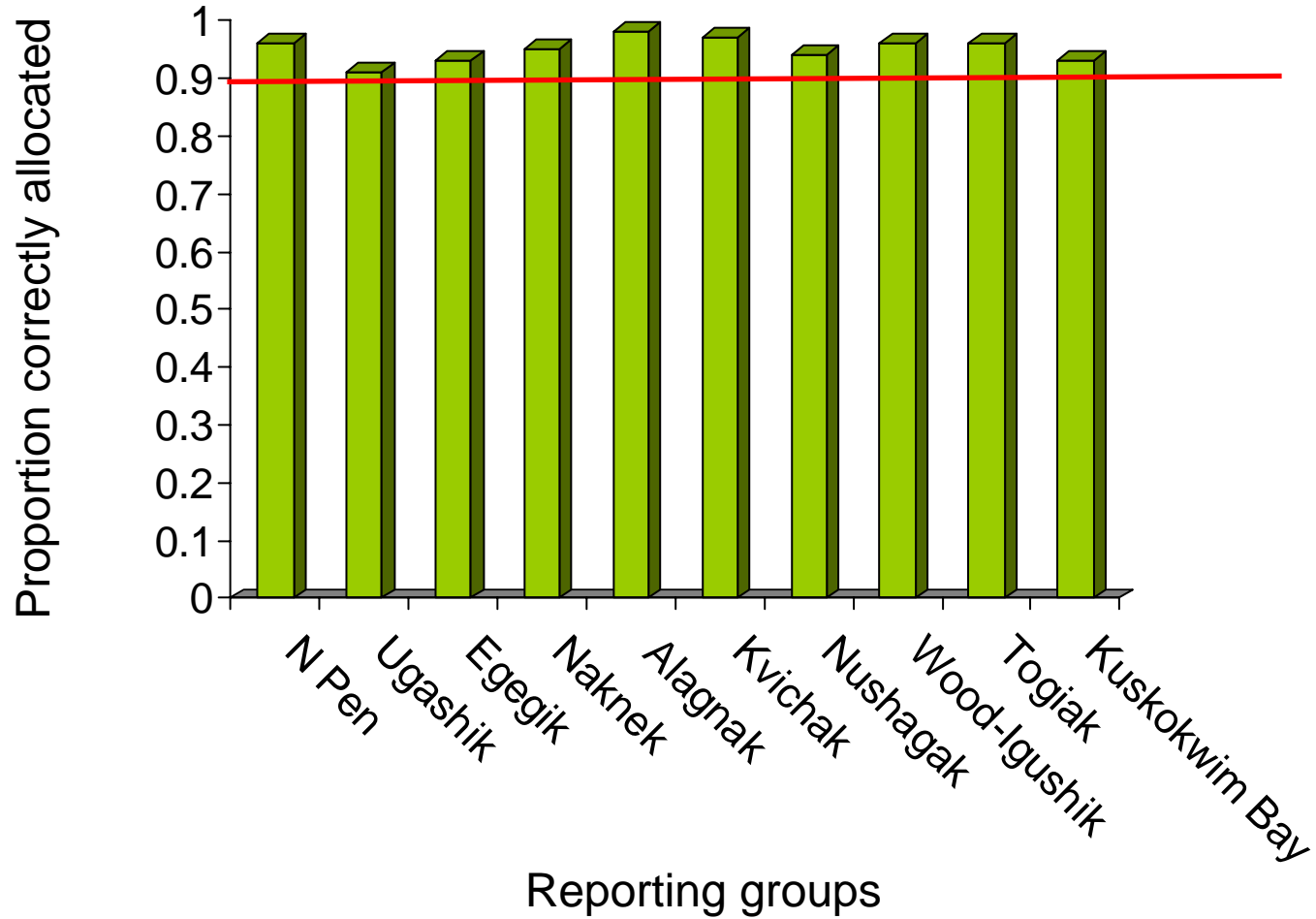
# 100% simulation result: Togiak R.



