**Supporting Information for:**

Performance of salmon fishery portfolios across western North America

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Supporting Information Order:

**Table S1.** Chinook salmon watershed portfolios.

| Coarse | Fine | Asset | Data sources in Asset |
|---|---|---|---|
| Canadian Yukon | Canadian Yukon | Canadian Yukon | Canadian Yukon |
| Bering | Bering | Goodnews | Goodnews |
| | | Nelson | Nelson |
| | | Nushagak | Nushagak |
| | Kuskokwim | Kuskokwim | Kuskokwim |
| Gulf of Alaska | Peninsula/Kodiak | Ayakulik | Ayakulik |
| | | Chignik | Chignik |
| | | Karluk | Karluk |
| | Central Alaska | Anchor | Anchor |
| | | Copper | Copper |
| | | Deshka | Deshka |
| Southeast Alaska | Southeast Alaska | Alsek | Alsek |
| | | Taku | Taku |
| | | Situk | Situk |
| | | Stikine | Stikine |
| Columbia | Lower Columbia | Clackamas | Clackamas |
| | | Clatskanie | Clatskanie |
| | | McKenzie | McKenzie |
| | | Sandy | Sandy Bright |
| | | | Sandy Spring |
| | | White Salmon | White Salmon |
| | | Coweeman | Coweeman |
| | | Elochoman | Elochoman |
| | | Grays | Grays |
| | | Kalama | Kalama Fall |
| | | | Kalama Spring |
| | | Lewis | Lewis |
| | | | Lewis Fall |
| | | | NF Lewis |
| | | Lower Cowlitz | LowerCowlitz |
| | | Mill | Mill |
| | | Upper Cowlitz | Upper Cowlitz |
| | | Upper Gorge | Upper Gorge |
| | | Washougal | Washougal |
| | Middle Columbia | Deschutes | Deschutes Spring Wild |
| | | | Round Butte Spring Hatchery |
| | | | Deschutes Fall Wild |
| | | | Warm Springs Spring Wild |
| | | | Warm Springs Spring Hatchery |
| | | John Day | John Day |
| | | Upper Yakima | Upper Yakima |
| | | Klickitat | Klickitat |
| | | Naches | Naches |
| | Upper Columbia | Entiat | Entiat |
| | | Methow | Methow Summer |
| | | | Methow Spring |
| | | OkanoganSummer | Okanogan Summer |
| | | Wenatchee | Wenatchee Summer |
| | | | Wenatchee Spring |

| Coarse | Fine | Asset | Data sources in Asset |
|---|---|---|---|
| Columbia | Snake | Catherine | Catherine |
| | | Grande Ronde | Grande Ronde Upper Main |
| | | Imnaha | Imnaha Main |
| | | Lostine | Lostine |
| | | Minam | Minam |
| | | Snake R lower Main | Snake R Lower Main Fall |
| | | Tucannon | Tucannon |
| | | Wenaha | Wenaha |
| | | EF SF Salmon | EF SF Salmon |
| | | Secesh | Secesh |
| | | SF Salmon Main | SF Salmon Main |
| | | BearValley | BearValley |
| | | Big | Big |
| | | Camas | Camas |
| | | Chamberlain | Chamberlain |
| | | Loon | Loon |
| | | Marsh | Marsh |
| | | Sulphur | Sulphur |
| | | EF Salmon | EF Salmon |
| | | Lemhi | Lemhi |
| | | Salmon R Lower Main | Salmon R Lower Main |
| | | Salmon R Upper Main | Salmon R Upper Main |
| | | Valley | Valley |
| | | Yankee | Yankee |
| California | Klamath-Trinity | Klamath | Bogus Fall |
| | | | Iron Gate Hatch Fall |
| | | | Klamath Fall |
| | | | Klamath Tribs Fall |
| | | | Salmon Fall |
| | | | Salmon Spring |
| | | | Scott Fall |
| | | | Shasta Fall |
| | | Trinity | SF Trinity Spring |
| | | | Trinity Fall |
| | | | Trinity Hatch Fall |
| | | | Trinity Hatch Spring |
| | | | Trinity Main Spring |
| | Sacramento | American | American Fall |
| | | | Nimbus Hatch Fall |
| | | Battle | Battle Fall |
| | | | Coleman Hatch Fall |
| | | | Coleman Hatch Late Fall |
| | | Deer | Deer Spring |
| | | Feather | Feather Fall |
| | | | Feather Hatch Fall |
| | | | Feather Hatch Spring |
| | | Mill | Mill Spring |
| | | Sacramento | Sacramento Fall |
| | | | Sacramento Spring |
| | | | Sacramento Winter |
| | | Yuba | Yuba Fall |
| | San Joaquin | Merced | Merced Fall |
| | | | Merced Hatch Fall |
| | | Mokelumne | Mokelumne Fall |
| | | | Mokelumne Hatch Fall |
| | | Stanislaus | Stanislaus Fall |
| | | Tuolumne | Tuolumne Fall |

**Table S2.** Sockeye salmon watershed portfolios.

| Portfolio | Asset | Data sources in asset |
|---|---|---|
| Bristol Bay | Alagnak | Alagnak |
| | Egegik | Egegik |
| | Igushik | Igushik |
| | Kvichak | Kvichak |
| | Naknek | Naknek |
| | Nushagak | Nushagak |
| | Ugashik | Ugashik |
| | Wood | Wood |
| Gulf of Alaska | Ayakulik | Ayakulik |
| | Chignik | Chignik |
| | | Black |
| | Copper | Copper Wild |
| | | Copper Hatchery |
| | FraserLake | Fraser Lake |
| | Karluk | Karluk Early |
| | | Karluk Late |
| | S Olga Lakes | S Olga Lakes Early |
| | | S Olga Lakes Late |
| Transboundary | Chilkat | Chilkat |
| | Chilkoot | Chilkoot |
| | Redoubt | Redoubt |
| | Nass | Nass |
| | Skeena | Skeena |
| | Stikine | Stikine |
| Fraser | Bowron | Bowron |
| | Chilko | Chilko |
| | Cultus | Cultus |
| | Harrison | Birkenhead |
| | | Weaver |
| | | Harrison |
| | Pitt | Pitt |
| | Portage | Gates |
| | | Portage |
| | Quesnel | Quesnel |
| | Stellako | Nadina |
| | | Stellako |
| | Stuart | Early Stuart |
| | | Late Stuart |
| | Thompson River | Fennell |
| | | Raft |
| | | Scotch |
| | | Seymour |
| | | Adams |
| | | Shuswap |
| Washington | Baker | Baker |
| | Okanogan | Okanogan |
| | Ozette | Ozette |
| | Quinault | Quinault |
| | Snake | Redfish Lake |
| | Wenatchee | Wenatchee |

