

Identification of adaptive genetic variation and application to management in rainbow trout/steelhead

Part 1

Matthew A. Campbell^{1,2*}

¹University of California Santa Cruz, ¹NOAA SWFSC, *Present Address: Hokkaido University

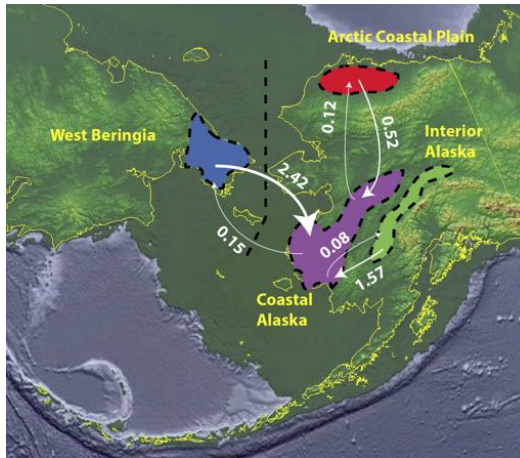
November 19, 2017

About Me

MSc, U. of Alaska
Fairbanks



This is actually a
pike!

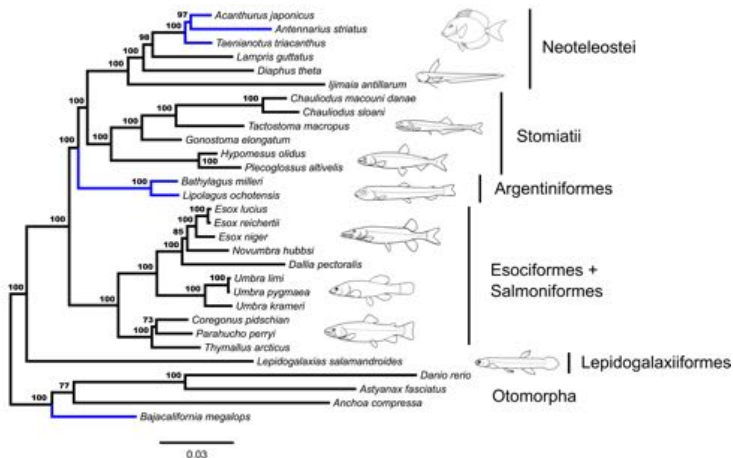


Campbell et al. (2015)

About Me

PhD

- U. of Alaska Fairbanks
- Chiba Museum
- NTU



Campbell et al. (2017)

About Me

Current Interests

- ▶ Consequences of genome duplication
- ▶ Adaptation genomics
- ▶ Non-invasive population genetics
- ▶ All of these in one with taimen!

Sakhalin Taimen



Photo: Wild Salmon Center

About Me

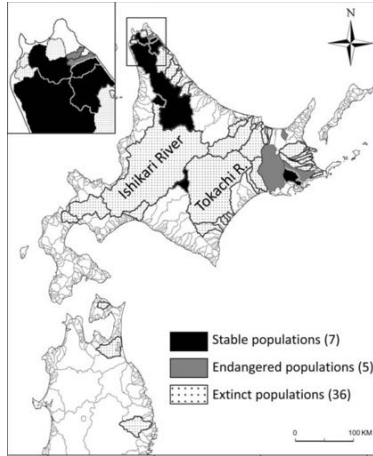
Sakhalin Taimen are large, rare, migratory, and unevenly distributed



Fukushima et al. (2011)

About Me

How do you detect and evaluate genetic diversity/census size from these fish?



Fukushima et al. (2011)

About Me

How do you detect and evaluate genetic diversity/census size from these fish

I expect that eDNA population genetics will become more practical and is something to keep your eye out for.

To the Task at Hand!

The Rainbow Trout



Certainly an adaptable species... (NZ photo).

Rainbow Trout

Where are they not found!!???



Vietnam 2,000,000 tons annually!?