# 100% simulation result: Togiak R.

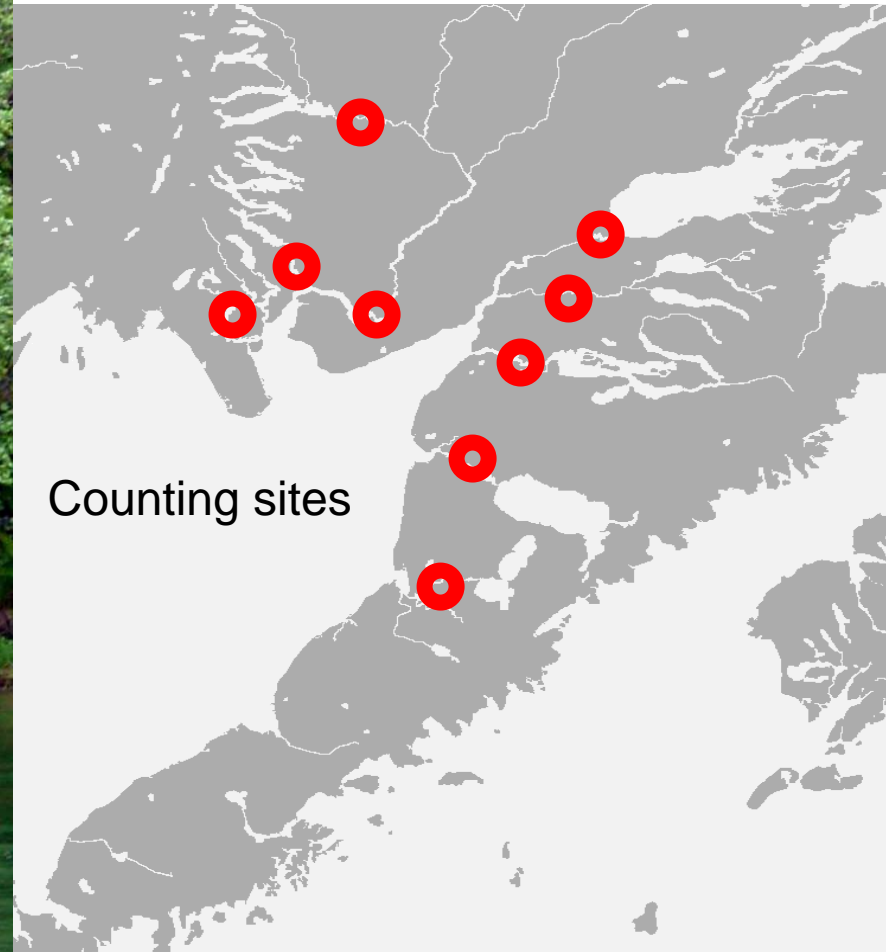


# Management-level simulations



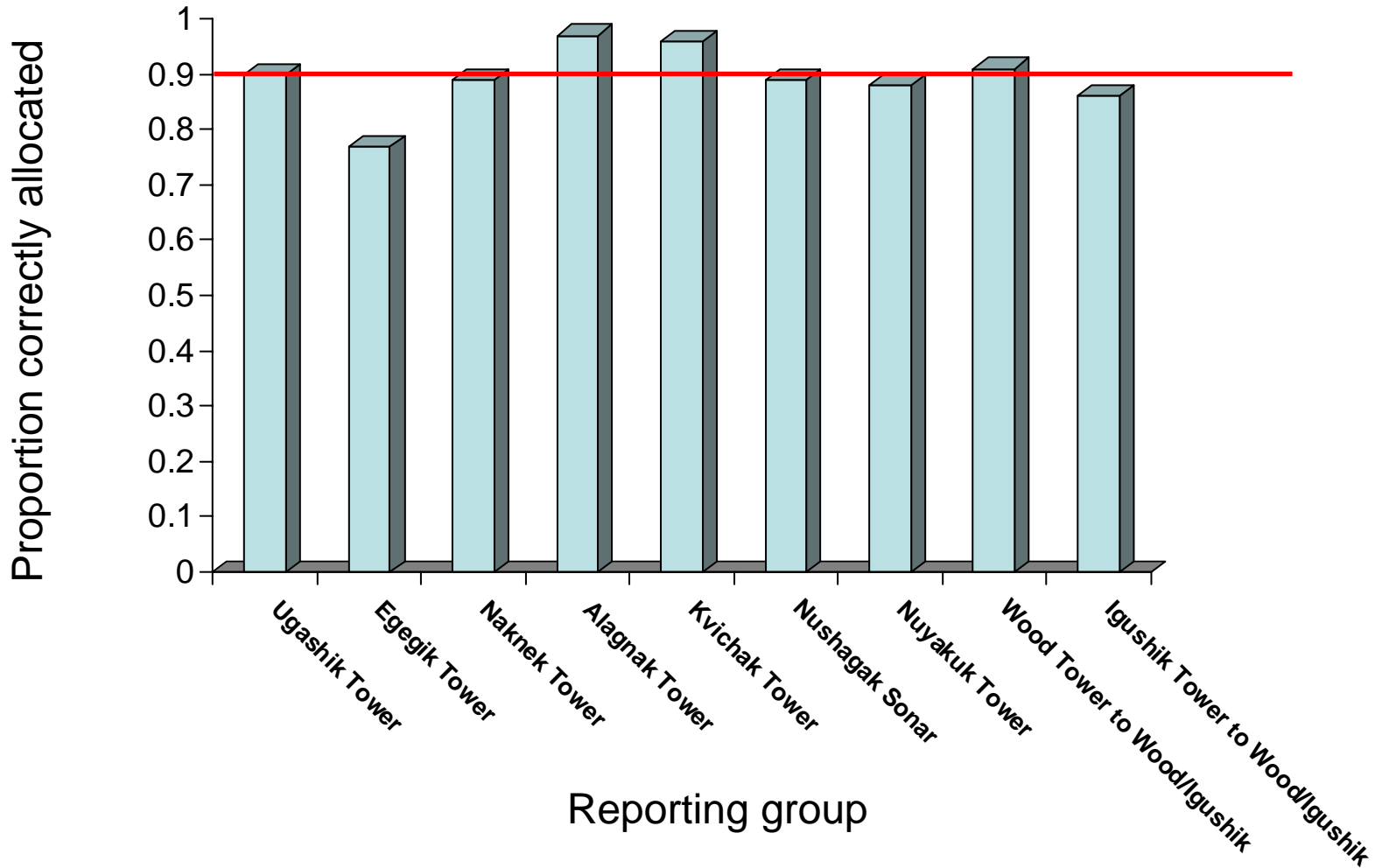


# Proof tests: Sample fish at counting sites

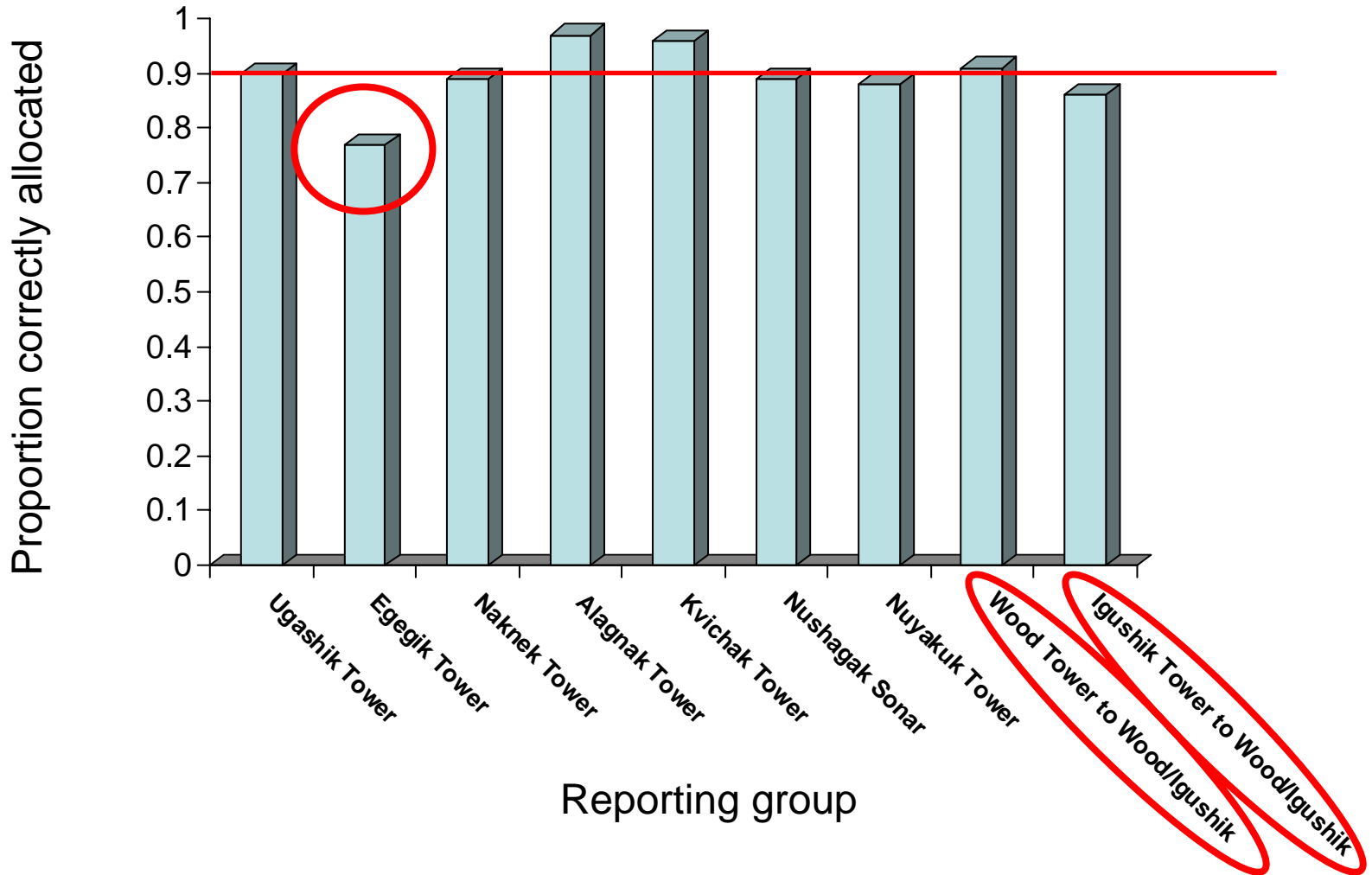


Counting sites

# Counting site sample estimates



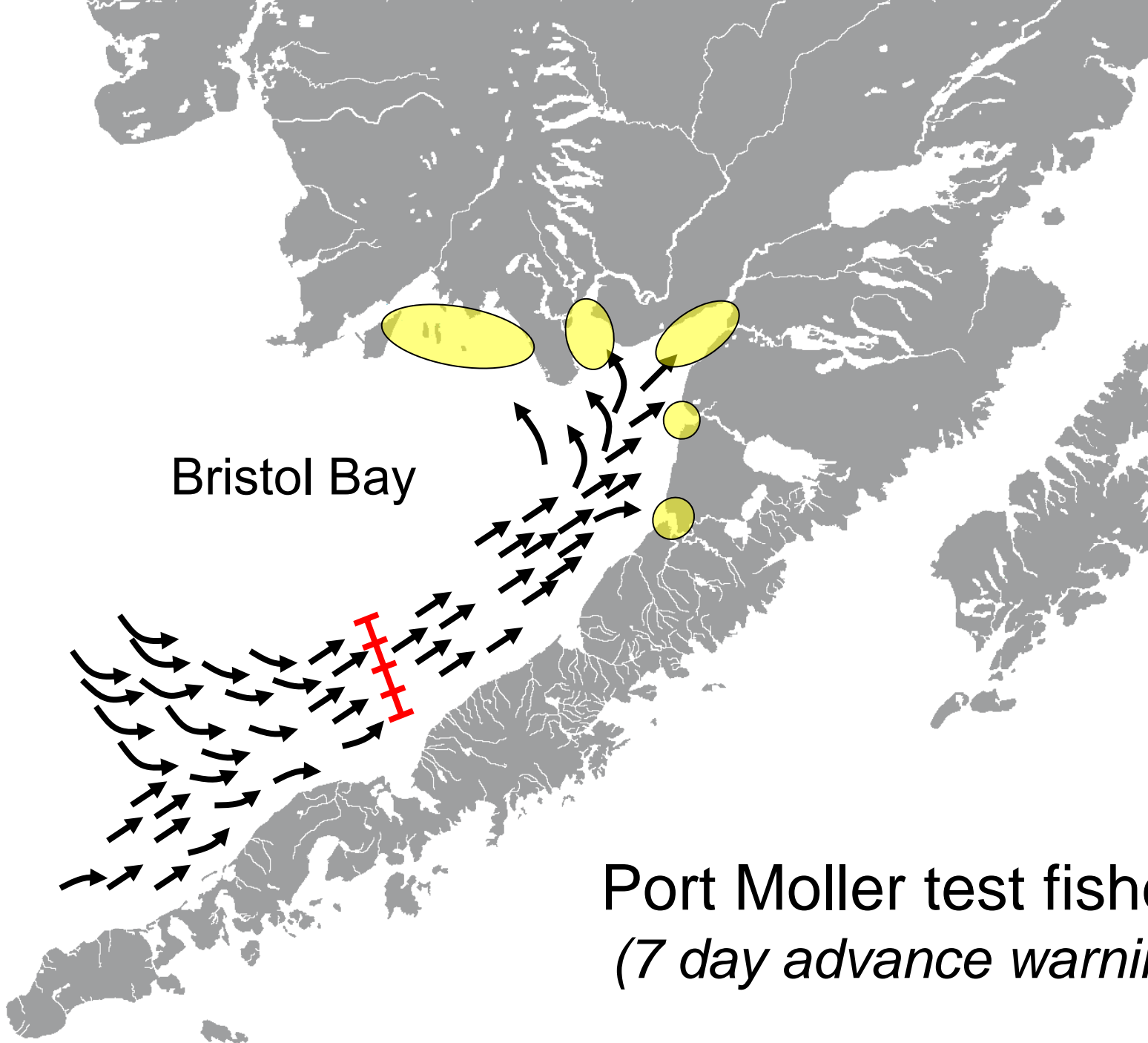
# Counting site sample estimates





# Baseline additions

- Egegik
  - 2006 Two new sites
- Wood
  - 2006 Lower lakes beach spawners
  - 2007 Upper lakes beach spawners
- Igushik
  - 2007 Middle drainage



Bristol Bay

Port Moller test fishery  
*(7 day advance warning)*

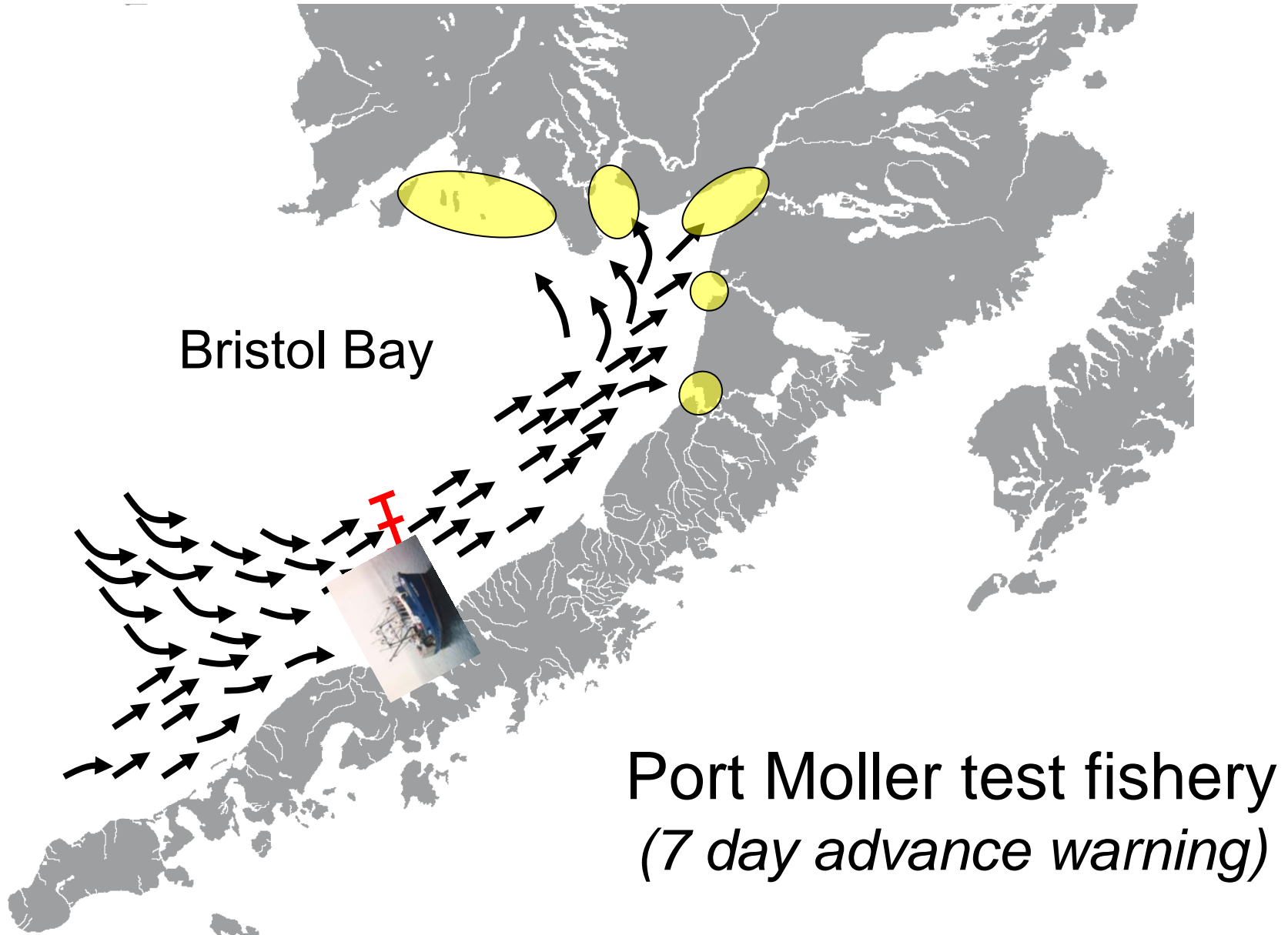
Scientific vessel used to capture fish at controlled locations and times



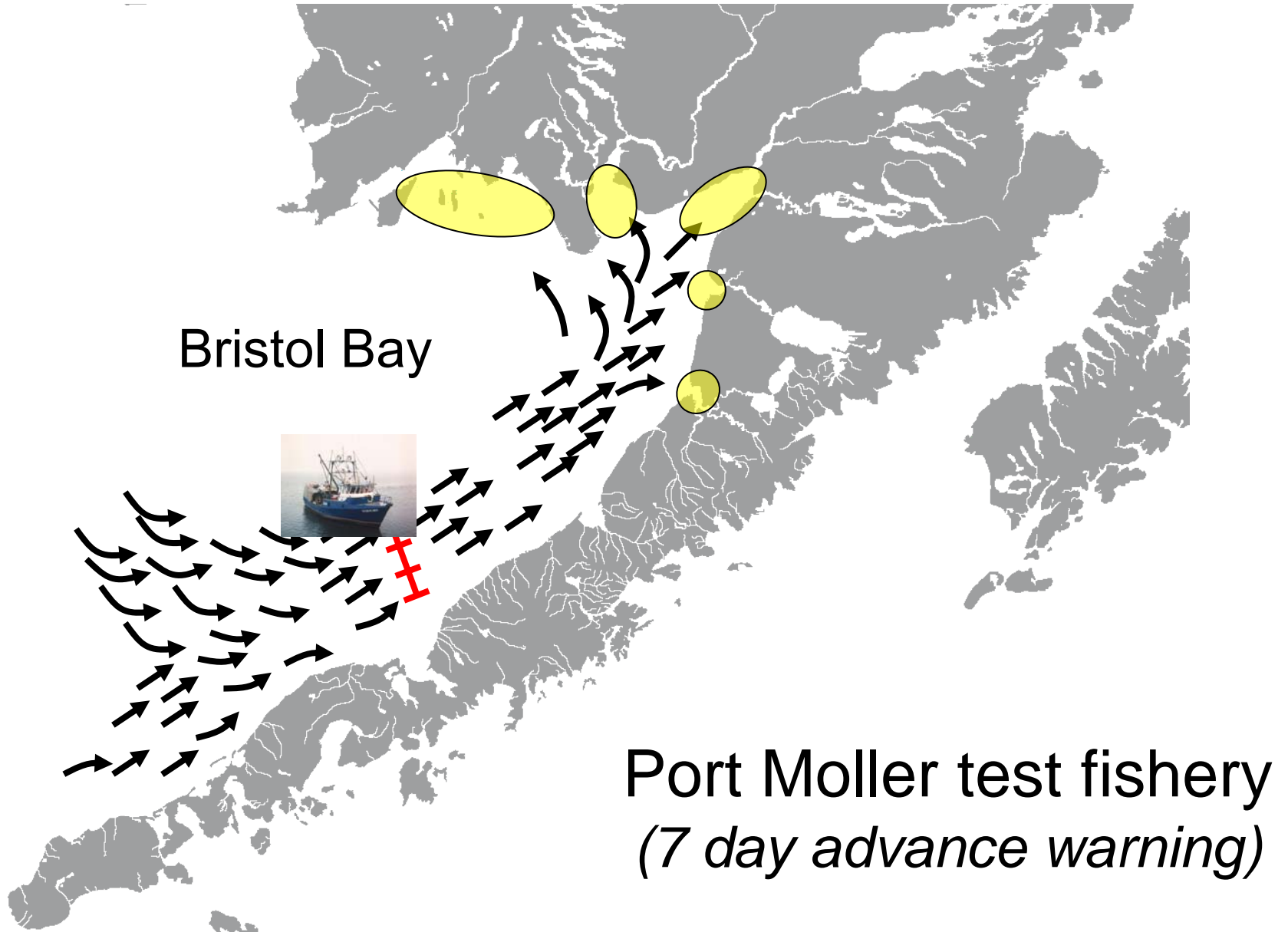
# Captured fish are sampled for genetic analysis



