# Applying Genetic Data to Management Needs: Sockeye Salmon Returning to Bristol Bay Drainages

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## Introduction

- Fishery managers benefit from understanding stock composition in mixture samples.
  - **a.** Target fishing on abundant stocks.
  - **b.** Estimating return-per-spawner to calculate escapement goals for maximum sustained yield.
- Genetic data is capable of providing stock composition estimates.
- Here we highlight three on-going projects using genetic data to solve management needs (see figure 1).

## Estimating stock composition in adults returning to Bristol Bay before they enter commercial fishing districts

**Introduction/Methods**. The test fishery conducted off Port Moller captures fish at 6 stations that are 20 miles apart. This fishery samples fish 5 to 7 days before fish enter commercial fishing districts. Stock composition of the catch provided fishery managers, fishers, and processors with confirmation of or alerts to deviations from preseason forecasts of stock-specific abundance. In 2005, nine in-season estimates were provided within a 48-hr turn around from the time samples arrived in the lab.

**Results.** Cumulative stock compositions over nine sampling periods grouped by station show some segregation by stock occurs at sea – a new finding (figure 2). Stocks are ordered by geographic position counter-clockwise starting from the North Alaska Peninsula and ending in the Kuskokwim Bay. Note that fish closer to spawning tributaries (stocks on the left-hand side) are closer to shore (stations 20 to 40 miles off-shore) than fish destined for tributaries farther away. Predicted stock strengths from this fishery in 2005 were generally in agreement with observed stock strengths.

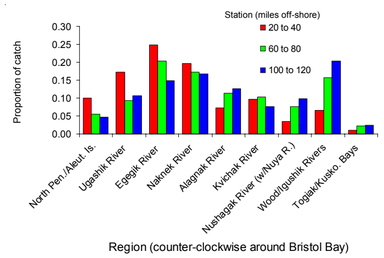


Figure 2. Stock composition by station in the Port Moller test fishery in 2005

## Updating and refining the baseline: Alagnak River as an example

**Introduction:** Alagnak River experienced unprecedented numbers of fish returning to spawn starting in 2003 (figure 3; photo shows fish waiting for spawning habitat to open up in Moraine Creek in 2004). Identifying all the stocks within the Alagnak River improves the stock-composition estimates used by fishery managers to target these abundant stocks.