<https://www.luke.fi/en/finnish-rainbow-trout-swims-vietnam/>

Rainbow Trout

Let's consider natural Rainbow Trout

Nomenclature

- ▶ Species name: *Oncorhynchus mykiss*
- ▶ Species name: Rainbow Trout, "*mykiss*"
- ▶ Life history variants: rainbow trout, steelhead, adfluvial rainbow trout



Freely interbreed if possible

Biology of Rainbow Trout

Resident rainbow trout

Residents

- ▶ No major migrations
- ▶ Typically inhabit small streams
- ▶ Tradeoff - safety for limited growth and reproductive potential



Biology of Rainbow Trout

Anadromous rainbow trout

"steelhead"

- ▶ Ocean-going migrations
- ▶ Biased towards females
- ▶ Tradeoff - reproductive potential versus safety



www.steelheadstalkers.com

Biology of Rainbow Trout

Adfluvial rainbow trout

Adfluvial rainbow trout

- ▶ Inhabit lakes
- ▶ Migrate and spawn in tributaries
- ▶ Tradeoff - reproductive potential versus safety
- ▶ Very similar to steelhead in tradeoffs



Jeremy Notch

Migration Exerts Very Different Pressures Compared to Residency

May interbreed, but alternative selection maintains some diversity

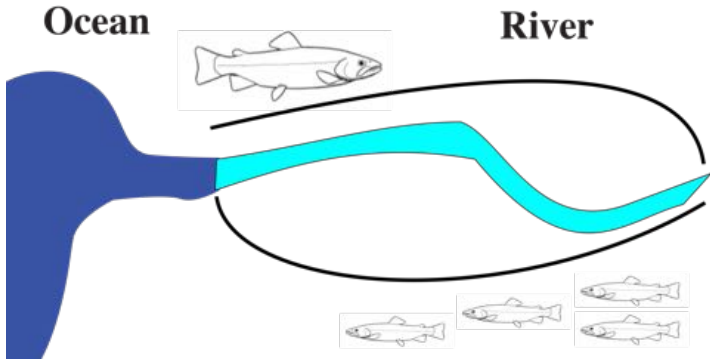


Emigrant "smolt"

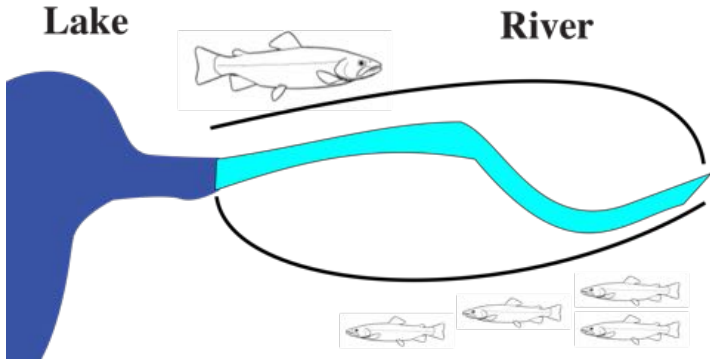


Resident

Let's quiz!!!



Let's quiz!!!



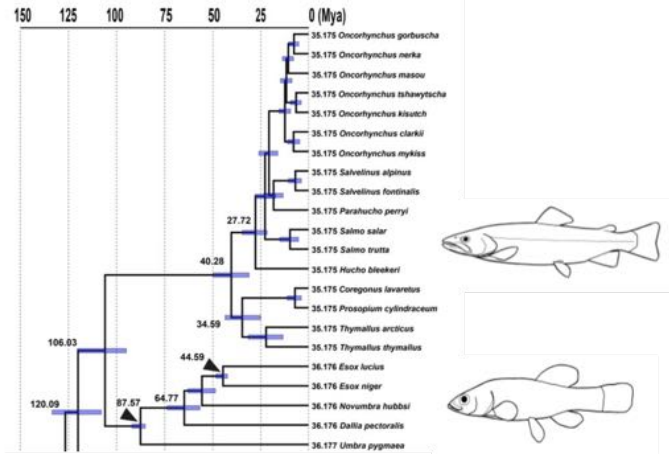
What about here?