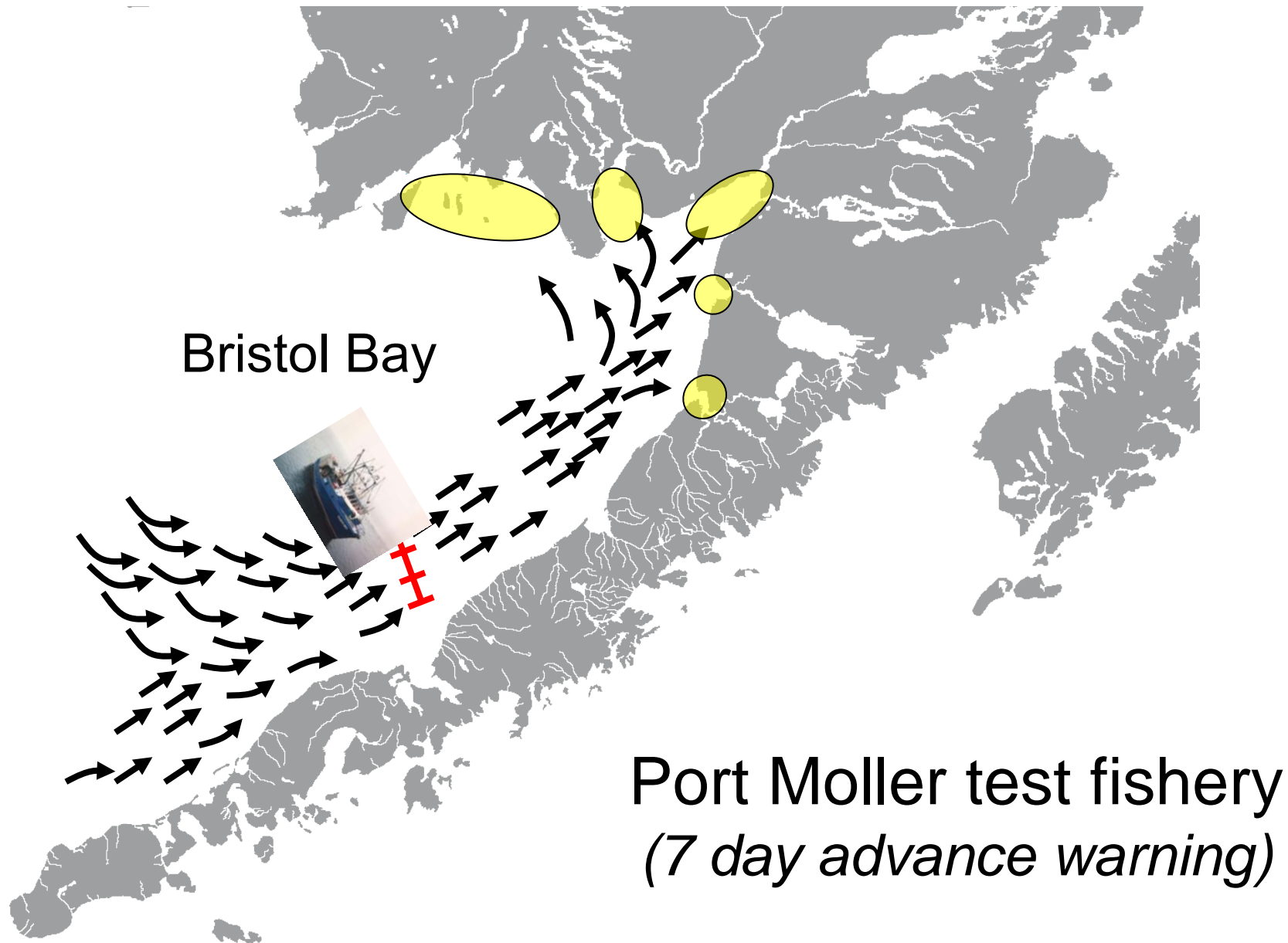
# Day 1 (am) – boat fishes on way out



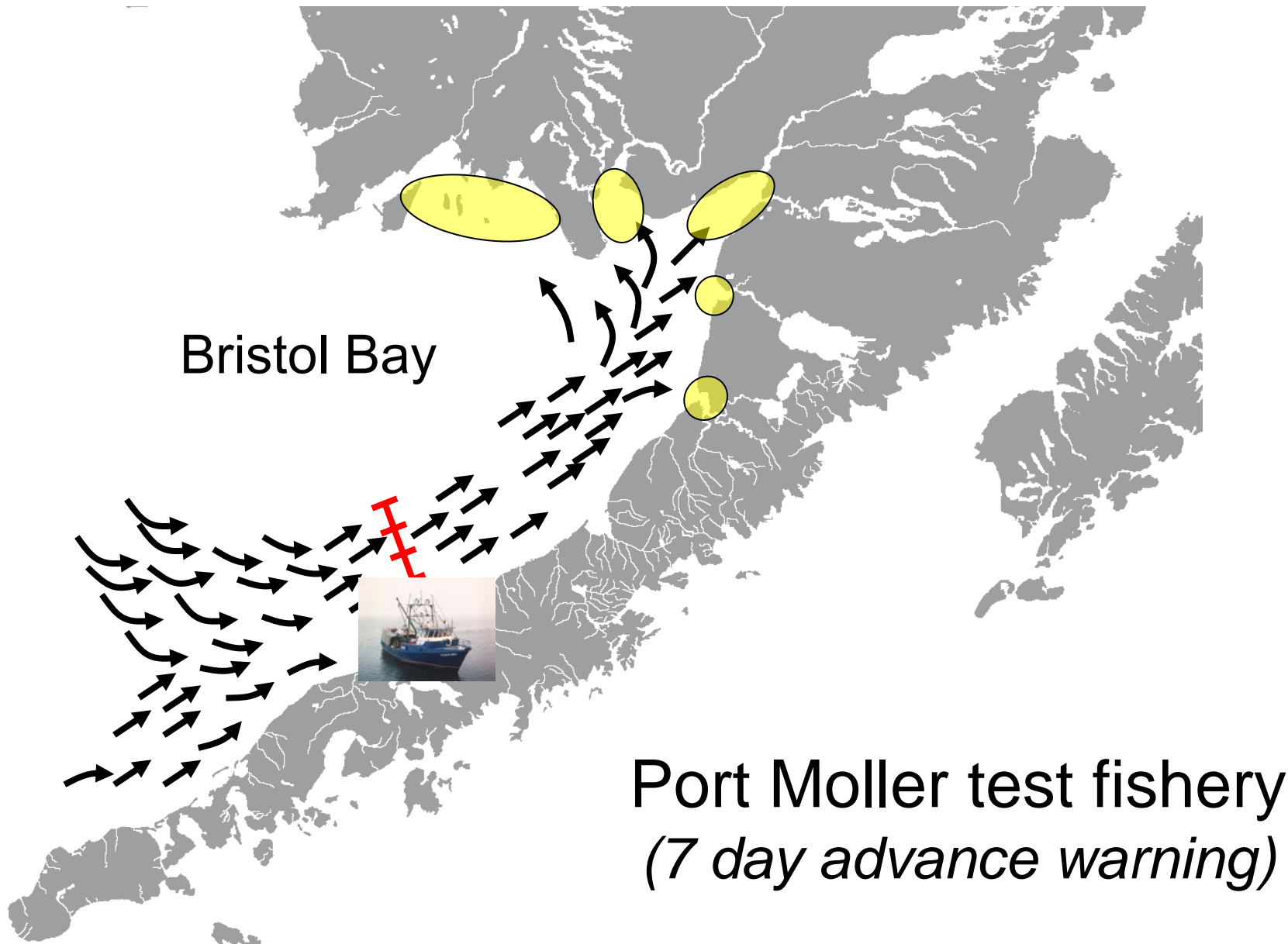
# Day 1 (pm) – boat overnights in Bay



# Day 2 (am) – boat fishes on way back

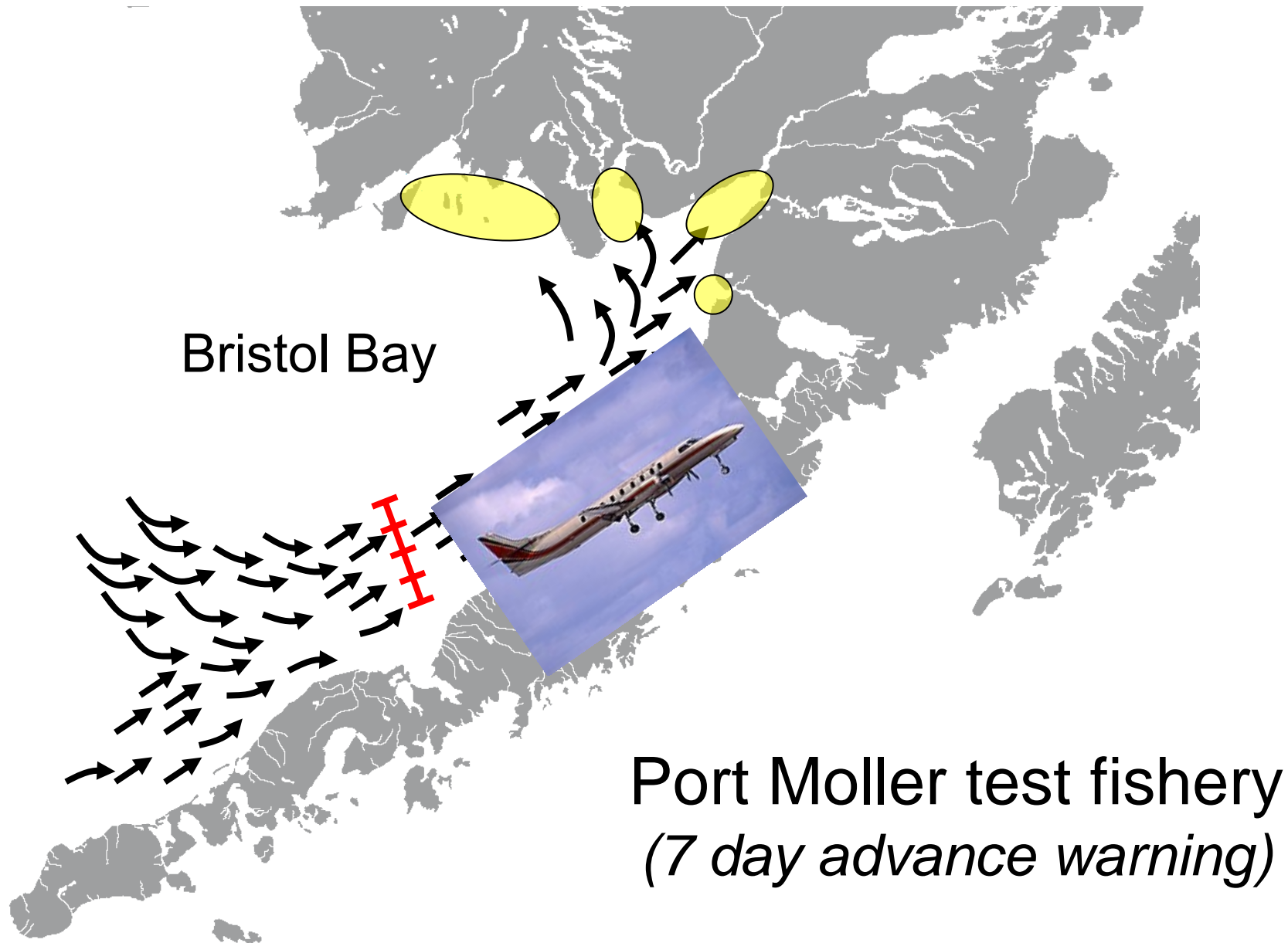


# Day 2 (pm) – boat delivers samples





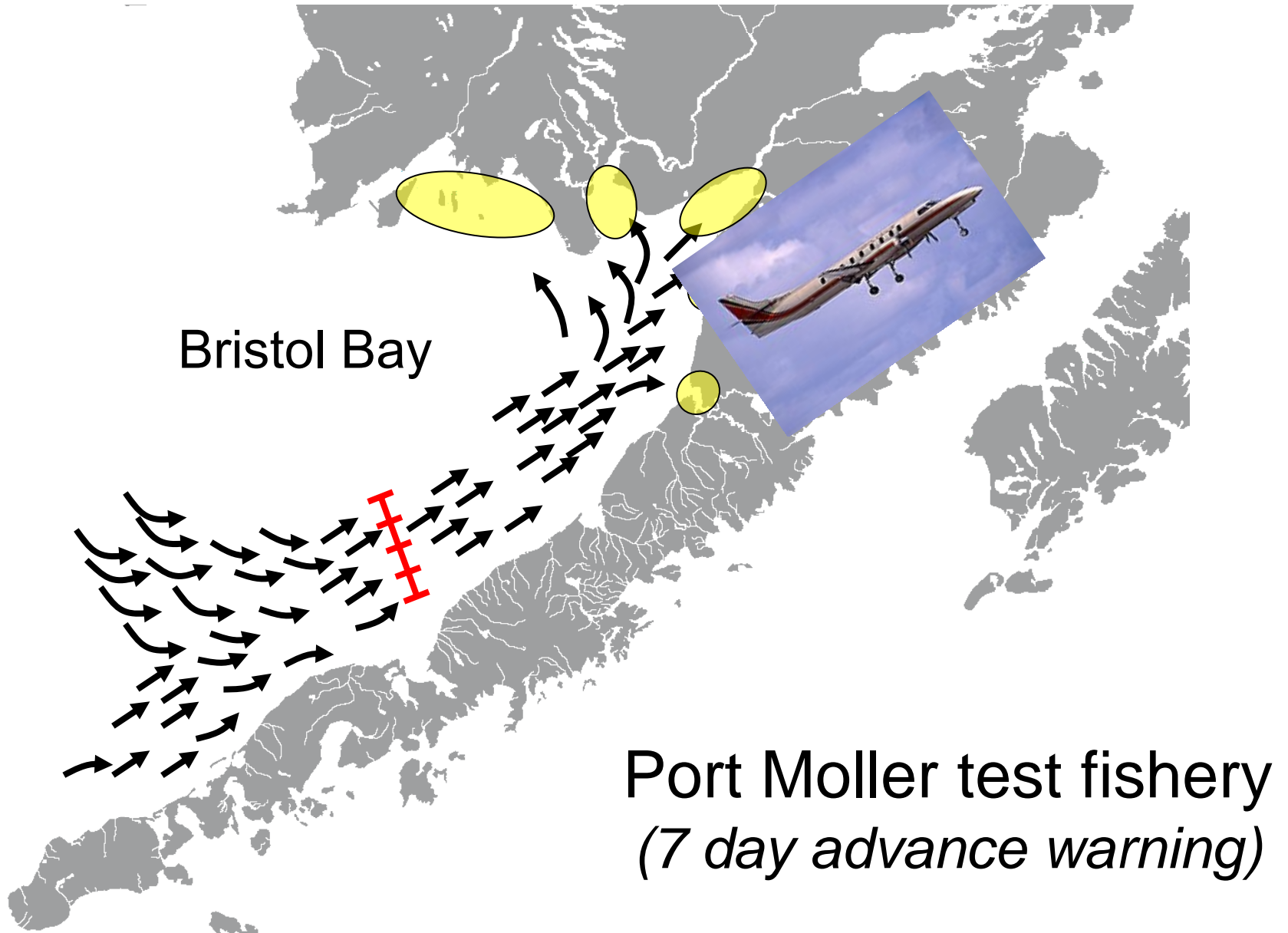
# Day 3 (pm) – Samples ship to Anchorage