**Table S3.** Chinook salmon fine-scale and coarse-scale watershed portfolio performance metrics.

| Portfolio Name | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance | Prop $\sigma^2_p$ from Cov | Prop $\sigma^2_p$ from Var |
|---|---|---|---|---|---|---|---|---|---|
| Fine-Scale | | | | | | | | | |
| CAN | 1 | 38.9 | 11.80 | 0.092 | 0.304 | 0 | 0.092 | 0 | 1 |
| BER | 3 | 45.1 | 10.19 | 0.051 | 0.226 | 0.013 | 0.038 | 0.263 | 0.737 |
| KUS | 1 | 40.7 | 12.40 | 0.093 | 0.305 | 0 | 0.093 | 0 | 1 |
| PEN | 3 | 43.8 | 9.22 | 0.044 | 0.210 | 0.007 | 0.037 | 0.163 | 0.837 |
| CEN | 3 | 40.1 | 10.40 | 0.067 | 0.260 | 0.005 | 0.063 | 0.069 | 0.931 |
| SEA | 4 | 41.8 | 9.91 | 0.056 | 0.237 | 0.004 | 0.052 | 0.08 | 0.92 |
| LCR | 15 | 17.5 | 7.37 | 0.177 | 0.421 | 0.127 | 0.05 | 0.717 | 0.283 |
| MCR | 5 | 19.2 | 7.99 | 0.173 | 0.415 | 0.081 | 0.091 | 0.47 | 0.53 |
| UCR | 4 | 17.1 | 7.74 | 0.206 | 0.454 | 0.083 | 0.123 | 0.401 | 0.599 |
| SNK | 23 | 8.0 | 5.33 | 0.441 | 0.664 | 0.384 | 0.057 | 0.872 | 0.128 |
| KLA | 2 | 18.0 | 10.74 | 0.357 | 0.597 | 0.093 | 0.264 | 0.26 | 0.74 |
| SAC | 7 | 23.3 | 9.95 | 0.182 | 0.427 | 0.106 | 0.076 | 0.584 | 0.416 |
| SJQ | 4 | 7.8 | 7.92 | 1.030 | 1.015 | 0.507 | 0.523 | 0.492 | 0.508 |
| Coarse-Scale | | | | | | | | | |
| CAN | 1 | 38.9 | 11.8 | 0.092 | 0.304 | 0 | 0.092 | 0 | 1.00 |
| BER | 4 | 53.7 | 10.835 | 0.041 | 0.202 | 0.014 | 0.027 | 0.342 | 0.658 |
| GOA | 6 | 60.5 | 9.844 | 0.026 | 0.163 | 0.001 | 0.026 | 0.025 | 0.975 |
| SEA | 4 | 41.8 | 9.914 | 0.056 | 0.237 | 0.004 | 0.052 | 0.08 | 0.92 |
| CR | 47 | 14.8 | 6.675 | 0.202 | 0.450 | 0.184 | 0.019 | 0.908 | 0.092 |
| CA | 13 | 18.7 | 9.55 | 0.260 | 0.510 | 0.192 | 0.069 | 0.737 | 0.263 |

**Table S4.** Sockeye salmon watershed portfolio performance metrics.

| Portfolio Name | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance | Prop $\sigma^2_p$ from Cov | Prop $\sigma^2_p$ from Var |
|---|---|---|---|---|---|---|---|---|---|
| Bristol Bay | 8 | 52.7 | 14.929 | 0.080 | 0.283 | 0.036 | 0.044 | 0.451 | 0.549 |
| Gulf of Alaska | 6 | 61.3 | 13.878 | 0.051 | 0.226 | 0.015 | 0.037 | 0.288 | 0.712 |
| Transboundary | 6 | 43.3 | 12.584 | 0.085 | 0.291 | 0.004 | 0.081 | 0.048 | 0.952 |
| Fraser | 8 | 26.8 | 12.264 | 0.210 | 0.458 | 0.010 | 0.200 | 0.046 | 0.954 |
| Washington | 5 | 17.0 | 8.579 | 0.255 | 0.505 | 0.045 | 0.210 | 0.177 | 0.823 |

**Table S5.** Watershed portfolio performance and watershed descriptor correlations. Only significant p-values based upon two-tailed Spearman Rank's R critical values are shown.

| Portfolio Type | Variable | Spearman's R | P-value |
|---|---|---|---|
| Chinook Fine Scale (n = 13) | PC 1 | 0.36 | |
| | PC 2 | 0.73 | < 0.05 |
| | Watershed Area | -0.39 | |
| | Floodplain Area | 0.10 | |
| | Mid-channel Nodes | 0.19 | |
| | Mean Human Footprint Index | -0.81 | < 0.005 |
| | Tributary Nodes per Drainage Line | -0.42 | |
| | Number of Dams | -0.89 | < 0.001 |
| | Total Lake Area | 0.01 | |
| | Total Glacier Area | 0.79 | < 0.005 |
| | Mean Watershed Elevation | -0.52 | |
| Sockeye (n = 5) | Watershed Area | 0.00 | |
| | Floodplain Area | 0.90 | |
| | Mid-channel Nodes | 0.90 | |
| | Mean Human Footprint Index | -0.90 | |
| | Tributary Nodes per Drainage Line | -0.80 | |
| | Number of Dams | -0.87 | |
| | Total Lake Area | 0.30 | |
| | Total Glacier Area | 0.70 | |
| | Mean Watershed Elevation | -0.20 | |

**Table S6.** Data sources and types.

| Species | Populations | Source | Point of Contact | Data Type | Citation |
|---|---|---|---|---|---|
| Chinook | Alaska | ADFG, Sport Fish | Bob Clark | Total Run | |
| Chinook | Central Valley | CDFW | Steve Lindley (NOAA) | Escapement/ Spawners | https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=15168 ("GrandTab") |
| Chinook | Columbia River | NOAA Salmonid Population Summary Database | | Spawners | https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:home:0 |
| Chinook | Deschutes River | ODFW | Jason Seals | Spawners | |
| Chinook | John Day River | ODFW | Jim Ruzycki | Spawners | |
| Chinook | Klamath-Trinity | CDFW | Steve Lindley (NOAA) | Escapement/ Spawners | https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentVersionID=75634 ("Klamath Megatable") |
| Chinook | Klickitat River | Yakima Klickitat Policy Group | Joe Zendt | Escapement | |
| Chinook | Upper Yakima River, Naches/American Rivers | Yakima Klickitat Policy Group | Bill Bosch | Escapement | Bosch, B. 2012. Summary of Data Collected by the Yakama Nation relative to Yakima River Spring Chinook Salmon and the Cle Elum Spring Chinook Supplementation and Research Facility, 2011 Annual Report. Appendix B in Sampson et al 2012, Yakima/Klickitat Fisheries Project Monitoring and Evaluation Final Report for the Performance Period May 1, 2011 through April 30, 2012. BPA technical report P127683, 314p |
| Chinook | Warm Springs River (Deschutes) | USFWS | David Hand | Spawners | |
| Chinook | Wenatchee, Methow, Okanogan Summer | Bioanalysts; Chelan Public Utility District | Tracey Hillman | Spawners | Hillman, T., M. Miller, T. Miller, M. Tonseth, M. Hughes, A. Murdoch, L. Keller, and J. Murauskas. 2013. Monitoring and evaluation of the Chelan County PUD hatchery programs: 2012 annual report. Report to the HCP Hatchery Committee, Wenatchee, WA. |
| Sockeye | Baker Lake | Skagit River System Cooperative, Upper Skagit Indian Tribe and WDFW | Brett Barkdull | Total Run | |
| Sockeye | Bristol Bay | Alaska Salmon Program Run Reconstruction from ADFG data | Curry Cunningham and Alaska Salmon Program Staff | Total Run | |
| Sockeye | Chignik | ADFG, Commercial Fisheries Division, Kodiak | Adam St Savior | Total Run | |
| Sockeye | Chilkat,Chilkoot, Redoubt | ADFG, Commercial Fisheries Division, Ketchikan | Steve Heinl | Total Run | |
| Sockeye | Columbia River | NOAA Salmonid Population Summary Database | | Spawners | https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:home:0 |
| Sockeye | Copper River | ADFG, Commercial Fisheries Division, PWS/ Copper River Area | Steve Moffitt | Total Run | |
| Sockeye | Fraser River | Pacific Salmon Commission | Steve Lantham | Total Run | |
| Sockeye | Kodiak | ADFG, Commercial Fisheries Division, Kodiak | Michelle Miller | Total Run | |
| Sockeye | Skeena, Nass, Stikine | DFO Canada | Steve Cox-Rogers | Total Run | Skeena Data: http://www.psf.ca/pdf/ISRP-final.pdf, in Appendix D |
| Sockeye | Ozette | NOAA Salmonid Population Summary Database | | Spawners | https://www.webapps.nwfsc.noaa.gov/apex/f?p=261:home:0 |
| Sockeye | Quinualt | Quinault Fisheries | Larry Gilbertson | Total Run | |

Agency Abbreviations: ADFG = Alaska Department of Fish and Game; CDFW = California Department of Fish and Wildlife; DFO = Department of Fisheries and Oceans; NOAA = National Oeanic and Atmospheric Administration; ODFW = Oregon Department of Fish and Wildlife; WDFW = Washington Department of Fish and Wildlife

**Figure S1.** Risk adjusted performance of coarse scale Chinook salmon watershed portfolios across North America from1985-2005. Bubble size indicates relative risk-adjusted performance as calculated by the Sharpe ratio. Bubble fill indicates the relative contribution of asset variance (white) and asset covariance (blue) to the total portfolio variance (see equation 3 in text). Portfolio abbreviations are as follows: BER= Bering, CA = California, COL = Columbia River, GOA = Gulf of Alaska, SEAK = Southeast Alaska, YUK = Canadian Yukon.

