

The State of the Salmon: Visualizing salmon population trends



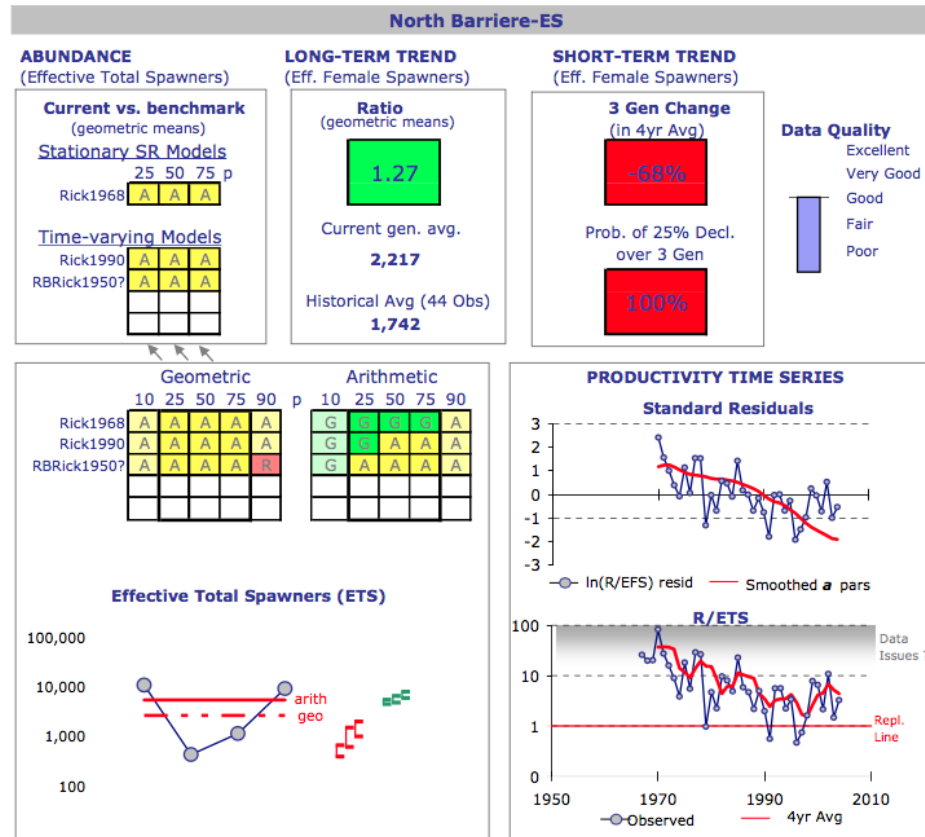
Michael Barrus

What

- Federal Department of Fisheries and Oceans (DFO) tasked with managing salmon in British Columbia
- Sockeye salmon from the Fraser river are most economically important fish in BC
- Data on these populations is not readily available to DFO scientists, nor easy to work with