Can you tell me about any migratory fishes in Vietnam?

- ▶ What are they?
- ▶ What kind of migrations do they have?
- ▶ Is there known within species variation? What causes it?

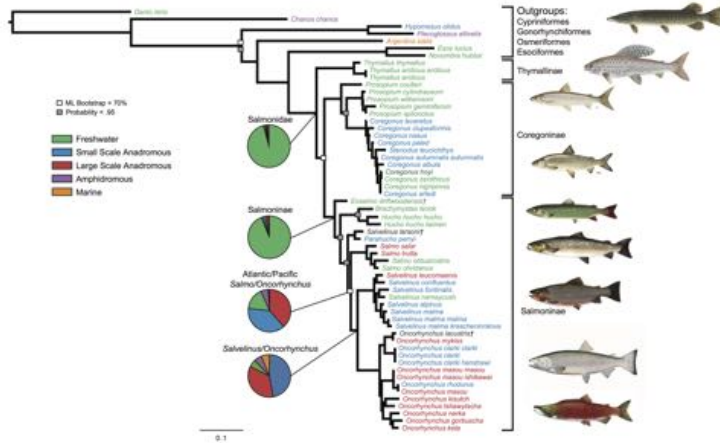
Evolutionary relationships of Salmonidae

Pike (Esocidae) and salmon (Salmonidae) are sister taxa



Campbell et al. (2013)

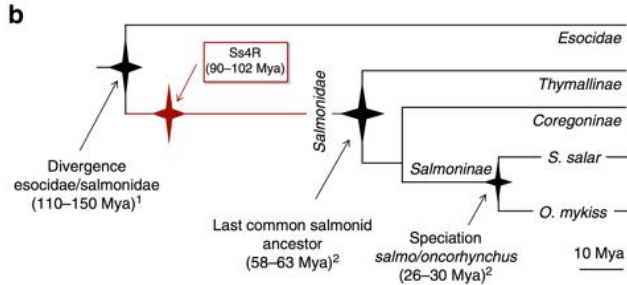
Origins of migratory behavior in Salmonidae, not Esocidae



Alexandrou et al. (2013)

Evolutionary relationships of Salmonidae

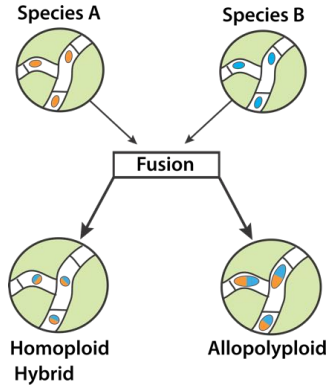
Are there big genomic differences between Pike and Salmon?



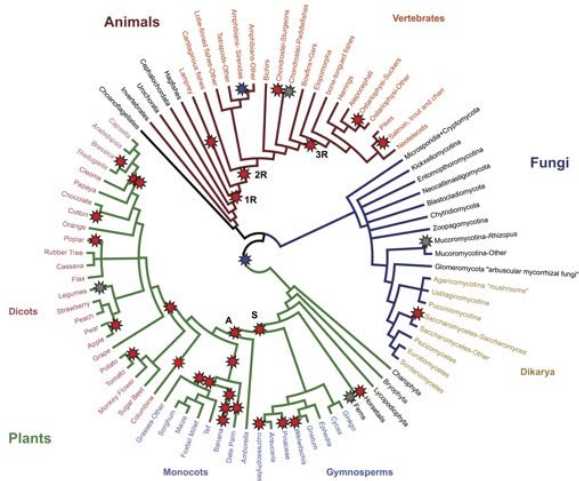
Berthelot et al. (2014)
Maybe about 80 Mya

Evolutionary relationships of Salmonidae

A whole-genome duplication event



A Whole-Genome Duplication Event?!



Campbell et al. (2016) : Not unusual, but something we should keep in mind