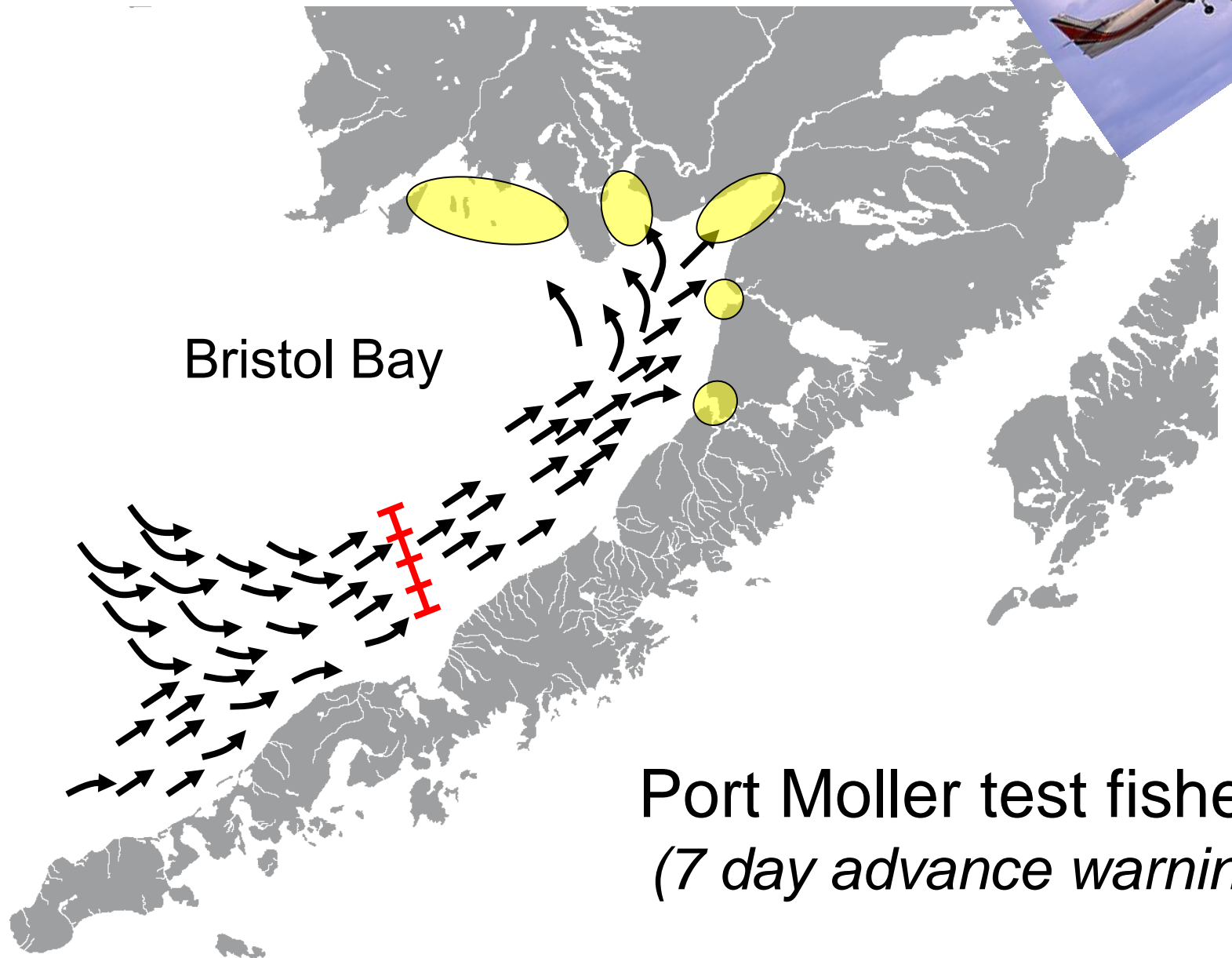
Bristol Bay

Port Moller test fishery  
*(7 day advance warning)*

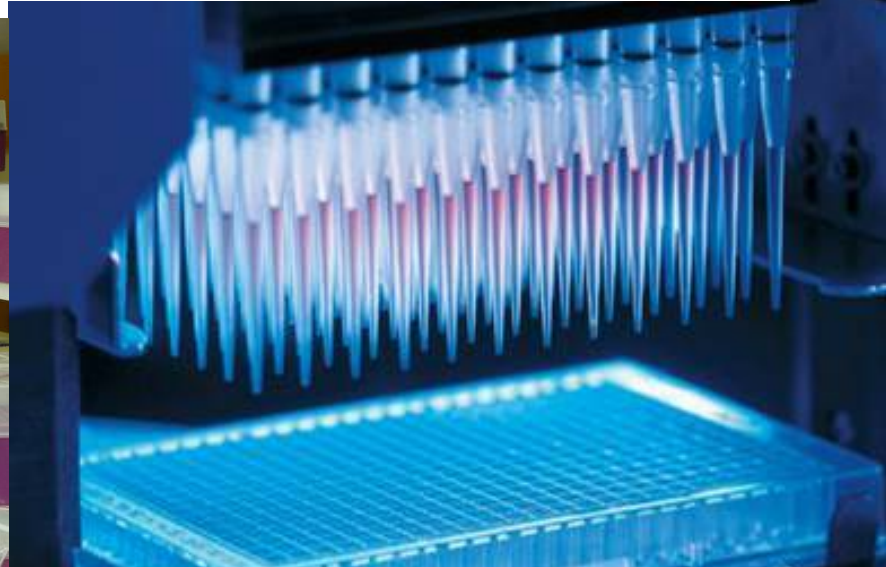
# Day 3 (pm) – Samples ship to Anchorage



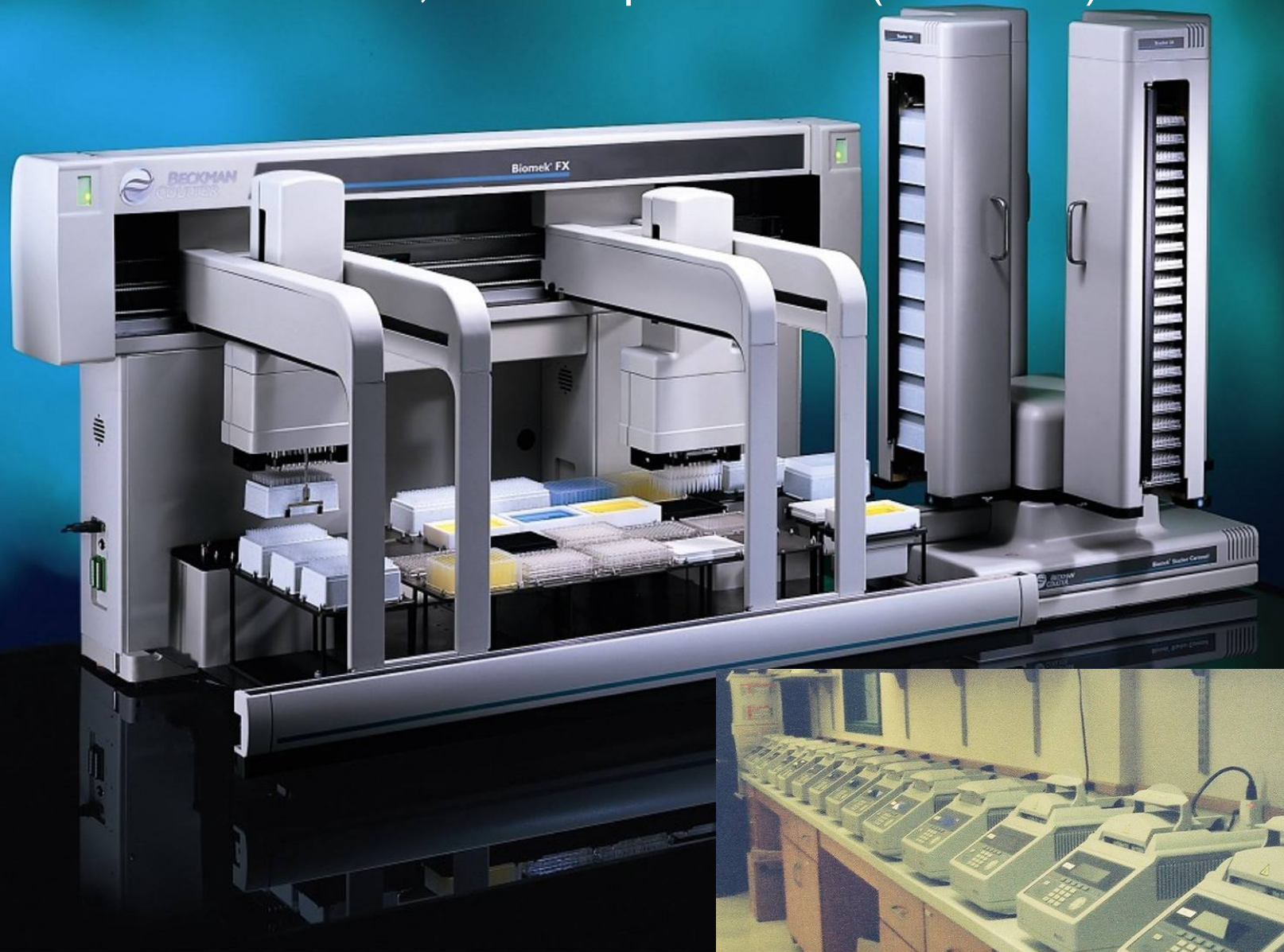
Day 3 (pm) – Samples ship to An...



# Day 4 (am-pm) – Samples analyzed in Anchorage



Robots allow for 10,000 fish per month (39 SNPs)



# Day 4 (pm) – Data analyzed



# Day 5 (am) – Analyses reported

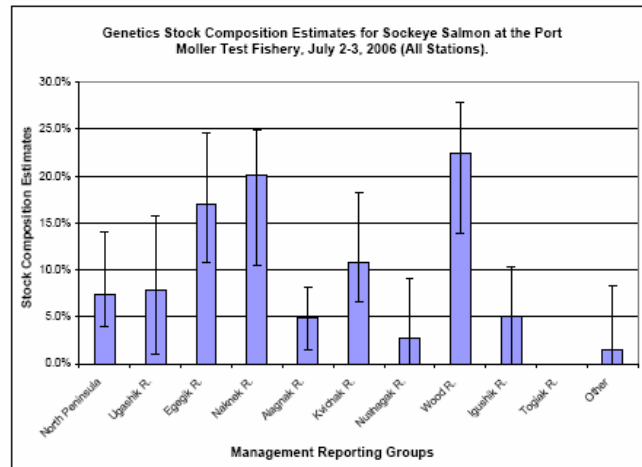
Alaska Department of Fish and Game

Division of Commercial Fisheries

## Bristol Bay Salmon Fishery Port Moller Sockeye Salmon Stock Composition Summary July 2-3, 2006 - All Stations

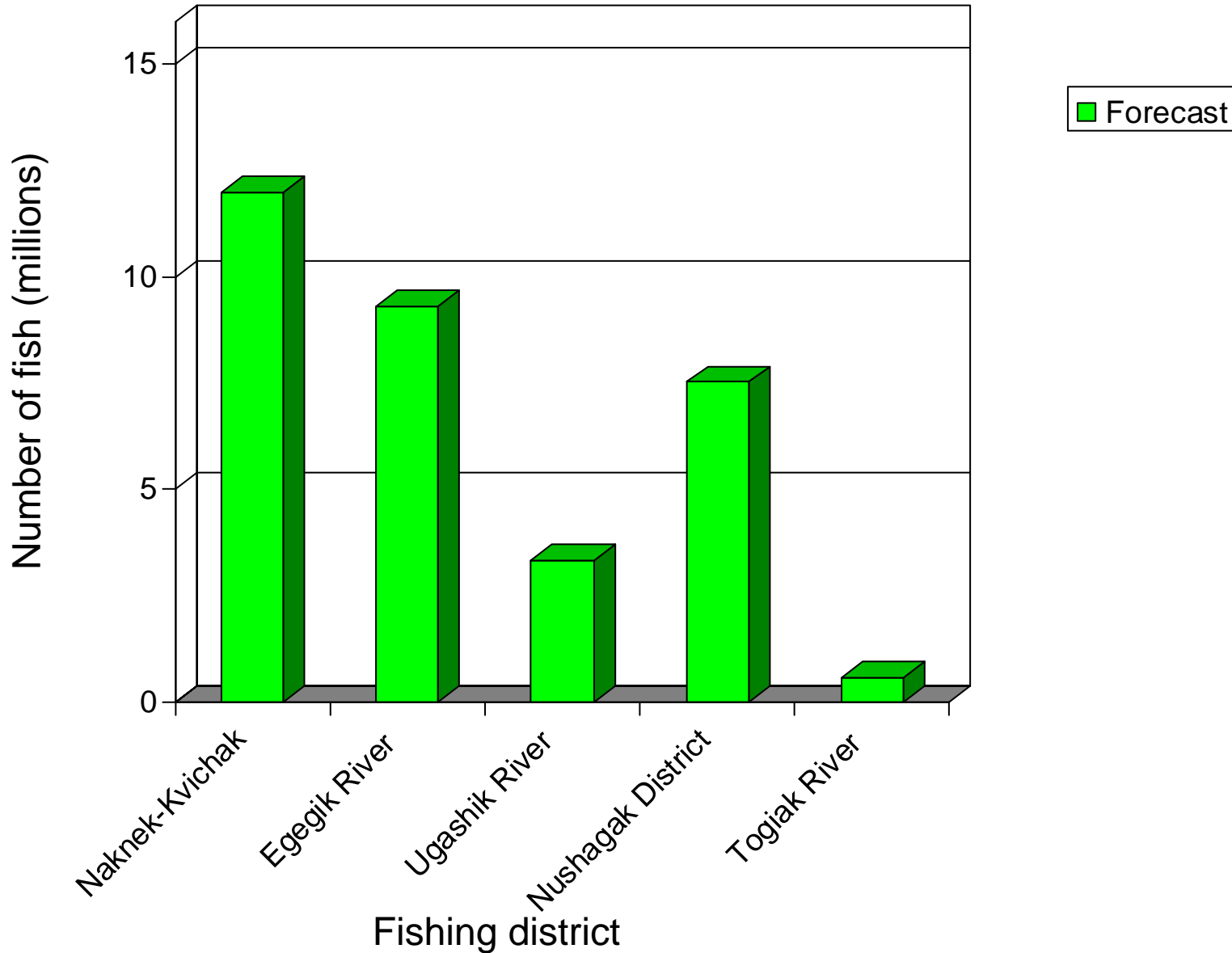
**Table 8.-** Genetics stock composition estimates for sockeye salmon from the Port Moller Test Fishery for July 2 and 3, 2006. There were 731 fish captured during these two days and 726 samples were received for analysis. A total of 190 fish were sampled (188 had adequate data to include in the genetics analysis; sample size=188).

| Management Reporting Groups | Stock Composition Estimate | 90% Confidence Intervals |       | 90% Deviations from Best Estimate |       |
|-----------------------------|----------------------------|--------------------------|-------|-----------------------------------|-------|
|                             |                            | Lower                    | Upper | Lower                             | Upper |
| North Peninsula             | 7.4%                       | 3.9%                     | 14.1% | 3.4%                              | 6.7%  |
| Ugashik R.                  | 7.9%                       | 1.1%                     | 15.8% | 6.9%                              | 7.8%  |
| Egegik R.                   | 17.1%                      | 10.8%                    | 24.7% | 6.2%                              | 7.6%  |
| Naknek R.                   | 20.2%                      | 10.4%                    | 24.9% | 9.7%                              | 4.7%  |
| Alagnak R.                  | 4.9%                       | 1.5%                     | 8.1%  | 3.4%                              | 3.2%  |
| Kvichak R.                  | 10.8%                      | 6.6%                     | 18.3% | 4.2%                              | 7.5%  |
| Nushagak R.                 | 2.8%                       | 0.0%                     | 9.1%  | 2.8%                              | 6.3%  |
| Wood R.                     | 22.5%                      | 13.9%                    | 27.0% | 8.6%                              | 5.4%  |
| Igushik R.                  | 5.1%                       | 0.0%                     | 10.3% | 5.1%                              | 5.2%  |
| Togiak R.                   | 0.0%                       | 0.0%                     | 0.0%  | 0.0%                              | 0.0%  |
| Other                       | 1.5%                       | 0.0%                     | 8.3%  | 1.5%                              | 6.9%  |