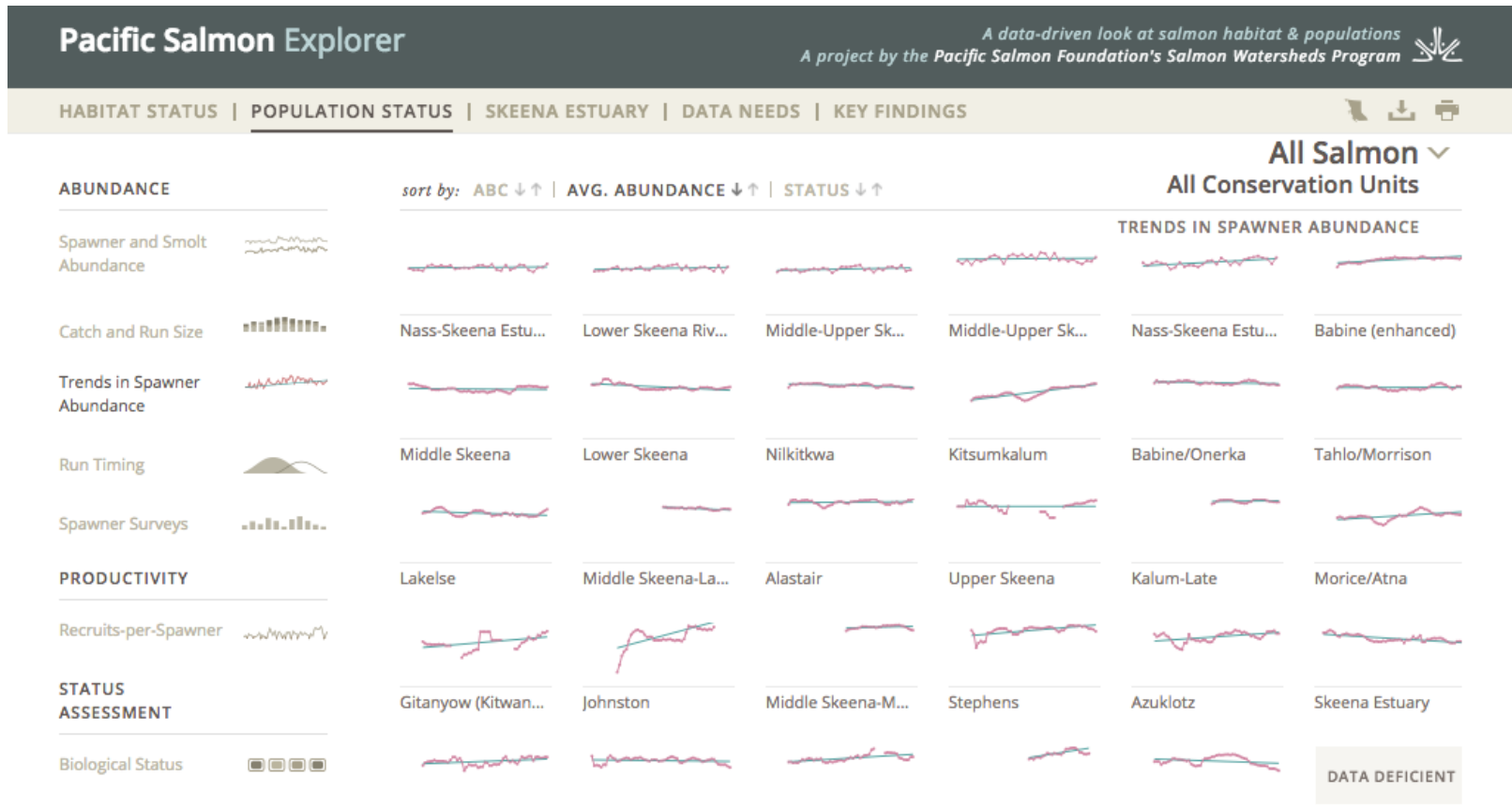
Existing tools

Annual PDF reports



Existing tools

Salmon Explorer



Tasks

- Conversations with three DFO experts
- “We want to be able to understand the state of the salmon...”
 - Discover trends and features in sockeye population measures
 - Compare trends and features across different Conservation Units (CUs)
 - Identify similarities between CUs
 - Explore existing dataset