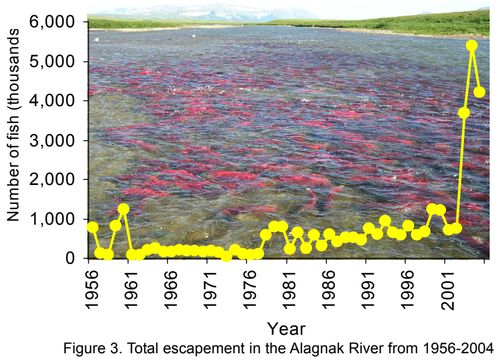


Figure 3. Total escapement in the Alagnak River from 1956-2004

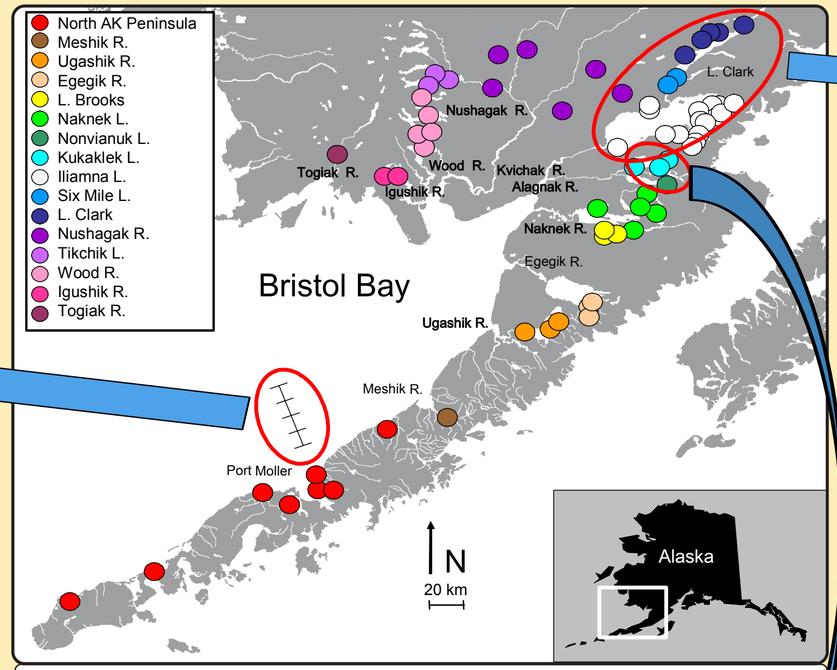


Figure 1. Sampling sites for spawning aggregates of sockeye salmon in Bristol Bay, Alaska, 100 fish per site, which make up the genetic baseline for mixed stock analysis. Genetic data (13 microsatellites and 4 SNPs) are able to distinguish among the 16 stocks represented by different colors. Locations of projects highlighted in this poster are circled in red out and arrows lead to further explanation.

**Methods:** Alagnak River drainage consists of two lake drainages. Previous data indicates that there are three stocks present in this drainage: Moraine Creek and Battle and Kulik rivers. These stocks are distinct from each other and from other Bristol Bay stocks. New collections include: Nanuktuk Creek and early and late and beach-spawning collections from previously sampled tributaries.


**Results:** Genetic data distinguishes between four stocks within the Alagnak drainage (figure 4). Note the tight clustering of collections at the four primary spawning sites. No variation was detected between years or between collections made early and late within years or between beach and tributary spawners. The finding of three genetically identifiable stocks with similar life histories within one nursery lake is unusual for sockeye salmon.

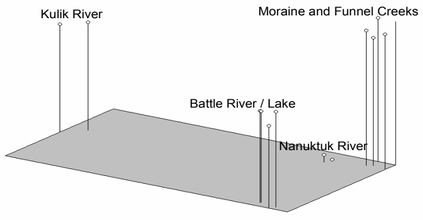


Figure 4. Multidimensional scaling of Cavalli-Sforza and Edwards genetic distances based on 13 microsatellites and 4 SNP loci of Alagnak River collections.

## Estimating the run-timing of Lake Clark stocks relative to other Kvichak River stocks

**Introduction:** Lake Clark stocks of sockeye salmon are heavily used for subsistence and are at historically low levels. Lake Clark stocks migrate up the Kvichak River in the company of other stocks. In-river stock composition estimates over time provide fishery managers with differences in the run timing among stocks. Stock-specific differences in run-timing may provide fishery managers with a tool to target abundant stocks.


Sockeye salmon hung to dry

**Results:** Genetic data can be used to partition daily estimates of fish passing through the Kvichak River into stock-specific estimates (figure 5). Note that some stocks (Six-mile Lake) show up early while other show up late (Iliamna tributary Late). Stock estimates were provided for days when 87% of the fish passed through the Kvichak River. Proportion of sockeye salmon migrating up the Kvichak River destined for Lake Clark were highest both early and during the second half of the run (figure 6). This pattern does not provide a clear tool for fishery managers to target more abundant stocks from the Kvichak River while avoiding Lake Clark stocks. The project continues for two more years to determine if these patterns are consistent from year to year.

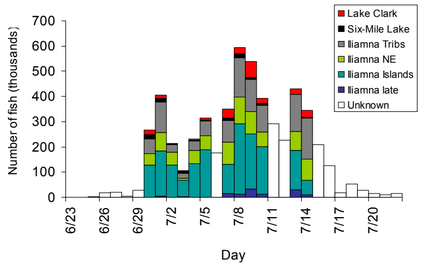


Figure 5. Stock-specific daily estimates of fish migrating up the Kvichak River in 2004

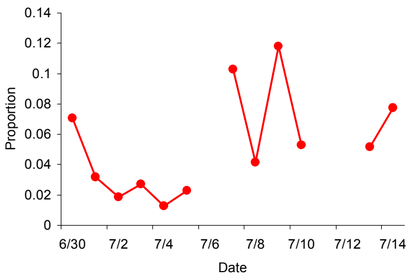


Figure 6. Proportion of fish migrating up the Kvichak River destined for Lake Clark in 2004

## Future Work

- Determine the stock composition of district fisheries.
- Determine the effect of moving district boundaries on stock composition.
- Identify the migration patterns of stocks on the high seas.

## Acknowledgments

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