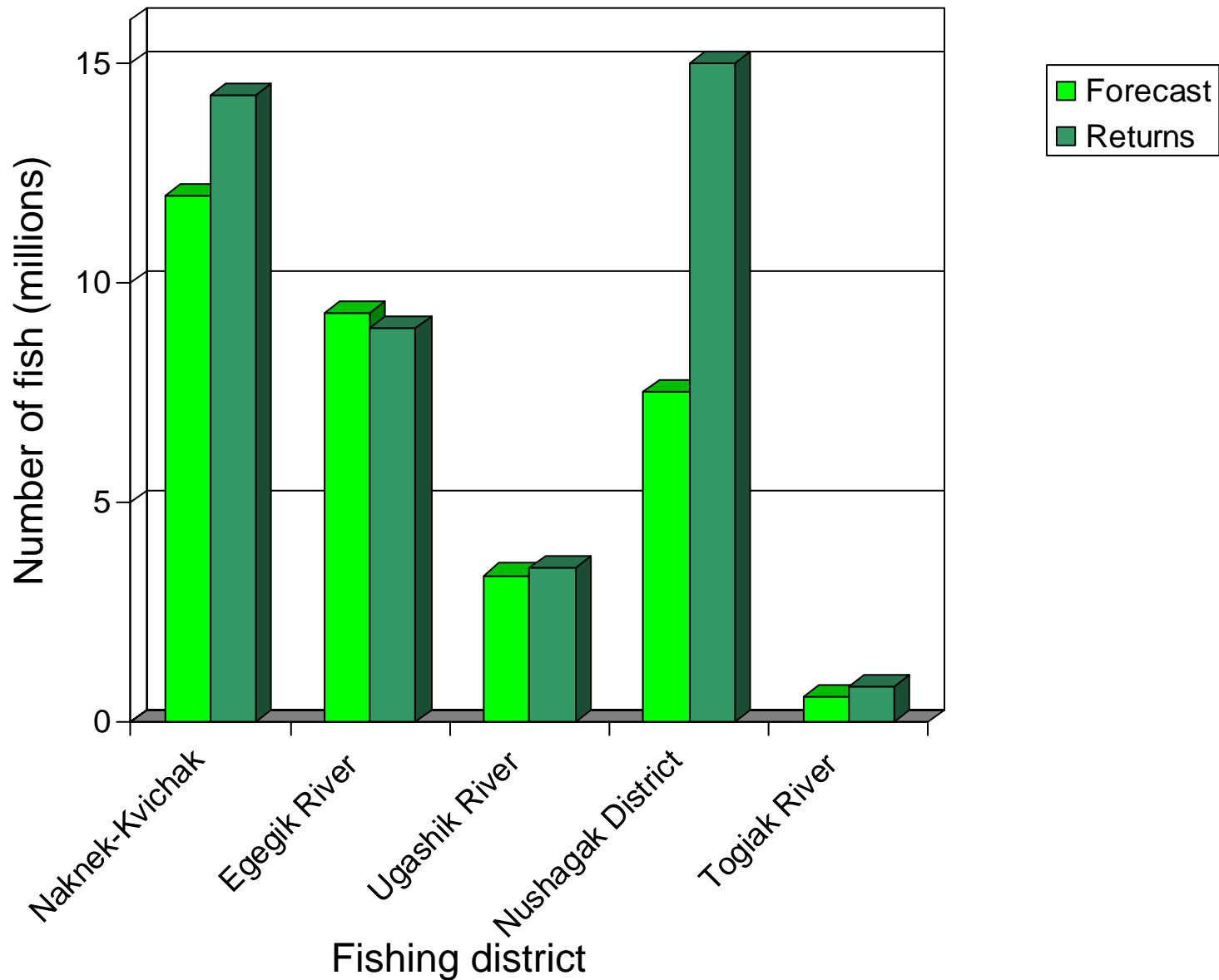
The genetics analysis was completed by the Alaska Department of Fish and Game, Division of Commercial Fisheries, Gene Conservation Laboratory.