What: Data

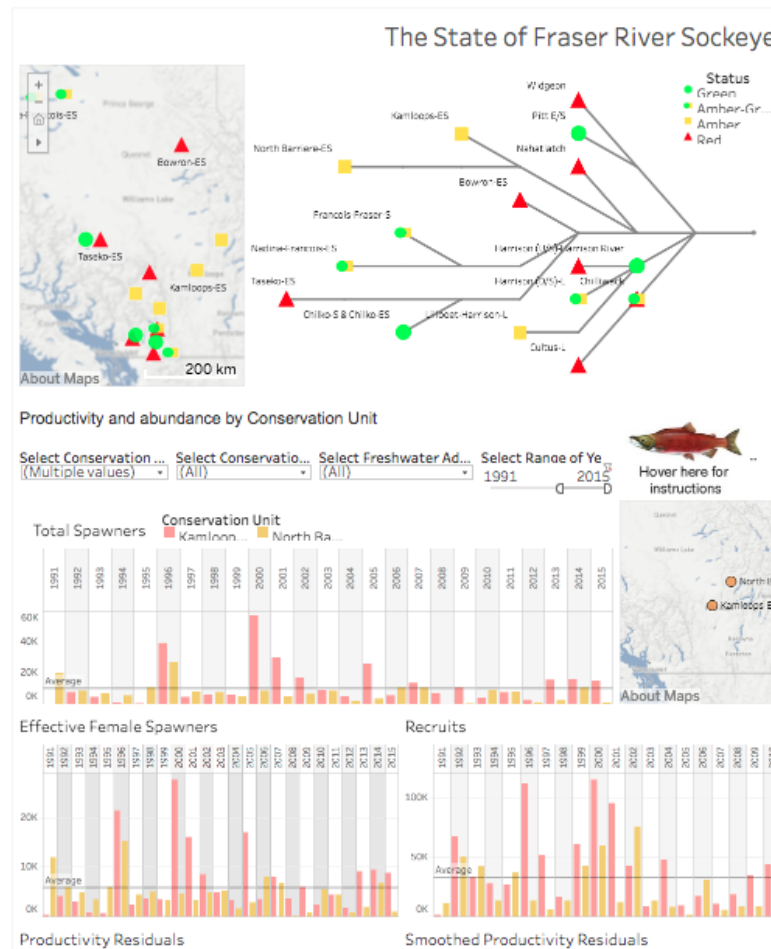
Data

- Geographic locations of salmon in Fraser river (many)
- Annual salmon counts from Fraser River watershed (1951-2015)
 - Adults
 - Juveniles
 - Partitioned by CUs

Derived

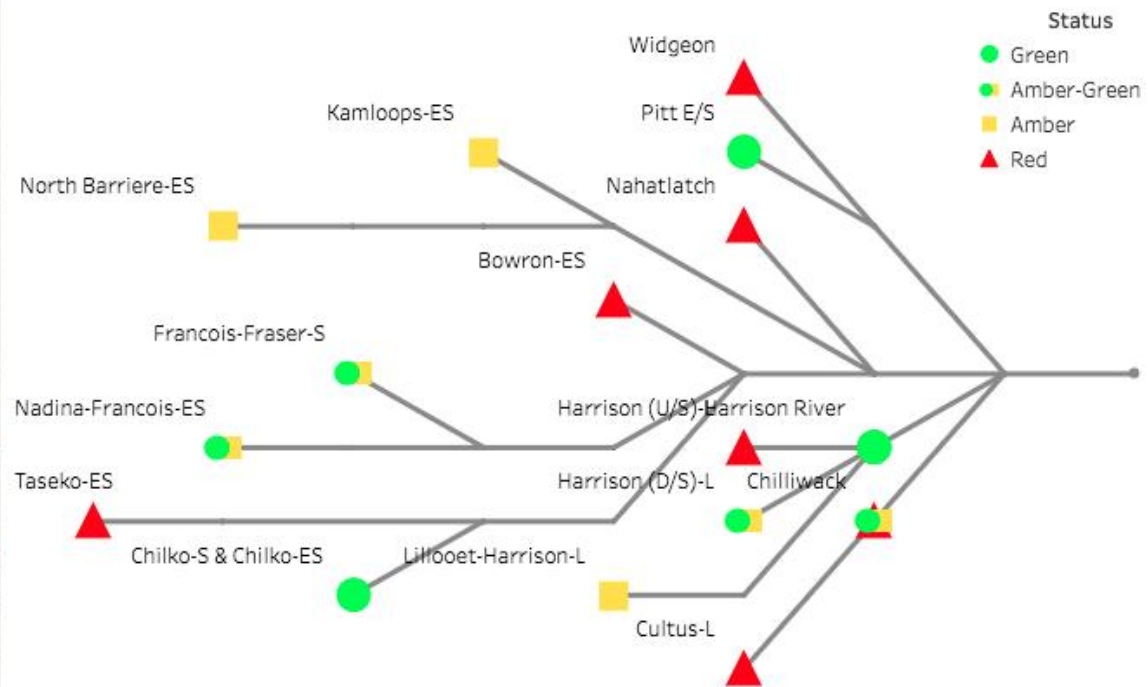
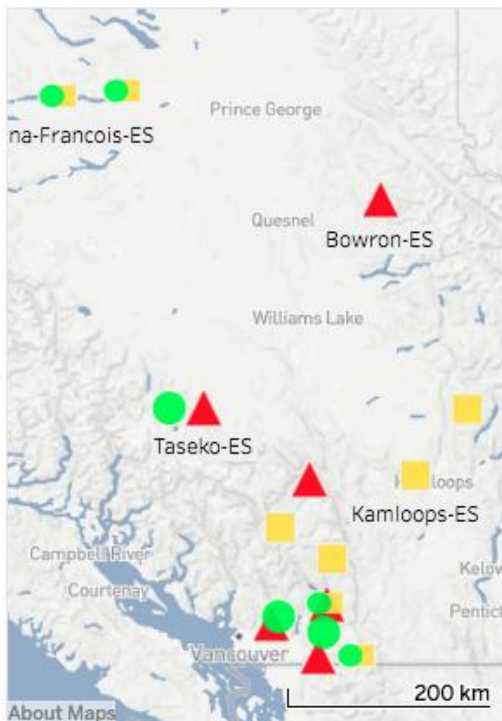
- Salmon
 - Population estimates, spawner estimates, measures of population health (5 measures per CU per year)
- Geospatial + Salmon
 - Conservation Units (CU) (16 locations)
 - CU status assessments (1 per CU)