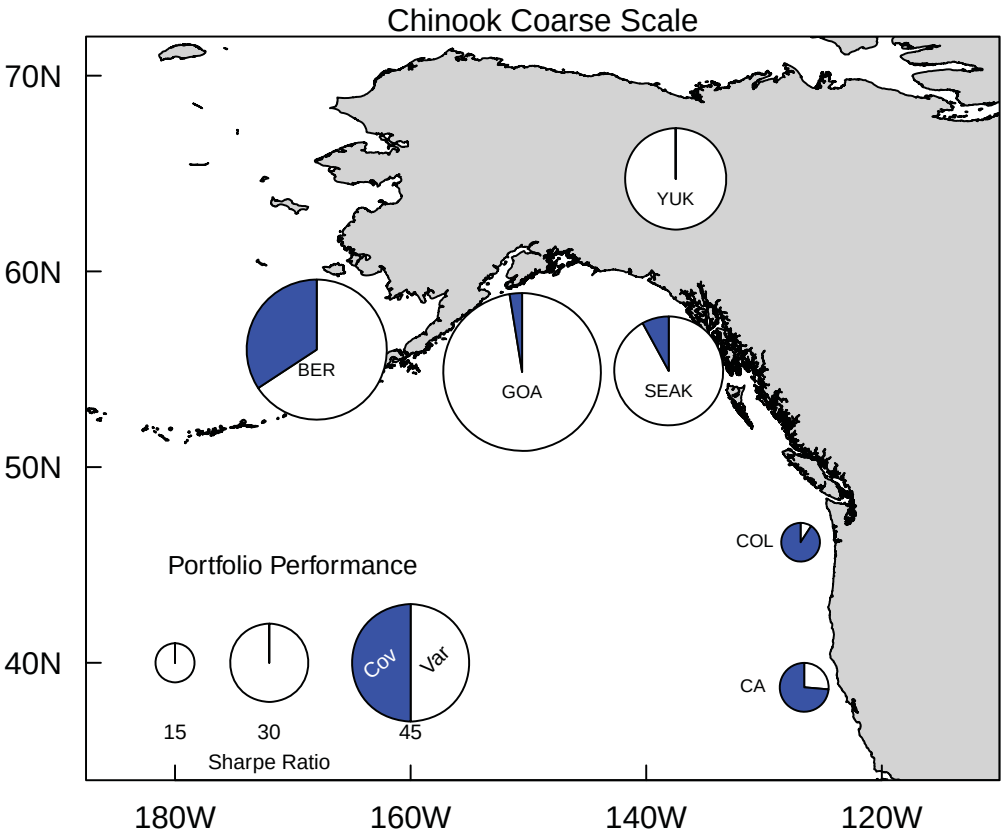


**Figure S2.** Relationship between fine-scale Chinook watershed portfolio performance and total glacier area in the watershed. Portfolio abbreviations as in Figure 1 in the main text.

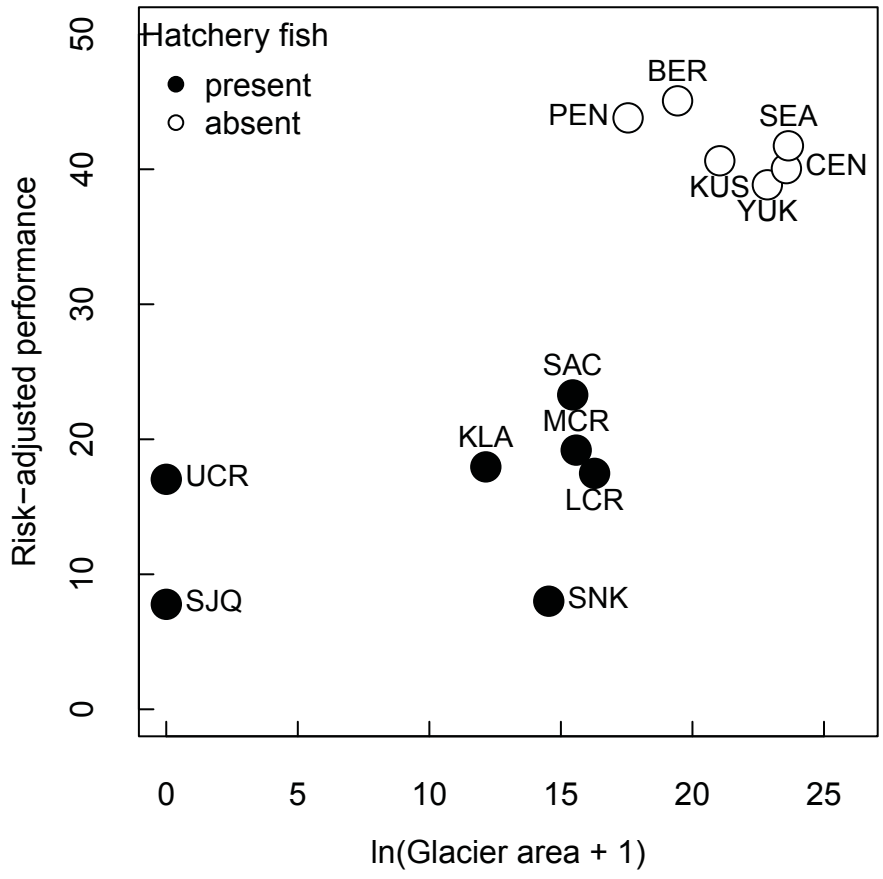


**Figure S3.** Relationship between the number of assets in a portfolio and portfolio performance measures for fine-scale Chinook salmon watershed portfolios. Top plot shows Sharpe ratio for each portfolio relative to the number of assets. Middle plot is the portfolio risk (standard deviation of the portfolio variance) versus the number portfolio of assets. Bottom plot is the proportion of portfolio variance derived from asset covariance versus the number of portfolio assets. Abbreviations are the same as for Figure 1 in the main text.