# Pre-season Forecast - 2006

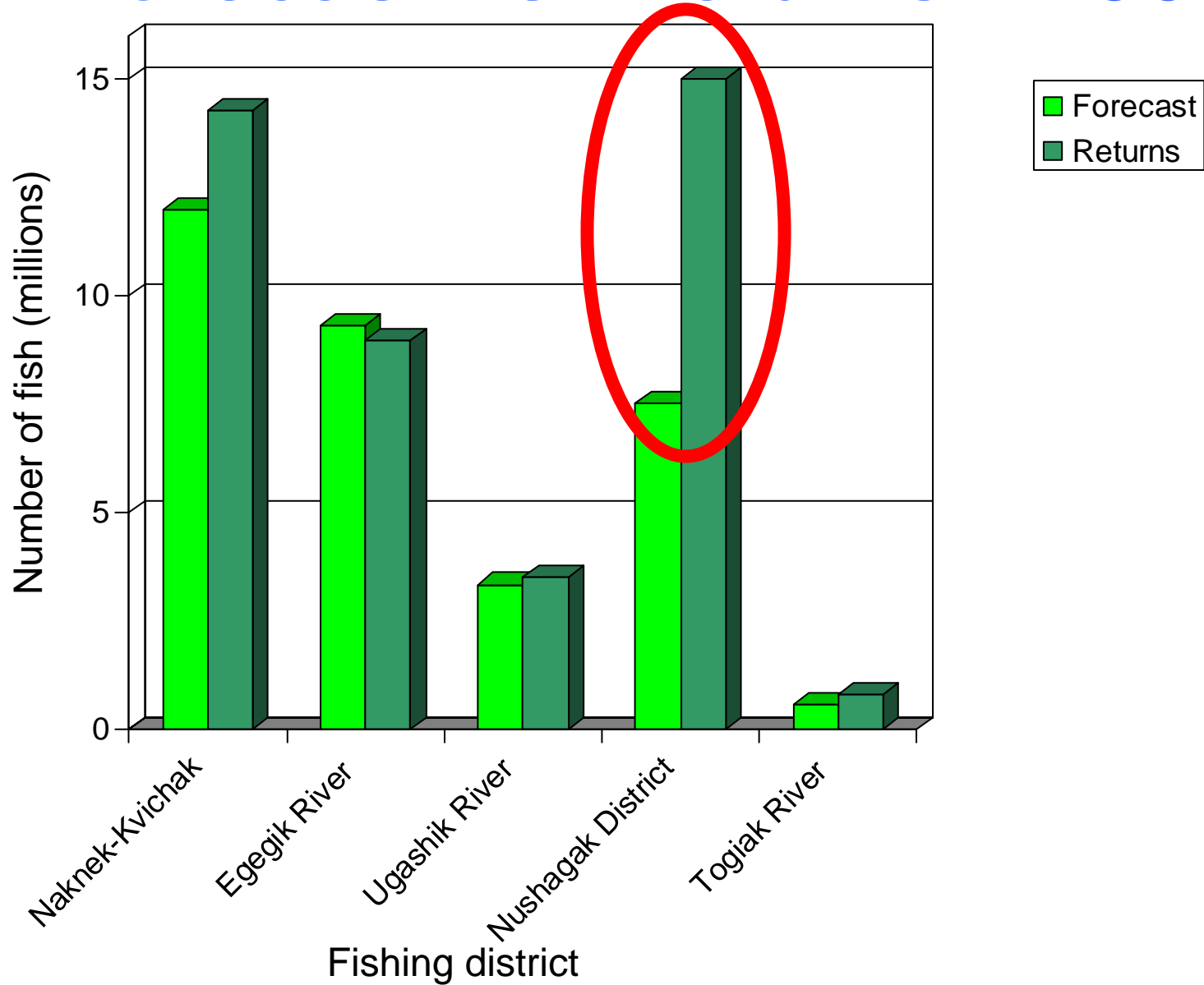




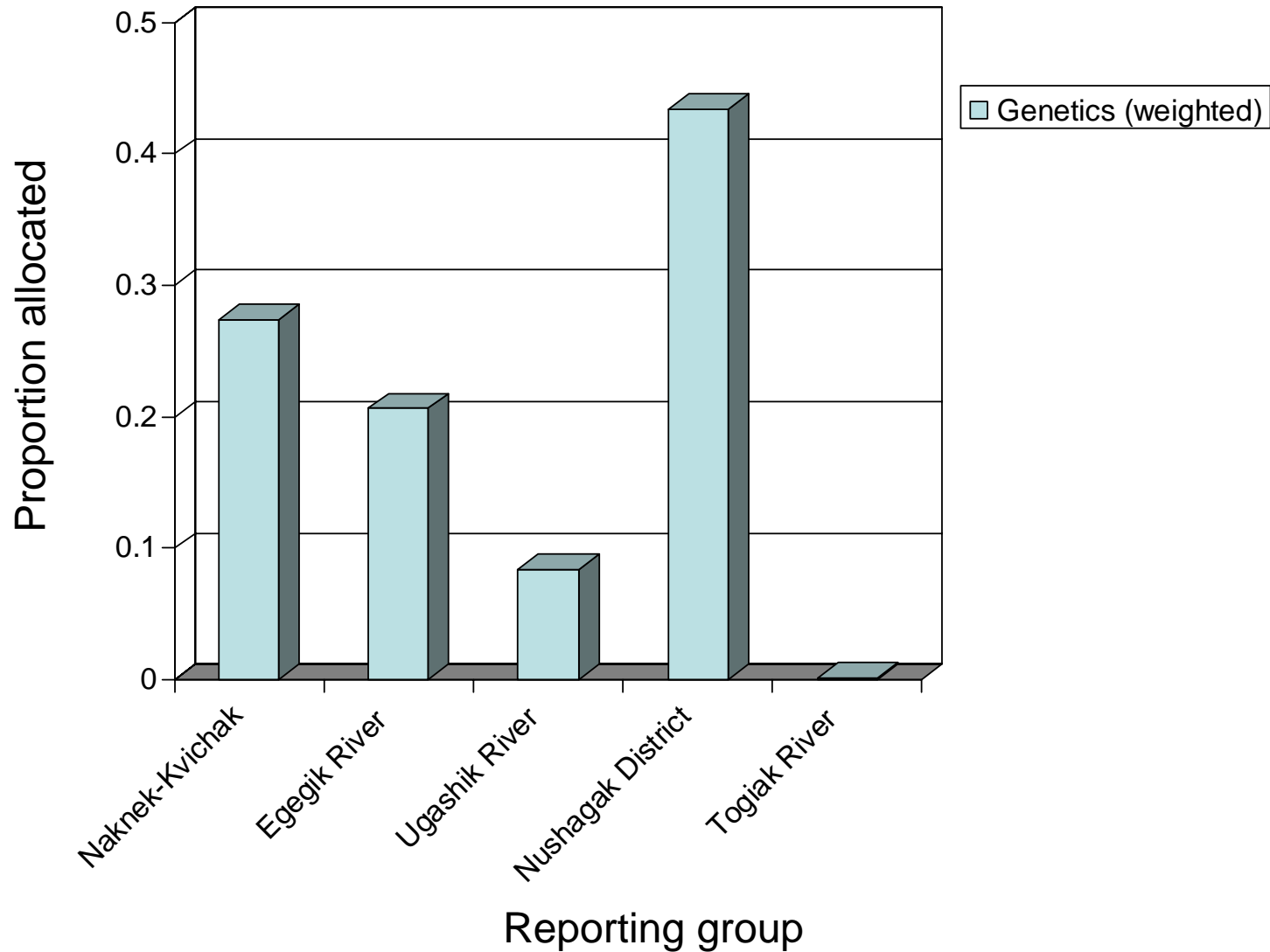
# Forecast vs. Returns - 2006



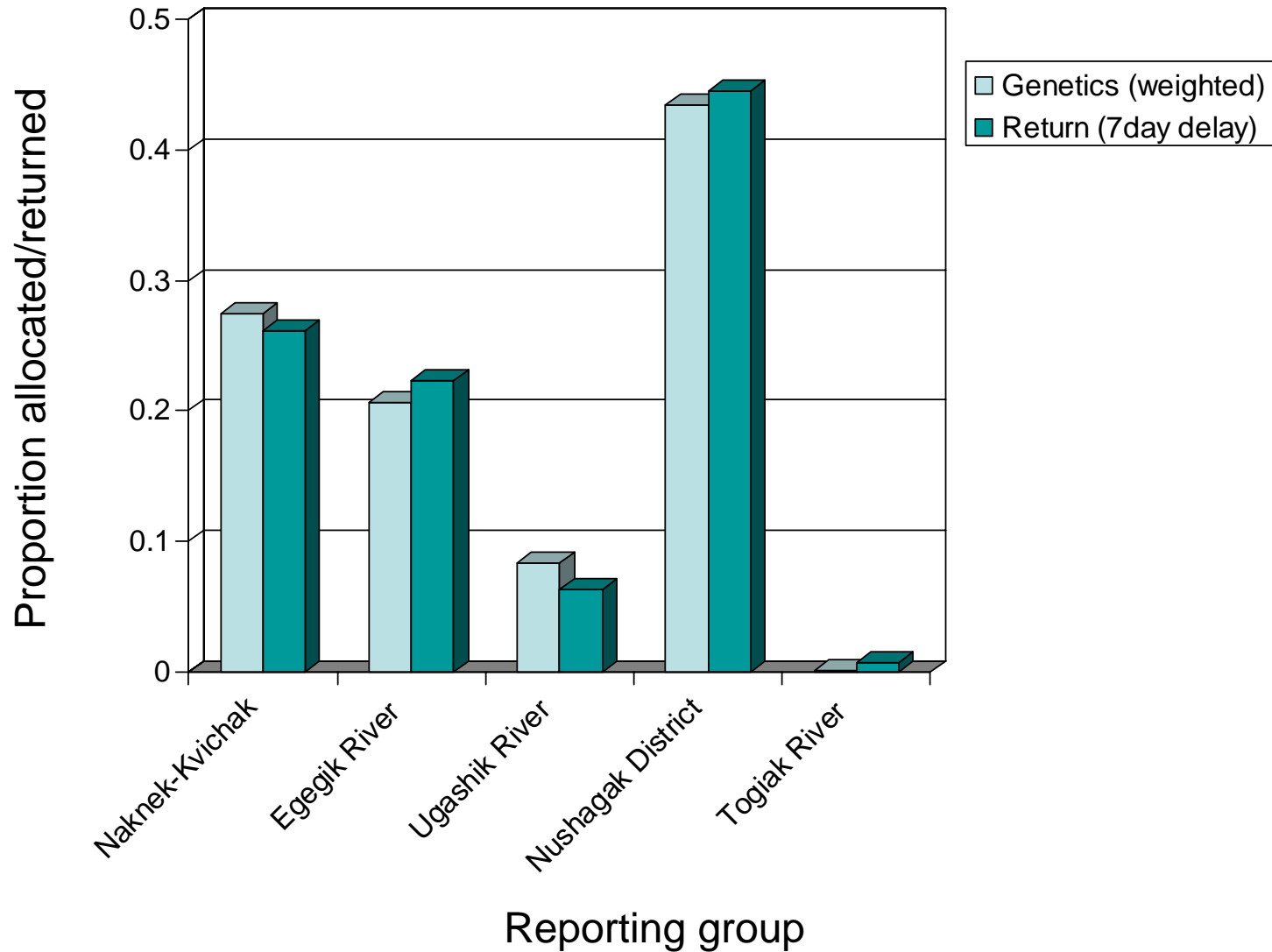
# Forecast vs. Returns - 2006



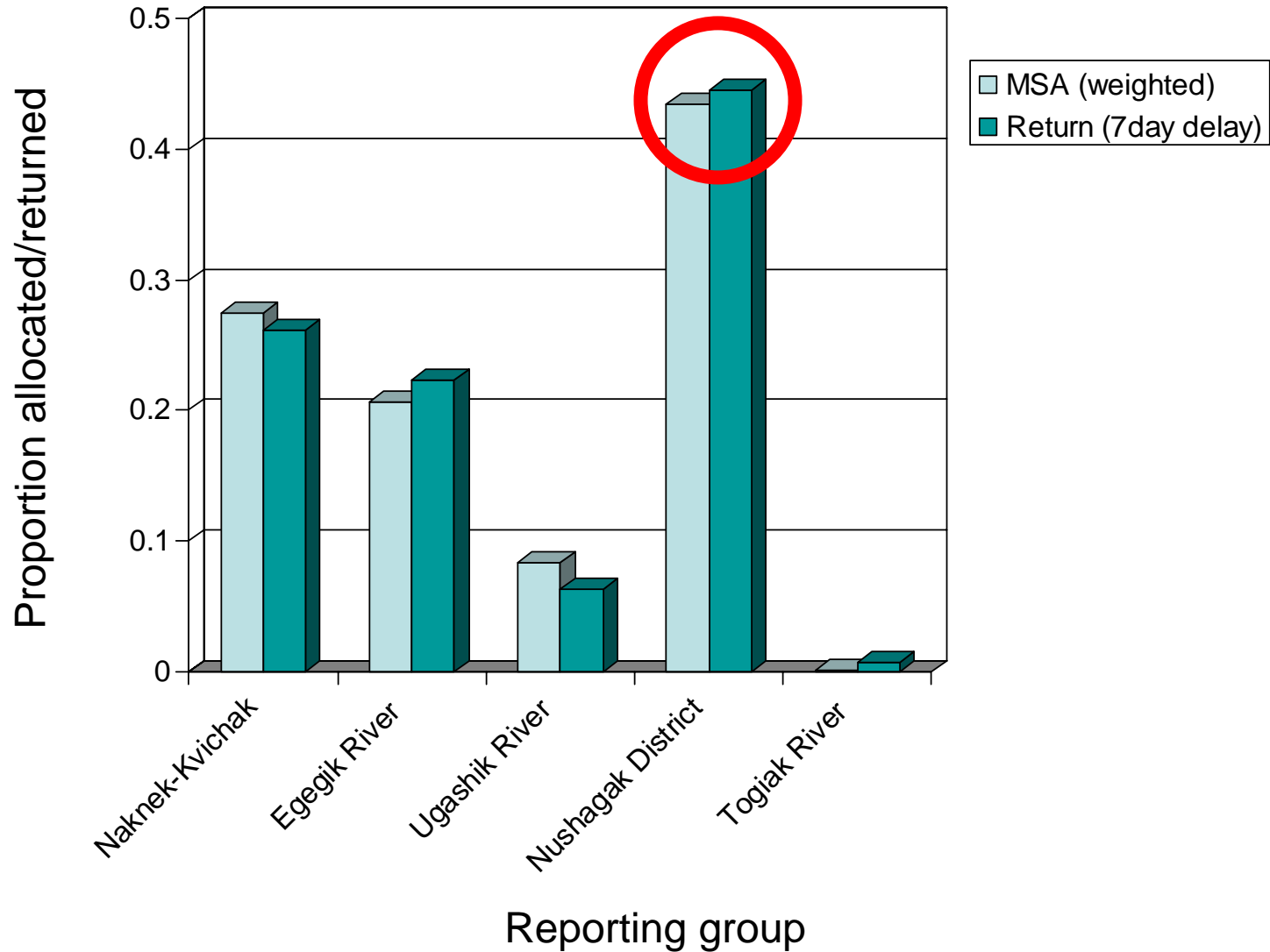
# Genetics Estimate - 2006



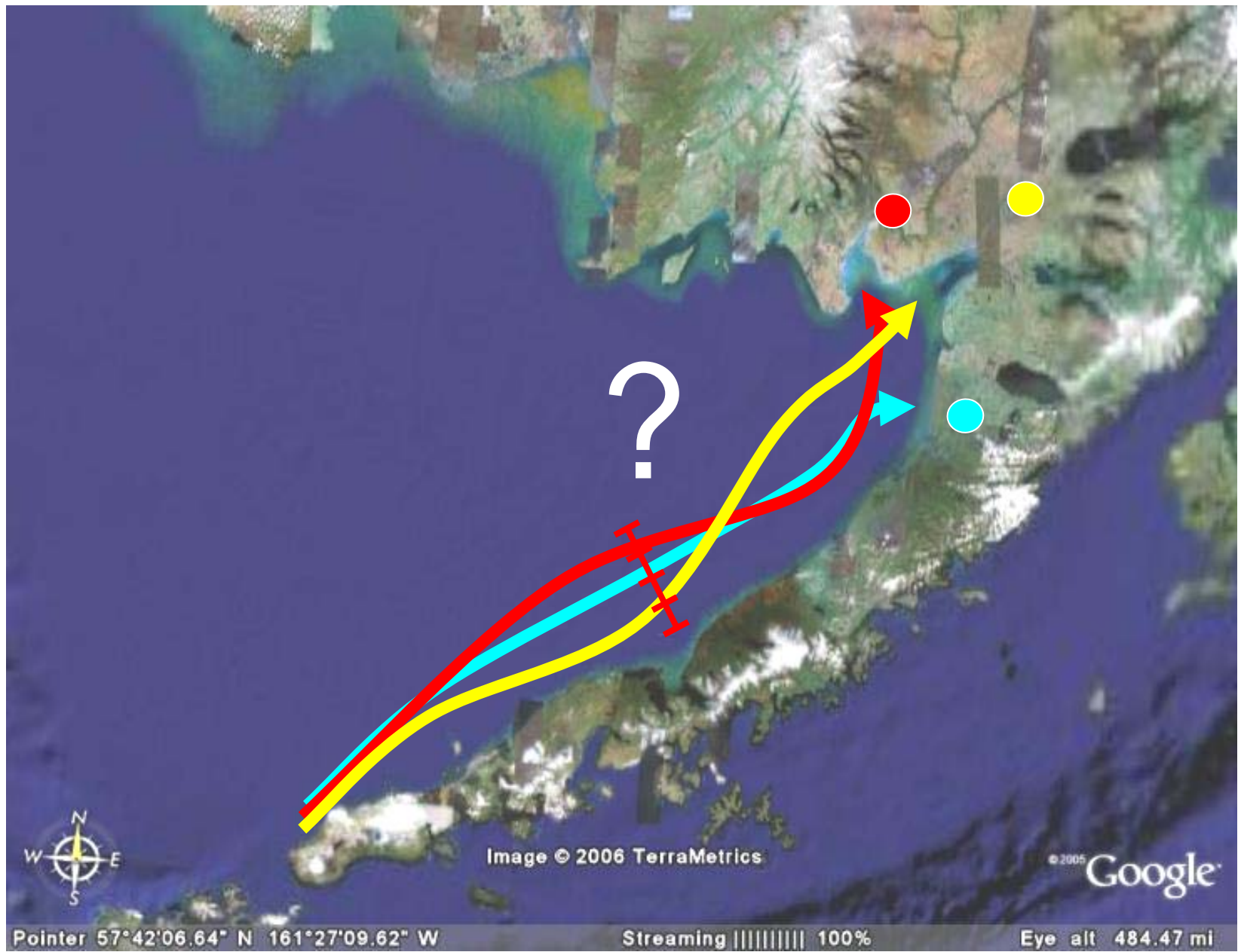
# Genetics vs. Returns - 2006



# Genetics vs. Returns - 2006



Are stocks intermixed as they pass Port Moller?



Or do stocks segregate?

?