Dashboard



Map/Tree

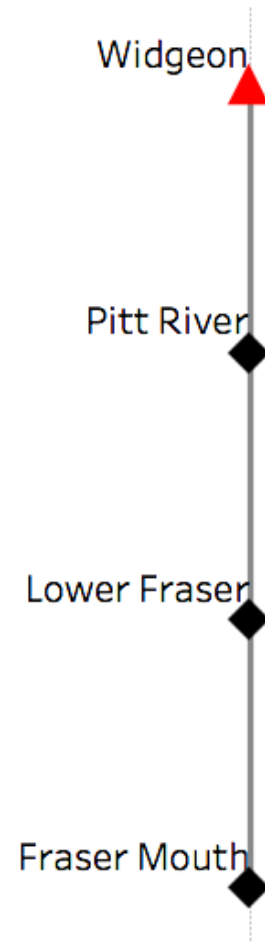
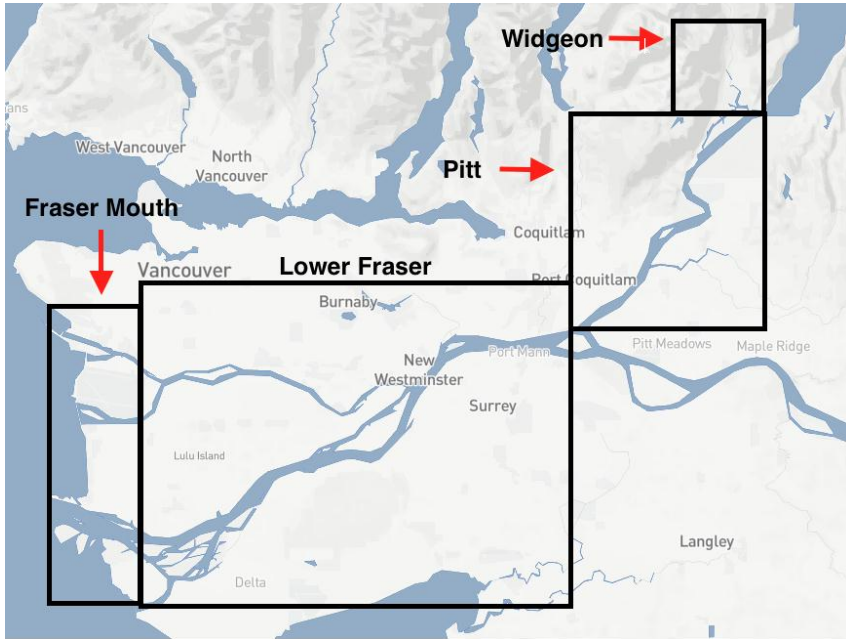
The State of Fraser River Sockeye