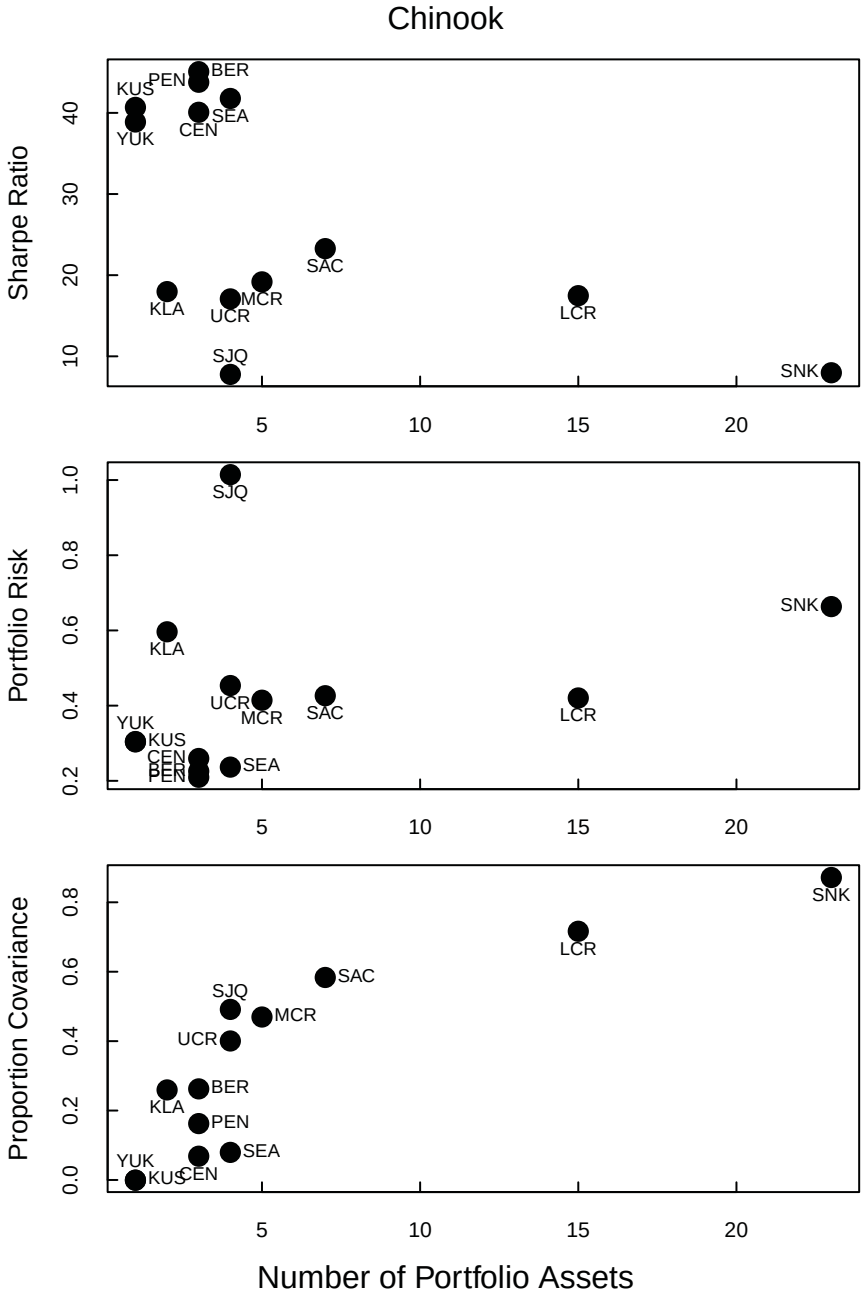
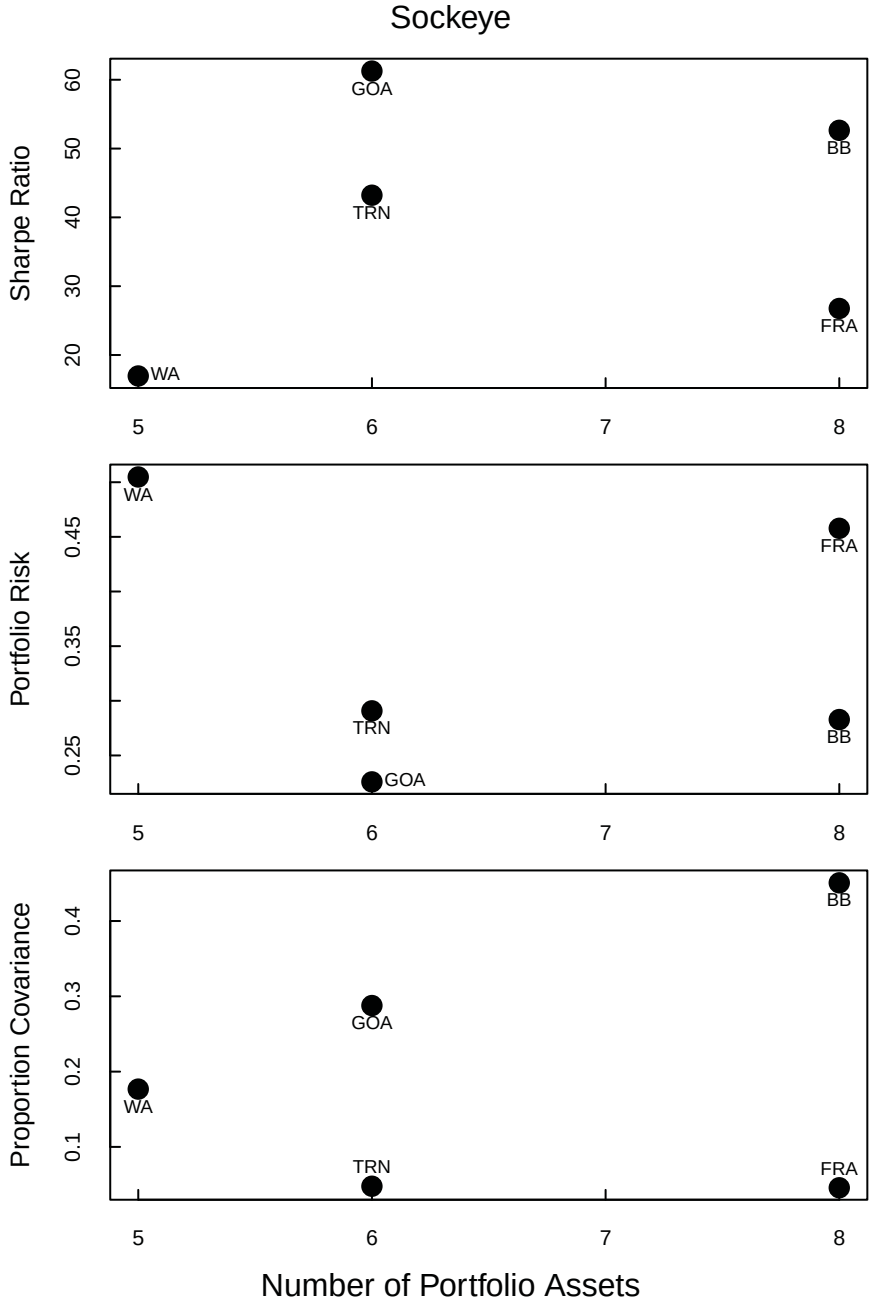


**Figure S4.** Relationship between the number of assets in a portfolio and portfolio performance measures for sockeye salmon watershed portfolios. Plots are the same as in Figure S3 and abbreviations are the same as for Figure 1 in main text.



**Appendix S1: Alternative Portfolios Methods**

Methods

*Management*

We created portfolios by grouping the data by regions used by state and federal agencies to management salmon populations and fisheries instead of watersheds, as described in the main text. These regions are often based upon spatial and/or genetic groupings but also reflect the socio-economic context of management and the constraints of fine-scale stock differentiation. For both species, management portfolios were explored at a fine and coarse spatial resolution. Fraser River sockeye management portfolios do not reflect current conservation units used for biological assessment but were the stock groupings used during the period for which we conducted our analyses.

*Genetics*

We developed portfolios based on the genetic structure of Chinook and sockeye salmon populations. Genetic portfolios are in many cases similar to watershed portfolios because genetic structure often reflects geographic patterns but genetic portfolios also capture how multiple life history types may have evolved or colonized a single geographic region. For Chinook salmon, genetic structure used to delineate portfolios was based upon analyses in Moran et al. (2013), Templin et al. (2011), Narum et al. (2010), and Banks et al. (2000). Sockeye salmon genetic portfolios were based upon analyses in Beacham et al. (2004, 2006). For both species we explored portfolios at a fine and coarse scale.