Image © 2006 TerraMetrics

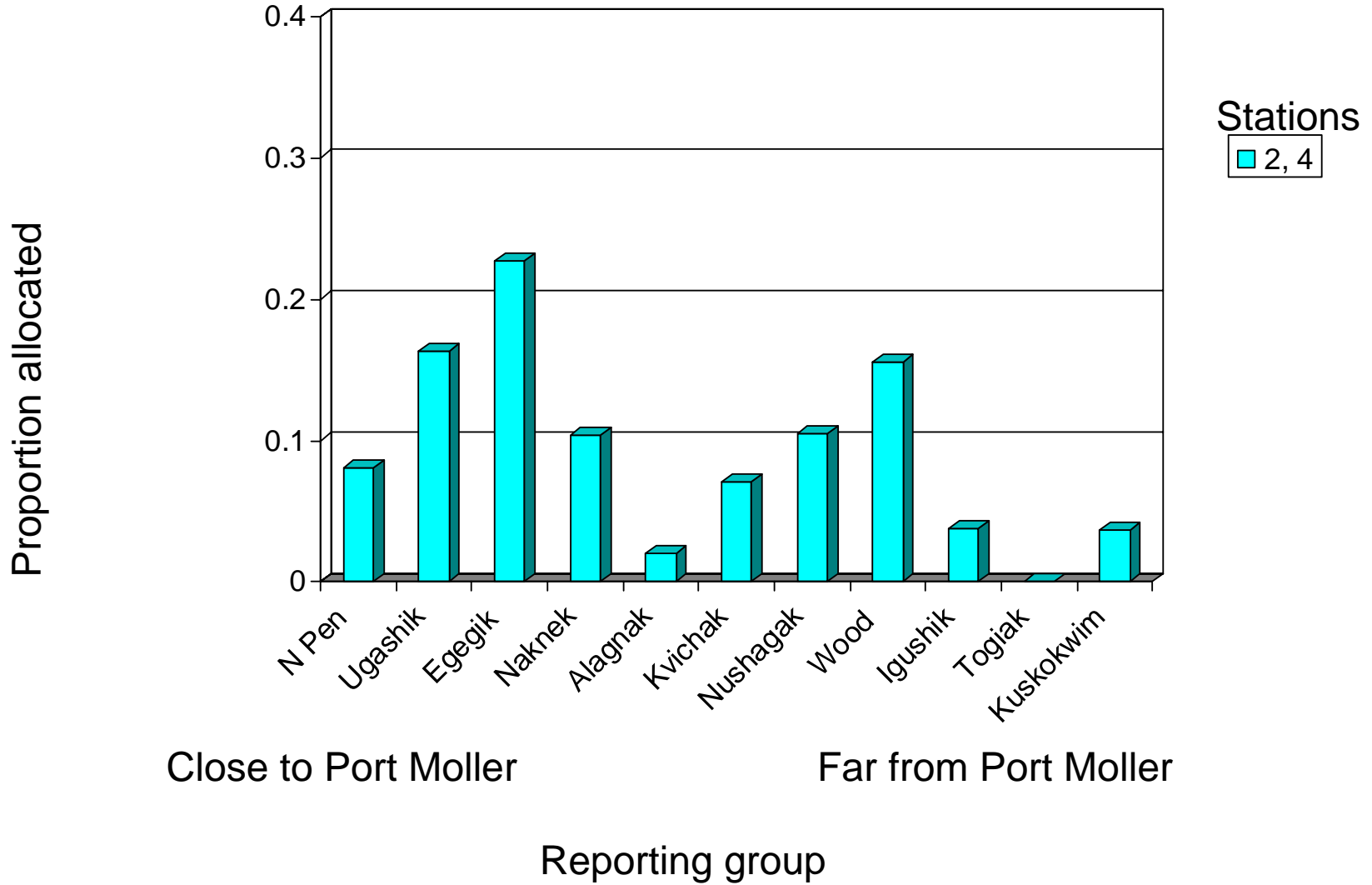
© 2005 Google

Pointer 57°42'06.64" N 161°27'09.62" W

Streaming ||||| 100%

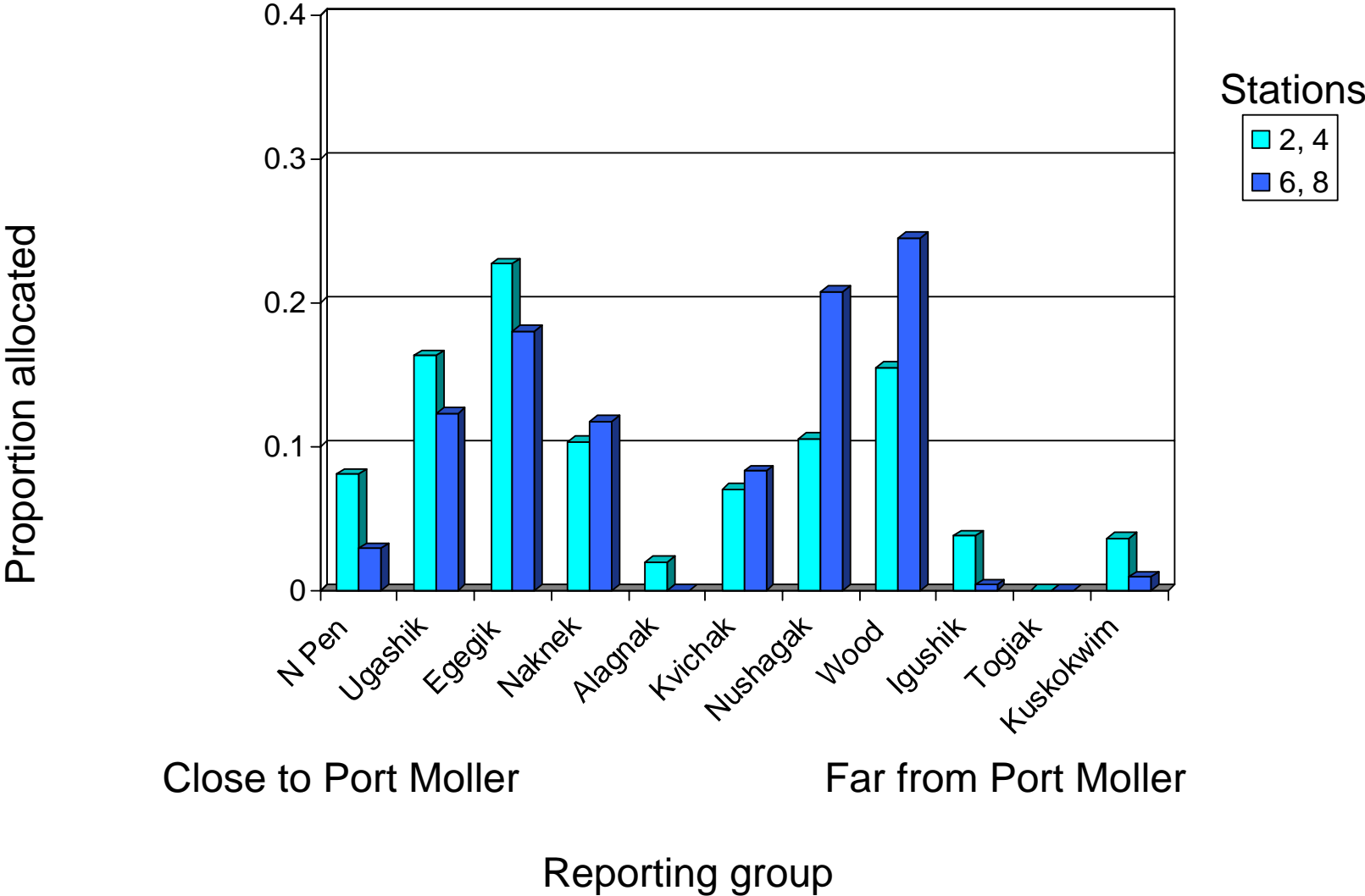
Eye alt 484.47 mi

# Inshore stations

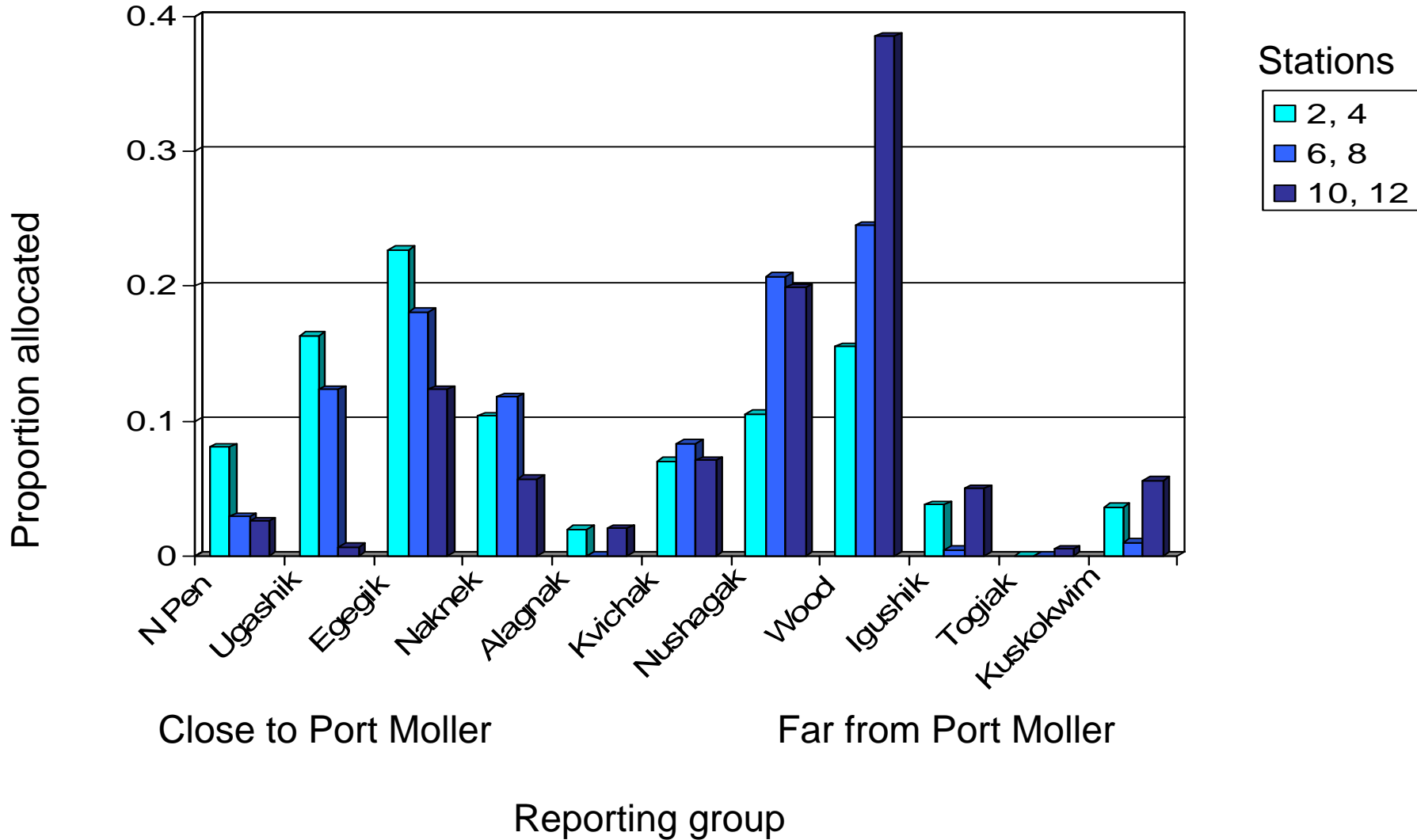




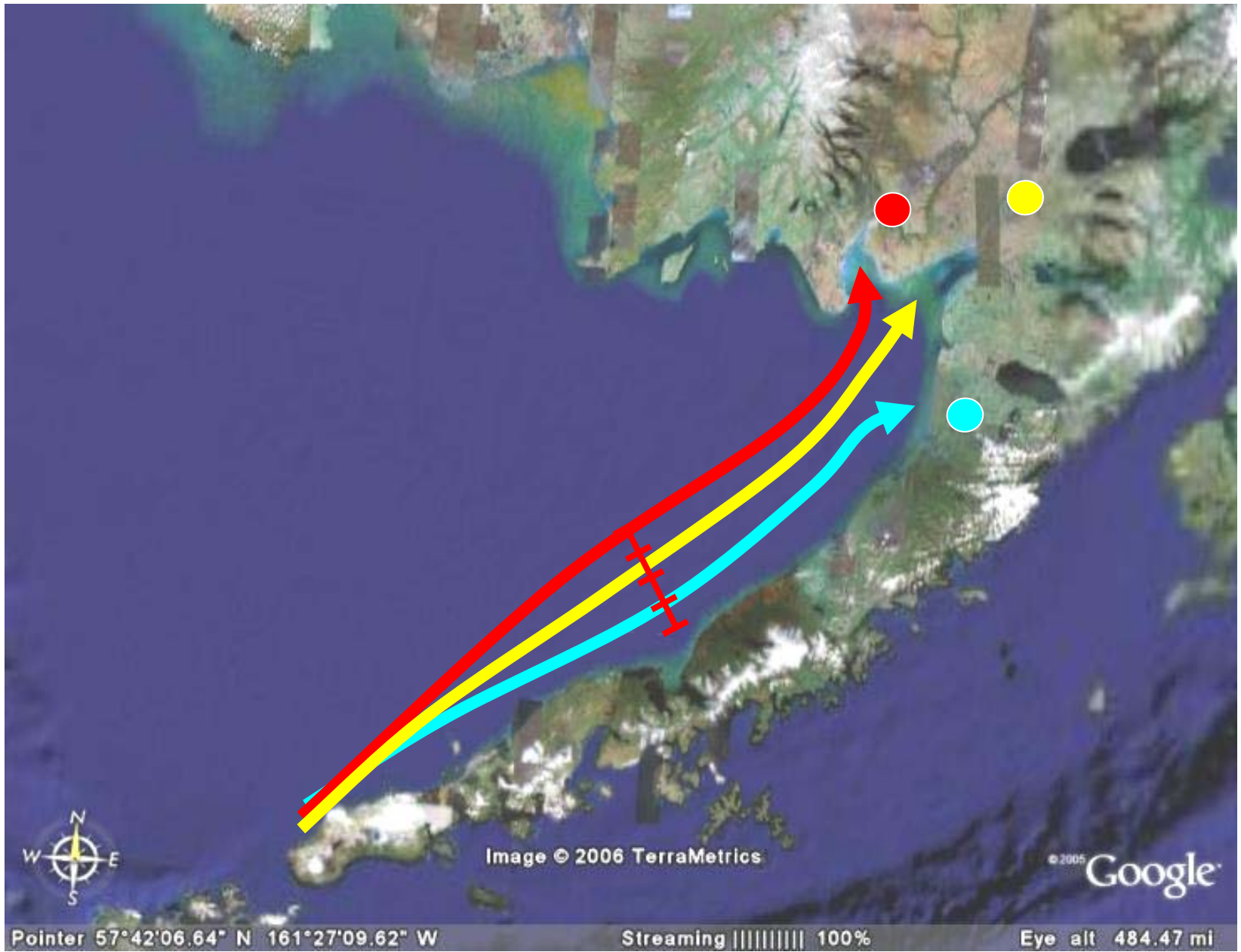
# In-shore and further off-shore stations



# Stock are segregated as they pass Port Moller



Data indicate they are not randomly mixed

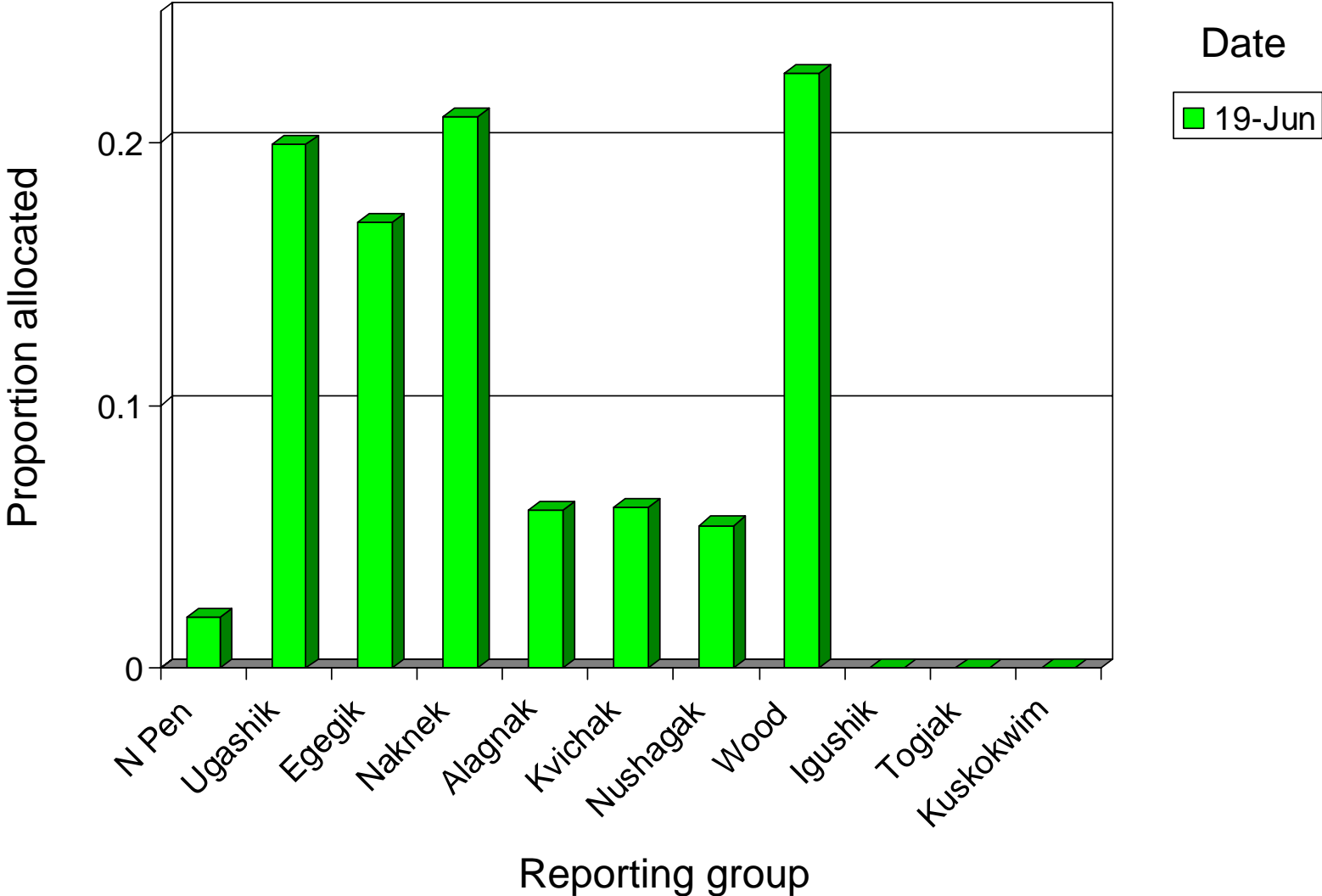


# Stock-specific schooling

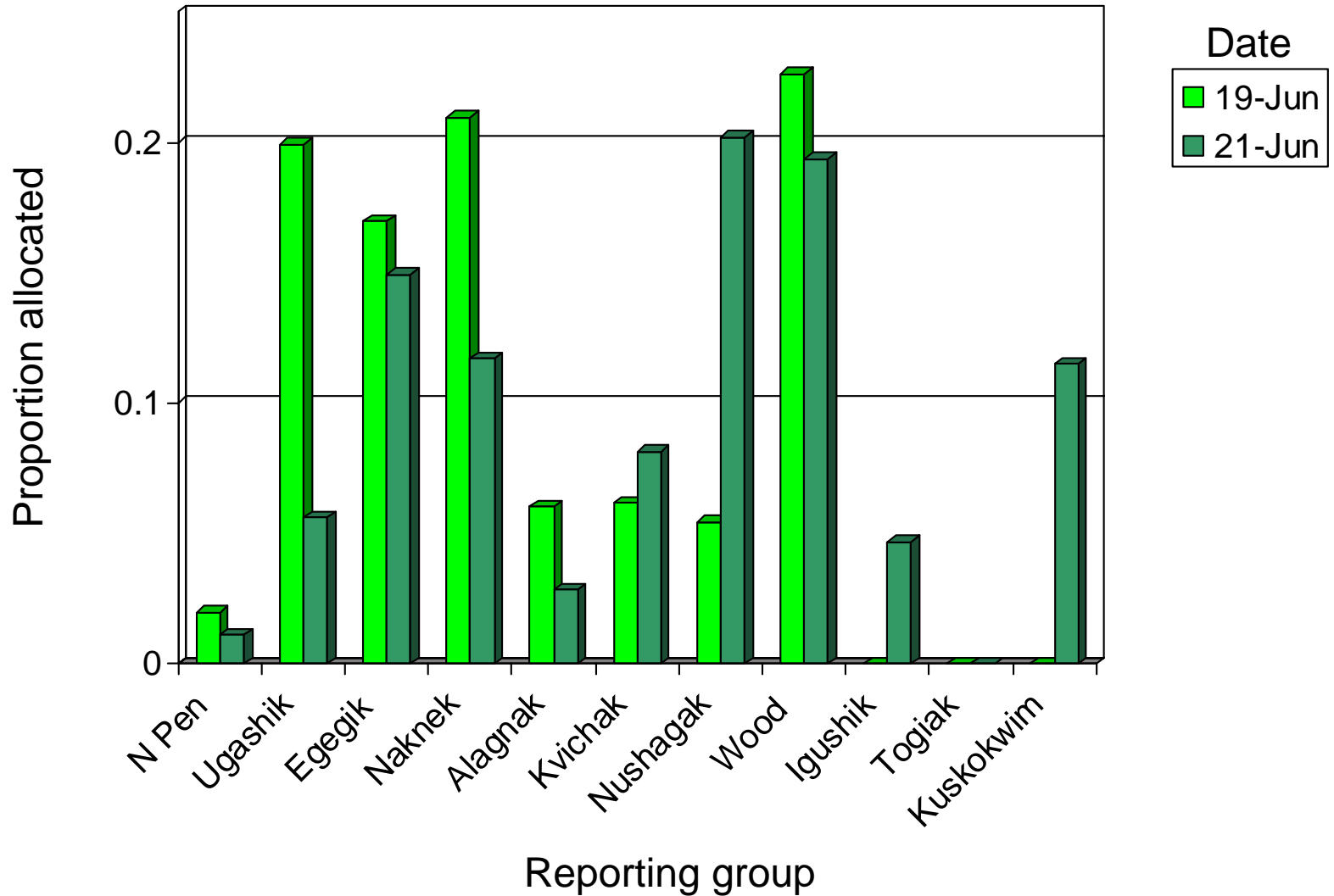
Are stock mixtures similar at the same location over short time periods?