Tree diagram

- Data:
 - Locations of salmon populations
 - Salmon counts
- Derived:
 - topological stream order
 - connections between streams
 - conservation units
 - conservation unit status
- How
 - Links /nodes for connectivity
 - Node shape/color indicate attribute
 - Orientation
 - Juxtaposed w/ map
- Why
 - Explore topology
 - Discover similarities

Tree diagram: Stream order



Tree diagram






- Stoplight color scheme already in use, preferred by departmental users
- Problems with colorblindness
- Solution:
 - dual encoding (hue/shape)

Status	Conservation Unit	Cyclic	Stock
Red	Takla-Trembleur-ESTu	cyclic	Early Stuart
Red	Nadina-Francois-ES		Nadina
Red*	Taseko-ES		Miscellaneous Early Summers
Red	Nahatlatch-ES		Miscellaneous Early Summers
Red	Bowron-ES		Bowron
Red	Cultus-L		Cultus
Red	Widgeon - River		Miscellaneous Lates
R/A	Chilliwack-ES		Miscellaneous Early Summers
R/A	Francois-Fraser-S		Stellako
R/A	Quesnel-S	cyclic	Quesnel
R/A	Takla-Trembleur-Stuart-S	cyclic	Late Stuart
Amber	North Barriere-ES		Fennel & Miscellaneous Early Summer
Amber	Anderson-Seton-ES	cyclic	Gates
Amber	Kamloops-ES		Raft & Miscellaneous Early Summers
Amber	Harrison (U/S)-L		Weaver
A/G	Pitt-ES		Pitt
A/G	Shuswap-ES	cyclic	Scotch, Seymour, Mis.Early Summers
Green*	Chilko-S & Chilko-ES agg.		Chilko
Green*	Lillooet-Harrison-L		Birkenhead
Green	Harrison (D/S)-L		Miscellaneous Lates
Green	Shuswap Complex-L	cyclic	Late Shuswap
Green	Harrison River - River Type		Harrison

Tree diagram

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2017 Status Designations

-  Green
-  Amber-Green
-  Amber
-  Red-Amber
-  Red

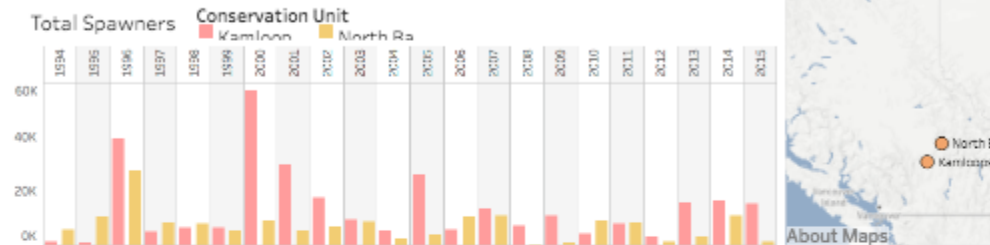
Metric comparisons

Productivity and abundance by Conservation Unit

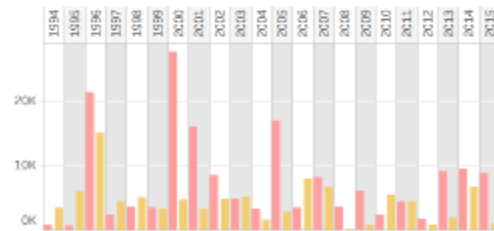
Select Conservation Unit: Select Conservation Status: Select Timescale:



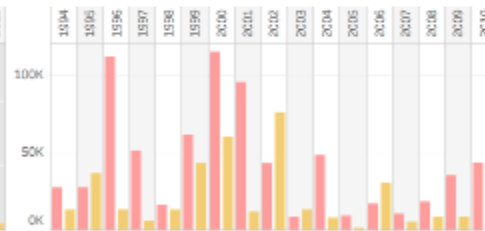
Hover here for instructions



Effective Female Spawners



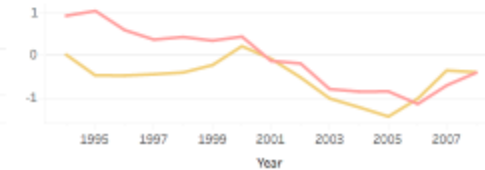
Recruits



Productivity Residuals



Smoothed Productivity Residuals



Metric comparisons: What

What: Data

- Annual salmon counts (1951-2015)
 - Adults
 - Juveniles
- Geographic locations of salmon in Fraser river

What: Derived

- Population estimates, spawner estimates, measures of population health (5 measures per CU per year)
- Conservation Units (CU) (16 locations)
- CU status assessments (1 per CU)

Metric comparisons

Why: Tasks

- Discover trends, features, distribution
- Compare trends and features
- Identify similarities
- Explore existing dataset

How:

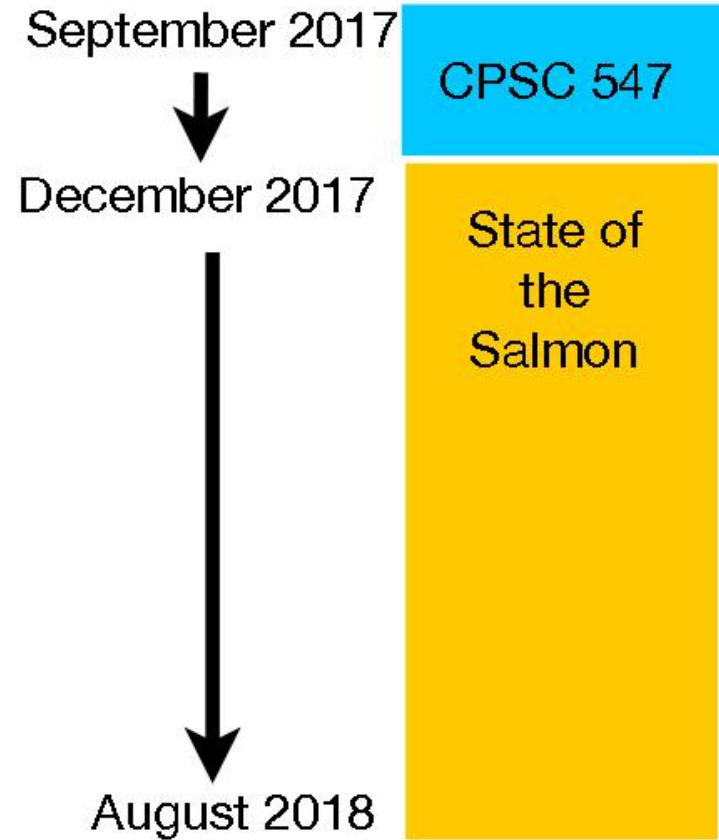
- Barcharts/lineplots
- Juxtapose
- Linked views
- Filter
- Details on demand

Limitations

- Tree plot
 - can only show one value per CU
- Metric comparisons
 - Scales poorly– hard to make comparisons across 4+ CUs and 20+ years
- Status encodings
 - Would prefer a diverging categorical color plot

Future directions

- State of the Salmon Project with DFO
- Expand dataset to include more CUs
- User surveys and testing



Future directions

- I have designed and will conduct surveys with ~15 salmon experts within the DFO
- Determine the tasks, data that are critical to their jobs
- Inform development of future visualizations
- Have designed and will conduct user studies with same ~15 users