**References**

Banks, M. A., V. K. Rashbrook, M. J. Calavetta, C. A. Dean, and D. Hedgecock. 2000. Analysis of microsatellite DNA resolves genetic structure and diversity of chinook salmon (Oncorhynchus tshawytscha) in California's Central Valley. Canadian Journal of Fisheries and Aquatic Sciences **57**:915-927.

Beacham, T. D., M. Lapointe, J. R. Candy, B. McIntosh, C. MacConnachie, A. Tabata, K. Kaukinen, L. T. Deng, K. M. Miller, and R. E. Withler. 2004. Stock identification of Fraser River sockeye salmon using microsatellites and major histocompatibility complex variation. Transactions of the American Fisheries Society **133**:1117-1137.

Beacham, T. D., B. McIntosh, C. MacConnachie, K. M. Miller, and R. E. Withler. 2006. Pacific rim population structure of Sockeye salmon as determined from microsatellite analysis. Transactions of the American Fisheries Society **135**:174-187.

Moran, P., D. J. Teel, M. A. Banks, T. D. Beacham, M. R. Bellinger, S. M. Blankenship, J. R. Candy, J. C. Garza, J. E. Hess, S. R. Narum, L. W. Seeb, W. D. Templin, C. G. Wallace, and C. T. Smith. 2013. Divergent life-history races do not represent Chinook salmon coast-wide: the importance of scale in Quaternary biogeography. Canadian Journal of Fisheries and Aquatic Sciences **70**:415-435.

Narum, S. R., J. E. Hess, and A. P. Matala. 2010. Examining Genetic Lineages of Chinook Salmon in the Columbia River Basin. Transactions of the American Fisheries Society **139**:1465-1477.

Templin, W. D., J. E. Seeb, J. R. Jasper, A. W. Barclay, and L. W. Seeb. 2011. Genetic differentiation of Alaska Chinook salmon: the missing link for migratory studies. Molecular Ecology Resources **11**:226-246.

**Table S7.** Chinook salmon management portfolios.

| Coarse | Fine | Asset |
|---|---|---|
| Alaska | AYK | Canadian Yukon |
| | | Kuskokwim |
| | Bristol Bay | Goodnews |
| | | Nelson |
| | | Nushagak |
| | Gulf | Ayakulik |
| | | Chignik |
| | | Karluk |
| | Central AK | Anchor |
| | | Deshka |
| | Copper | Copper |
| | SE Alaska | Alsek |
| | | Situk |
| | | Stikine |
| | | Taku |
| Columbia | Lower Columbia | Clatskanie |
| | | Coweeman |
| | | Elochoman |
| | | Grays |
| | | Kalama Fall |
| | | Kalama Spring |
| | | Lewis |
| | | Lewis Fall |
| | | Lower Cowlitz |
| | | Mill |
| | | NFLewis |
| | | Sandy Bright |
| | | Sandy Spring |
| | | Upper Cowlitz |
| | | Upper Gorge |
| | | Washougal |
| | | White Salmon |
| | Willamette | Clackamas |
| | | McKenzie |
| | Mid Columbia Fall | Deschutes Fall Wild |
| | Upper Columbia Summer | Methow Summer |
| | | Okanogan Summer |
| | | Wenatchee Summer |
| | Snake Fall | SnakeRLowerMain |
| | MidColumbia Spring | Deschutes SpringWild |
| | | John Day |
| | | Klicktat |
| | | Naches |
| | | Round Butte Hatch Spring |
| | | Upper Yakima |
| | | Warm Springs Hatch Spring |
| | | Warm Springs Wild Spring |

| Coarse | Fine | Asset |
|---|---|---|
| Columbia | Snake Spring | Bear Valley |
| | | Big |
| | | Camas |
| | | Catherine |
| | | EF Salmon |
| | | EFSF Salmon |
| | | Grande Ronde Upper Main |
| | | Imnaha Main |
| | | Lemhi |
| | | Loon |
| | | Lostine |
| | | Marsh |
| | | Minam |
| | | Salmon R Lower Main |
| | | Salmon R Upper Main |
| | | Secesh |
| | | SF Salmon Main |
| | | Sulphur |
| | | Tucannon |
| | | Valley |
| | | Wenaha |
| | | Yankee |
| | Upper Columbia Spring | Entiat |
| | | Methow |
| | | Wenatchee |
| California | Klamath-Trinity | Bogus Fall |
| | | Iron Gate Hatch Fall |
| | | Klamath Fall |
| | | Klamath Tribs Fall |
| | | Salmon Fall |
| | | Salmon Spring |
| | | Scott Fall |
| | | SF Trinity Spring |
| | | Shasta Fall |
| | | Trinity Fall |
| | | Trinity Hatch Fall |
| | | Trinity Hatch Spring |
| | | Trinity Main Spring |
| | Central Valley Fall | American Fall |
| | | Battle Fall |
| | | ColemanHatch Fall |
| | | Feather Fall |
| | | Feather Hatch Fall |
| | | Merced Fall |
| | | Merced Hatch Fall |
| | | Mokelumne Fall |
| | | MokelumneHatch Fall |
| | | NimbusHatch Fall |
| | | Sacramento Fall |
| | | Stanislaus Fall |
| | | Tuolumne Fall |
| | | Yuba Fall |
| | Central Valley Late Fall | Coleman Hatch Late Fall |
| | Central Valley Winter | SacramentoWinter |
| | Central Valley Spring | Deer Spring |
| | | Feather Hatch Spring |
| | | Mill Spring |
| | | Sacramento Spring |

**Table S8.** Sockeye salmon management portfolios.

| Coarse | Fine | Asset |
|---|---|---|
| Alaska | Bristol Bay | Alagnak |
| | | Egegik |
| | | Igushik |
| | | Kvichak |
| | | Naknek |
| | | Nushagak |
| | | Ugashik |
| | | Wood |
| | Chignik | Chignik |
| | Kodiak | Ayakulik |
| | | Fraser Lake |
| | | Karluk |
| | | S Olga |
| | Copper | Copper |
| | SE Alaska | Chilkat |
| | | Chilkoot |
| | | Redoubt |
| British Columbia | Early Stuart | Early Stuart |
| | Early Summer | Bowron |
| | | Early Summer Misc |
| | | Fennell |
| | | Gates |
| | | Nadina Early Late |
| | | Pitt |
| | | Raft |
| | | Scotch |
| | | Seymour |
| | Summer | Chilko |
| | | Late Stuart |
| | | Quesnel |
| | | Stellako |
| | Late | Adams |
| | | Birkenhead |
| | | Cultus |
| | | Harrison |
| | | Late Summer Misc |
| | | Portage |
| | | Shuswap |
| | | Weaver |
| | Skeena | Skeena |
| | Nass | Nass |
| | Stikine | Stikine |

| Coarse | Fine | Asset |
|---|---|---|
| Washington | Upper Columbia | Okanogan |
| | | Wenatchee |
| | Snake | Snake |
| | Ozette | Ozette |
| | Baker | Baker |
| | Quinault | Quinault |