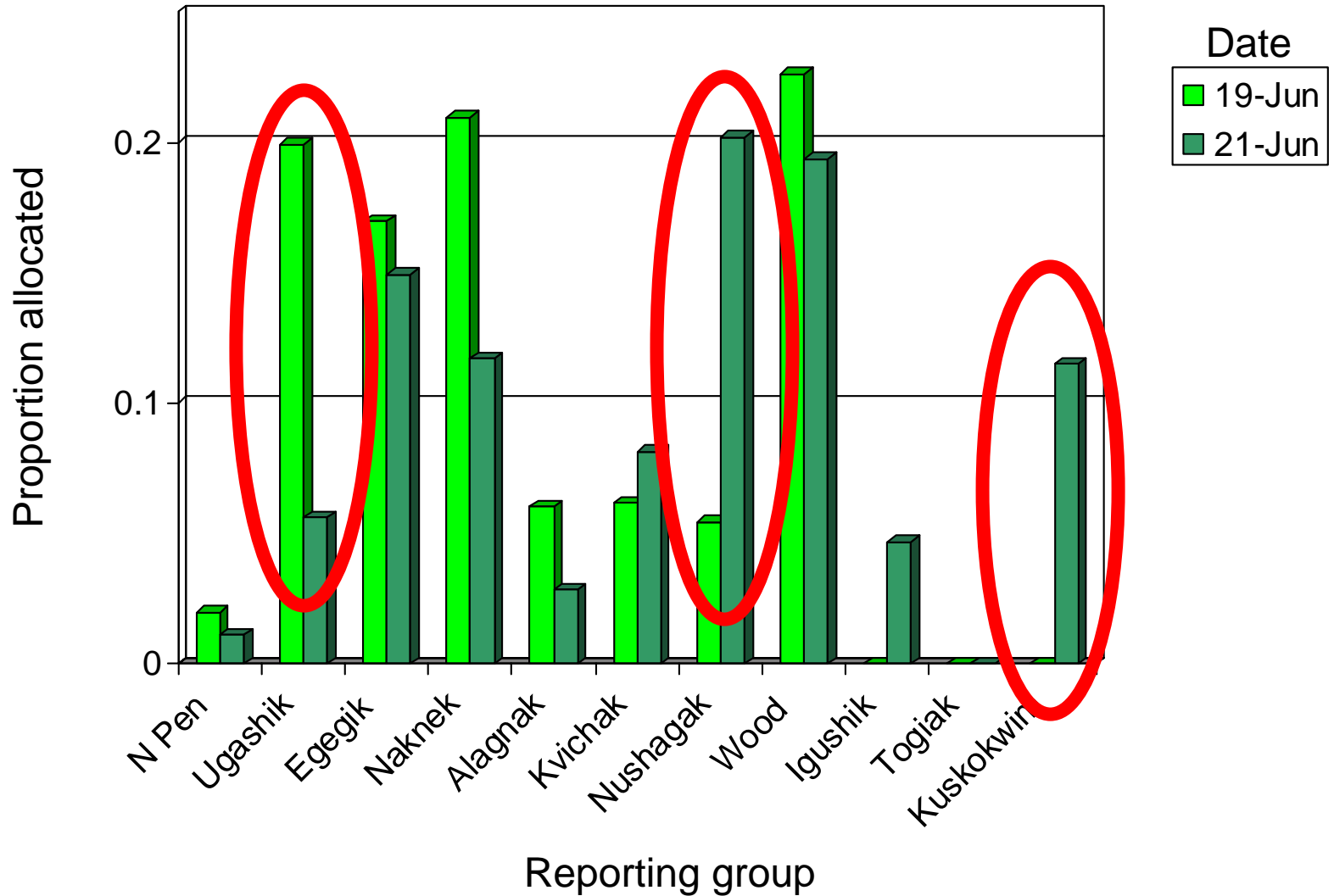
# Stock composition on one day (Station 4)



# Stock composition can change a lot between samples (2 days apart at station 4)



# Stock composition can change a lot between samples (2 days apart at station 4)



# Conclusions: Port Moller 2006

- In-season estimate matched in-shore strength.
- Predicted the large Wood River run.
- Lots of variability from sample to sample.
- Consistent stock distribution patterns by station.



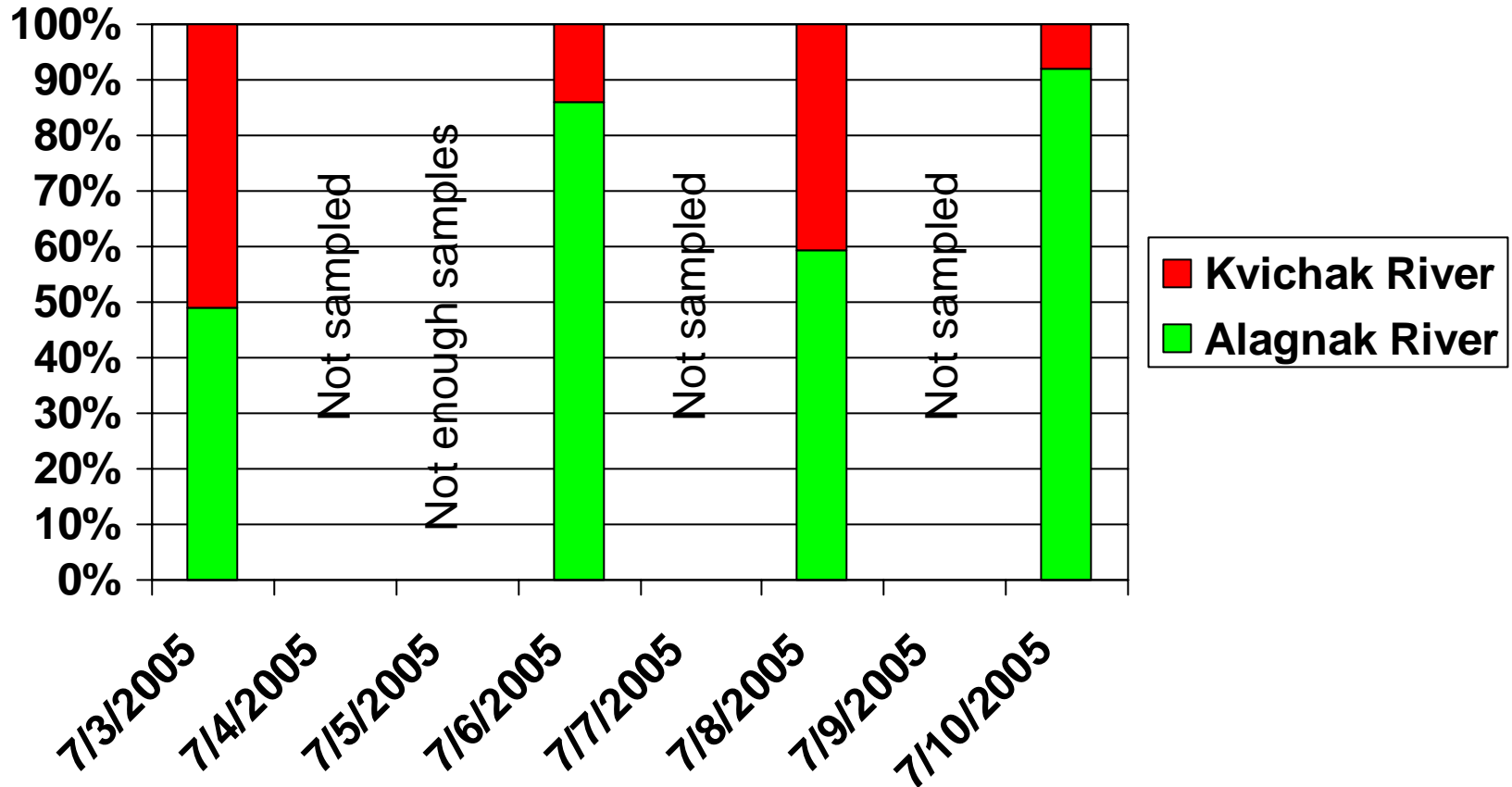


# Alagnak River SHA in 2005

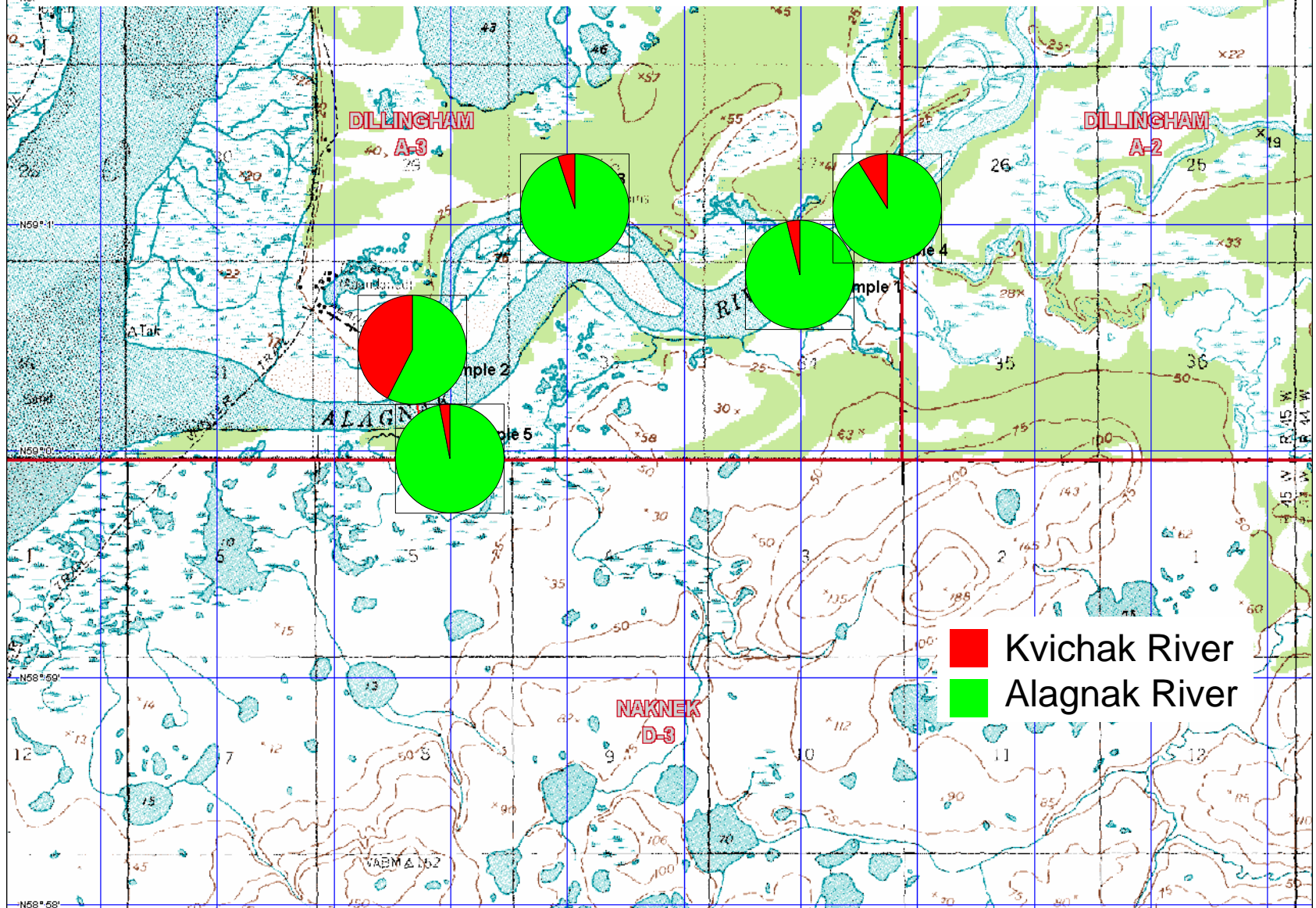
- Forecast: High returns to the Alagnak but low to Kvichak
- Directed fishery in the ARSHA
- Want to know: Stock composition of the ARSHA



# ARSHA averaged 78% Alagnak



# Relatively more Alagnak fish at upstream sites



# Conclusions: ARSHA 2005

- Overall harvest was 78% Alagnak.
- Lots of variability from sample to sample.
- Upriver better than downriver.
- Need to look at year-to-year variability.



# Conclusions

- Genetic diversity good for Genetic Stock ID
- Extrapolation: Sampling design critical
  - Fish not mixed
  - Variation within year
  - Variation between years?
- Mixture sample size
  - Generally, sample size of 400 is good
  - Smaller samples sizes OK in some cases
  - Larger sample sizes required to detect small components



# Where we go from here...

- Baseline improvements

- Egegik
- Wood/Igushik

- District sampling

- All districts sampled in 2006 – continue in future
  - 16,392 collected
  - 4,644 analysis in progress
- Initial use: brood tables
- Multiple years will provide patterns



# Acknowledgements

- Western Alaska Disaster Fund
- North Pacific Research Board
- State of Alaska General Funds
- Bristol Bay Science and Research Institute