**Table S9.** Chinook salmon genetics portfolios.

| Coarse | Fine | Asset |
|---|---|---|
| Bering | Upper Yukon | Canadian Yukon |
| | Lower Yukon | Goodnews |
| | | Kuskokwim |
| | | Nushagak |
| | North Peninsula | Nelson |
| Gulf of Alaska | Gulf | Anchor |
| | | Ayakulik |
| | | Chignik |
| | | Deshka |
| | | Karluk |
| | | Kenai |
| | Copper | Copper |
| SE Alaska | SE Alaska | Alsek |
| | | Situk |
| | | Stikine |
| | | Taku |
| Lower Columbia | Lower Columbia | Clatskanie |
| | | Coweeman |
| | | Elochoman |
| | | Grays |
| | | Kalama Fall |
| | | Kalama Spring |
| | | Lewis |
| | | Lewis Fall |
| | | Lower Cowlitz |
| | | Mill |
| | | NF Lewis |
| | | Sandy Bright |
| | | Sandy Spring |
| | | Upper Cowlitz |
| | | Upper Gorge |
| | | Washougal |
| | | White Salmon |
| | Willamette | Clackamas |
| | | McKenzie |
| Middle Upper Columbia Fall | Middle Columbia Fall | Deschutes Wild Fall |
| | Upper Columbia Summer | Methow Summer |
| | | Okanogan Summer |
| | | Wenatchee Summer |
| | Snake Fall | Snake R Lower Main |
| Middle Upper Columbia Spring | Middle Columbia Spring | Deschutes Wild Spring |
| | | John Day |
| | | Klickitat |
| | | Naches |
| | | Round Butte Hatch Spring |
| | | Upper Yakima |
| | | Warm Springs Hatch Spring |
| | | Warm Springs Wild Spring |
| | Snake Grande Ronde | Catherine |
| | | Grande Ronde Upper Main |
| | | Imnaha Main |
| | | Lostine |
| | | Minam |
| | | Wenaha |
| | Snake Tucannon | Tucannon |

| Coarse | Fine | Asset |
|---|---|---|
| Middle Upper Columbia Spring | Snake Middle Salmon | Bear Valley |
| | | Big |
| | | Camas |
| | | Loon |
| | | Marsh |
| | | Sulphur |
| | Snake South Salmon | EFSF Salmon |
| | | Secesh |
| | | SF Salmon Main |
| | Snake Upper Salmon | EF Salmon |
| | | Lemhi |
| | | Salmon R Lower Main |
| | | Salmon R Upper Main |
| | | Valley |
| | | Yankee |
| | Upper Columbia Spring | Entiat |
| | | Methow |
| | | Wenatchee |
| Klamath-Trinity | Klamath-Trinity | Bogus Fall |
| | | Iron Gate Hatch Fall |
| | | Klamath Fall |
| | | Klamath Tribs Fall |
| | | Salmon Fall |
| | | Salmon Spring |
| | | Scott Fall |
| | | SF Trinity Spring |
| | | Shasta Fall |
| | | Trinity Fall |
| | | Trinity Hatch Fall |
| | | Trinity Hatch Spring |
| | | Trinity Main Spring |
| Central Valley Fall | Central Valley Fall | American Fall |
| | | Battle Fall |
| | | Coleman Hatch Fall |
| | | Feather Fall |
| | | Feather Hatch Fall |
| | | Merced Fall |
| | | Merced Hatch Fall |
| | | Mokelumne Fall |
| | | Mokelumne Hatch Fall |
| | | Nimbus Hatch Fall |
| | | Sacramento Fall |
| | | Stanislaus Fall |
| | | Tuolumne Fall |
| | | Yuba Fall |
| Central Valley Late Fall | Central Valley Late Fall | Coleman Hatch Late Fall |
| Central Valley Winter | Central Valley Winter | Sacramento Winter |
| Central Valley Spring | Central Valley Spring | Deer Spring |
| | | Feather Hatch Spring |
| | | Mill Spring |
| | | Sacramento Spring |

**Table S10.** Sockeye salmon genetics portfolios.

| Coarse | Fine | Asset |
|---|---|---|
| West Bristol Bay | Igushik | Igushik |
| | Wood | Wood |
| | Nushagak | Nushagak |
| East Bristol Bay | Kvichak | Kvichak |
| | Alagnak | Alagnak |
| | Naknek | Naknek |
| | Egegik | Egegik |
| | Ugashik | Ugashik |
| Chignik | Chignik | Chignik |
| Kodiak | Kodiak | Ayakulik |
| | | Fraser Lake |
| | | Karluk |
| | | S Olga |
| Copper | Copper | Copper |
| SE Alaska | SE Alaska | Chilkat |
| | | Chilkoot |
| | | Redoubt |
| Fraser | Upper Fraser | Early Stuart |
| | | Late Stuart |
| | | Nadina Early Late |
| | | Stellako |
| | Bowron-Quesnel | Bowron |
| | | Quesnel |
| | North Thompson | Fennell |
| | | Raft |
| | South Thompson | Adams |
| | | Portage |
| | | Scotch |
| | | Seymour |
| | | Shuswap |
| | Gates | Gates |
| | Lower Fraser | Birkenhead |
| | | Harrison |
| | | Pitt |
| | | Weaver |
| | Cultus | Cultus |
| | Chilko | Chilko |
| North Coast | Skeena | Skeena |
| | Nass | Nass |
| | Stikine | Stikine |
| Columbia | Upper Columbia | Okanogan |
| | | Wenatchee |
| | Snake | Snake |
| Washingon Coast | Washingon Coast | Ozette |
| | | Quinault |
| Baker | Baker | Baker |

**Table S11.** Chinook salmon management portfolio performance metrics.

| Portfolio Name | Criteria | Scale | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance |
|---|---|---|---|---|---|---|---|---|---|
| AYK | Management | Fine | 2 | 50.39 | 12.109 | 0.058 | 0.24 | 0.011 | 0.046 |
| BB | | | 3 | 45.09 | 10.188 | 0.051 | 0.226 | 0.013 | 0.038 |
| Gulf | | | 3 | 43.83 | 9.217 | 0.044 | 0.21 | 0.007 | 0.037 |
| Central AK | | | 2 | 24.38 | 9.912 | 0.165 | 0.407 | 0.026 | 0.139 |
| Copper | | | 1 | 51.06 | 11.261 | 0.049 | 0.221 | 0 | 0.049 |
| SEAK | | | 4 | 41.76 | 9.914 | 0.056 | 0.237 | 0.004 | 0.052 |
| LCR | | | 17 | 17.12 | 7.033 | 0.169 | 0.411 | 0.117 | 0.051 |
| Will | | | 2 | 15.25 | 8 | 0.275 | 0.525 | 0.077 | 0.198 |
| MCR F | | | 1 | 18.72 | 9.085 | 0.236 | 0.485 | 0 | 0.236 |
| UCR F | | | 3 | 17.92 | 8.062 | 0.202 | 0.45 | 0.059 | 0.144 |
| Snake F | | | 1 | 6.07 | 7.339 | 1.461 | 1.209 | 0 | 1.461 |
| MCR S | | | 8 | 15.48 | 7.073 | 0.209 | 0.457 | 0.124 | 0.085 |
| Snake S | | | 22 | 7.68 | 5.192 | 0.458 | 0.676 | 0.4 | 0.058 |
| UCR S | | | 3 | 6.58 | 6.166 | 0.877 | 0.936 | 0.383 | 0.494 |
| Klam | | | 13 | 17.61 | 8.326 | 0.224 | 0.473 | 0.131 | 0.093 |
| CV F | | | 14 | 17.2 | 9.206 | 0.287 | 0.535 | 0.214 | 0.072 |
| CV LF | | | 1 | 4.11 | 6.699 | 2.651 | 1.628 | 0 | 2.651 |
| CV W | | | 1 | 5.85 | 7.465 | 1.629 | 1.276 | 0 | 1.629 |
| CV S | | | 4 | 12.26 | 6.883 | 0.315 | 0.561 | -0.107 | 0.423 |
| AK | | Coarse | 15 | 91.43 | 10.291 | 0.013 | 0.113 | 0.003 | 0.01 |
| PNW | | | 57 | 15.37 | 6.598 | 0.184 | 0.429 | 0.168 | 0.016 |
| CA | | | 33 | 19.75 | 8.524 | 0.186 | 0.432 | 0.15 | 0.036 |

**Table S12.** Chinook salmon genetic portfolio performance metrics.

| Portfolio Name | Criteria | Scale | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance |
|---|---|---|---|---|---|---|---|---|---|
| Up Yukon | Genetics | Fine | 1 | 38.87 | 11.8 | 0.092 | 0.304 | 0 | 0.092 |
| Low Yukon | | | 3 | 48.64 | 11.338 | 0.054 | 0.233 | 0.017 | 0.037 |
| N Pen | | | 1 | 31.46 | 8.953 | 0.081 | 0.285 | 0 | 0.081 |
| Gulf | | | 5 | 47.54 | 9.507 | 0.04 | 0.2 | 0.003 | 0.037 |
| Copper | | | 1 | 51.06 | 11.261 | 0.049 | 0.221 | 0 | 0.049 |
| SEAK | | | 4 | 41.76 | 9.914 | 0.056 | 0.237 | 0.004 | 0.052 |
| MCR S | | | 8 | 15.48 | 7.073 | 0.209 | 0.457 | 0.124 | 0.085 |
| MCR F | | | 1 | 18.72 | 9.085 | 0.236 | 0.485 | 0 | 0.236 |
| UCR F | | | 3 | 17.92 | 8.062 | 0.202 | 0.45 | 0.059 | 0.144 |
| LCR | | | 17 | 17.12 | 7.033 | 0.169 | 0.411 | 0.117 | 0.051 |
| Snake F | | | 1 | 6.07 | 7.339 | 1.461 | 1.209 | 0 | 1.461 |
| Snake GR | | | 6 | 9.22 | 5.687 | 0.38 | 0.617 | 0.233 | 0.147 |
| Snake Low | | | 1 | 5.3 | 5.578 | 1.106 | 1.052 | 0 | 1.106 |
| Snake MF | | | 6 | 4.2 | 4.405 | 1.099 | 1.048 | 0.696 | 0.403 |
| Snake SF | | | 3 | 9.63 | 6.083 | 0.399 | 0.632 | 0.183 | 0.216 |
| Snake US | | | 6 | 5.77 | 4.648 | 0.65 | 0.806 | 0.427 | 0.223 |
| UCR S | | | 3 | 6.58 | 6.166 | 0.877 | 0.936 | 0.383 | 0.494 |
| Will | | | 2 | 15.25 | 8 | 0.275 | 0.525 | 0.077 | 0.198 |
| Klam | | | 13 | 17.61 | 8.326 | 0.224 | 0.473 | 0.131 | 0.093 |
| CV F | | | 14 | 17.2 | 9.206 | 0.287 | 0.535 | 0.214 | 0.072 |
| CV LF | | | 1 | 4.11 | 6.699 | 2.651 | 1.628 | 0 | 2.651 |
| CV W | | | 1 | 5.85 | 7.465 | 1.629 | 1.276 | 0 | 1.629 |
| CV S | | | 4 | 12.26 | 6.883 | 0.315 | 0.561 | -0.107 | 0.423 |
| Bering | | Coarse | 5 | 60.59 | 11.045 | 0.033 | 0.182 | 0.012 | 0.021 |
| GOA | | | 6 | 60.53 | 9.844 | 0.026 | 0.163 | 0.001 | 0.026 |
| SEAK | | | 4 | 41.76 | 9.914 | 0.056 | 0.237 | 0.004 | 0.052 |
| LCR | | | 19 | 18.08 | 7.151 | 0.156 | 0.396 | 0.114 | 0.043 |
| MUCR F | | | 5 | 17.66 | 8.161 | 0.213 | 0.462 | 0.103 | 0.111 |
| MUCR S | | | 33 | 10.09 | 5.855 | 0.337 | 0.58 | 0.303 | 0.033 |
| Klam | | | 13 | 17.61 | 8.326 | 0.224 | 0.473 | 0.131 | 0.093 |
| CV F | | | 14 | 17.2 | 9.206 | 0.287 | 0.535 | 0.214 | 0.072 |
| CV LF | | | 1 | 4.11 | 6.699 | 2.651 | 1.628 | 0 | 2.651 |
| CV W | | | 1 | 5.85 | 7.465 | 1.629 | 1.276 | 0 | 1.629 |
| CV S | | | 4 | 12.26 | 6.883 | 0.315 | 0.561 | -0.107 | 0.423 |

**Table S13.** Sockeye salmon management portfolio performance metrics.

| Portfolio Name | Criteria | Scale | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance |
|---|---|---|---|---|---|---|---|---|---|
| BB | Management | Fine | 8 | 52.68 | 14.929 | 0.08 | 0.283 | 0.036 | 0.044 |
| Chignik | | | 1 | 49.41 | 14.703 | 0.089 | 0.298 | 0 | 0.089 |
| Kodiak | | | 4 | 41.68 | 13.48 | 0.105 | 0.323 | 0.03 | 0.074 |
| Copper | | | 1 | 51.3 | 14.521 | 0.08 | 0.283 | 0 | 0.08 |
| SEAK | | | 3 | 26.56 | 11.415 | 0.185 | 0.43 | -0.042 | 0.227 |
| E Stuart | | | 1 | 12.12 | 12.305 | 1.03 | 1.015 | 0 | 1.03 |
| E Summer | | | 9 | 27.91 | 10.541 | 0.143 | 0.378 | 0.013 | 0.129 |
| Summer | | | 4 | 18.89 | 13.498 | 0.51 | 0.714 | 0.094 | 0.416 |
| Late | | | 8 | 12.85 | 11.004 | 0.733 | 0.856 | 0.365 | 0.368 |
| Skeena | | | 1 | 24.57 | 14.84 | 0.365 | 0.604 | 0 | 0.365 |
| Nass | | | 1 | 31.45 | 13.653 | 0.188 | 0.434 | 0 | 0.188 |
| Stikine | | | 1 | 17.08 | 11.883 | 0.484 | 0.696 | 0 | 0.484 |
| UCR | | | 2 | 13.76 | 9.904 | 0.518 | 0.72 | 0.103 | 0.415 |
| Snake | | | 1 | 2.03 | 2.663 | 1.718 | 1.311 | 0 | 1.718 |
| Ozette | | | 1 | 8.78 | 7.708 | 0.77 | 0.878 | 0 | 0.77 |
| Baker | | | 1 | 7.05 | 8.114 | 1.325 | 1.151 | 0 | 1.325 |
| Quinault | | | 1 | 14.3 | 10.501 | 0.54 | 0.735 | 0 | 0.54 |
| AK | | Coarse | 17 | 65.54 | 14.053 | 0.046 | 0.214 | 0.026 | 0.02 |
| BC | | | 25 | 38.62 | 11.735 | 0.092 | 0.304 | 0.026 | 0.066 |
| WA | | | 6 | 20.21 | 8.993 | 0.198 | 0.445 | 0.044 | 0.154 |

**Table S14.** Sockeye salmon genetic portfolio performance metrics.

| Portfolio Name | Criteria | Scale | Assets in Portfolio | Sharpe ratio | Portfolio Return ($U_p$) | Portfolio Variance ($\sigma^2_p$) | Portfolio Risk ($\sigma_p$) | Weighted Asset Covariance | Weighted Asset Variance |
|---|---|---|---|---|---|---|---|---|---|
| Kvichak | Genetics | Fine | 1 | 16.46 | 15.653 | 0.904 | 0.951 | 0 | 0.904 |
| Alagnak | | | 1 | 22.75 | 14.396 | 0.401 | 0.633 | 0 | 0.401 |
| Naknek | | | 1 | 33.41 | 15.22 | 0.207 | 0.456 | 0 | 0.207 |
| Egegik | | | 1 | 31.32 | 15.965 | 0.26 | 0.51 | 0 | 0.26 |
| Ugashik | | | 1 | 30.4 | 15.147 | 0.248 | 0.498 | 0 | 0.248 |
| Igushik | | | 1 | 23.35 | 13.322 | 0.326 | 0.571 | 0 | 0.326 |
| Wood | | | 1 | 36.38 | 15.214 | 0.175 | 0.418 | 0 | 0.175 |
| Nushagak | | | 1 | 28.11 | 14.164 | 0.254 | 0.504 | 0 | 0.254 |
| Chignik | | | 1 | 49.41 | 14.703 | 0.089 | 0.298 | 0 | 0.089 |
| Kodiak | | | 4 | 41.68 | 13.48 | 0.105 | 0.323 | 0.03 | 0.074 |
| Copper | | | 1 | 51.3 | 14.521 | 0.08 | 0.283 | 0 | 0.08 |
| SEAK | | | 3 | 26.56 | 11.415 | 0.185 | 0.43 | -0.042 | 0.227 |
| Upper Fraser | | | 4 | 19.81 | 12.331 | 0.388 | 0.623 | 0.084 | 0.303 |
| Bow/Ques | | | 2 | 11.01 | 12.08 | 1.203 | 1.097 | -0.13 | 1.333 |
| N Thomp | | | 2 | 13.21 | 9.974 | 0.57 | 0.755 | 0.01 | 0.56 |
| S Thomp | | | 5 | 8.58 | 10.904 | 1.615 | 1.271 | 0.812 | 0.803 |
| Gates | | | 1 | 10.24 | 10.636 | 1.079 | 1.039 | 0 | 1.079 |
| L Fraser | | | 4 | 22.72 | 11.662 | 0.263 | 0.513 | 0.022 | 0.241 |
| Cultus | | | 1 | 4.88 | 8.386 | 2.95 | 1.717 | 0 | 2.95 |
| Chilko | | | 1 | 21.05 | 14.233 | 0.457 | 0.676 | 0 | 0.457 |
| Skeena | | | 1 | 24.57 | 14.84 | 0.365 | 0.604 | 0 | 0.365 |
| Nass | | | 1 | 31.45 | 13.653 | 0.188 | 0.434 | 0 | 0.188 |
| Stik | | | 1 | 17.08 | 11.883 | 0.484 | 0.696 | 0 | 0.484 |
| UCR | | | 2 | 13.76 | 9.904 | 0.518 | 0.72 | 0.103 | 0.415 |
| Snake | | | 1 | 2.03 | 2.663 | 1.718 | 1.311 | 0 | 1.718 |
| WA Coast | | | 2 | 15.98 | 9.319 | 0.34 | 0.583 | 0.022 | 0.317 |
| Baker | | | 1 | 7.05 | 8.114 | 1.325 | 1.151 | 0 | 1.325 |
| W BB | | Coarse | 3 | 46.44 | 14.275 | 0.094 | 0.307 | 0.013 | 0.082 |
| E BB | | | 5 | 42.5 | 15.295 | 0.13 | 0.36 | 0.048 | 0.082 |
| Chignik | | | 1 | 49.41 | 14.703 | 0.089 | 0.298 | 0 | 0.089 |
| Kod/Cen | | | 5 | 53 | 13.701 | 0.067 | 0.258 | 0.017 | 0.05 |
| SEAK | | | 3 | 26.56 | 11.415 | 0.185 | 0.43 | -0.042 | 0.227 |
| Fraser | | | 20 | 32.1 | 11.512 | 0.129 | 0.359 | 0.031 | 0.097 |
| N Coast | | | 3 | 35.49 | 13.569 | 0.146 | 0.382 | 0.033 | 0.113 |
| Columbia | | | 3 | 12.94 | 9.046 | 0.489 | 0.699 | 0.142 | 0.346 |
| WA Coast | | | 2 | 15.98 | 9.319 | 0.34 | 0.583 | 0.022 | 0.317 |
| Baker | | | 1 | 7.05 | 8.114 | 1.325 | 1.151 | 0 | 1.325 |

**Figure S5.** Performance of Chinook salmon management (top) and genetic (bottom) portfolios described by the Sharpe Ratio. Large figures are portfolios assembled at fine scales and inset figures are coarse scale portfolios. Portfolios are plotted in a north to south gradient from left to right.

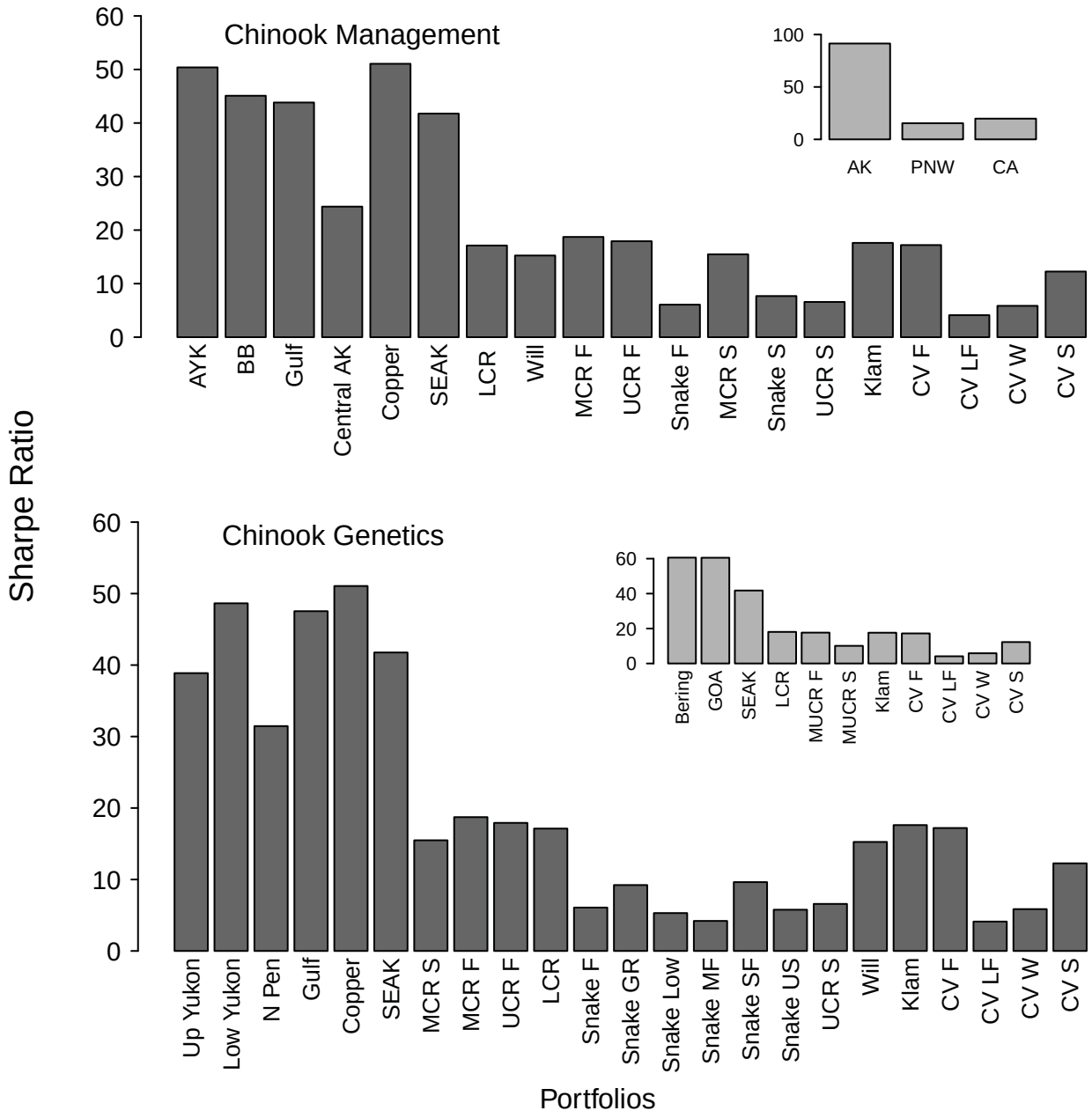


**Figure S6.** Performance of sockeye salmon management (top) and genetics (bottom) portfolios described by the Sharpe Ratio. Large figures are portfolios assembled at fine scales and inset figures are coarse scale portfolios. Portfolios are plotted in a north to south gradient from left to right.