Two creeks. One species. Juvenile *O. mykiss* movements during early stages of recolonization

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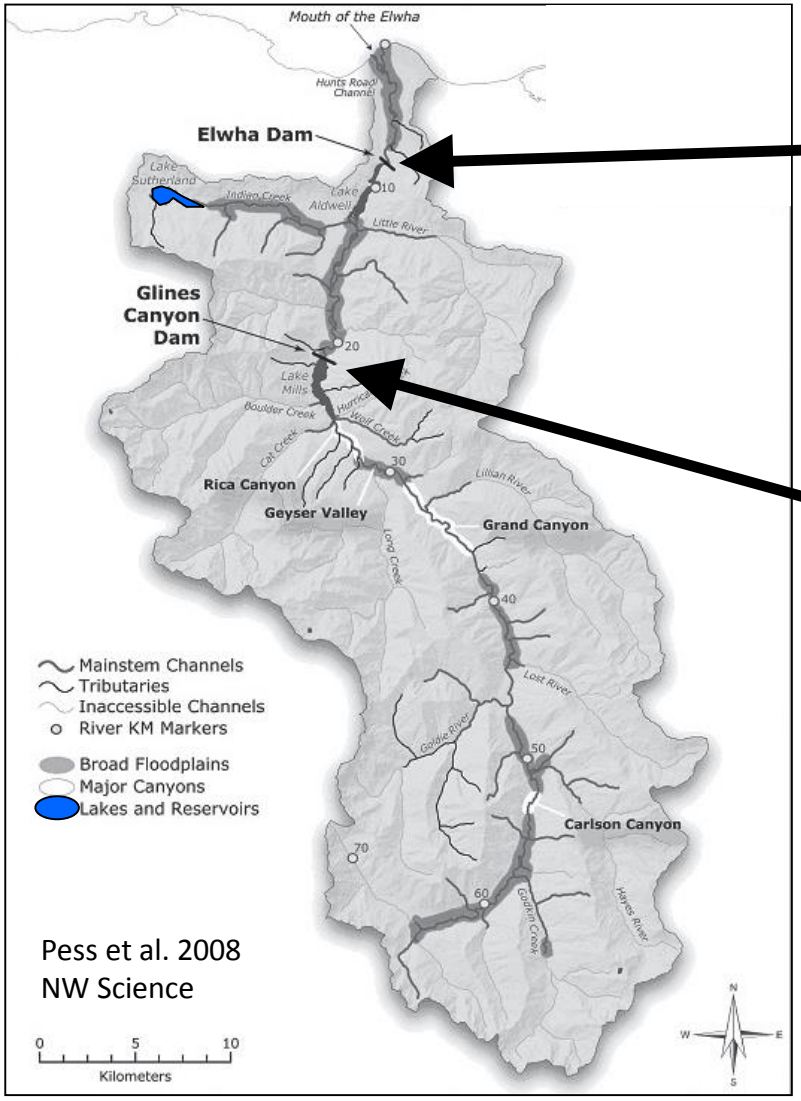
1. Trout Unlimited, 2. NOAA-NWFSC, 3. Lower Elwha Klallam Tribe

Funding and partners

- Funding
  - Provided by Lower Elwha Klallam Tribe
  - PIT work – LEKT and NOAA, TU
  - Smolt trap – LEKT and NOAA
  - Analyses – NOAA, TU and LEKT
- Partners
  - NOAA/NWFSC
    - George Pess
    - Martin Liermann
    - Todd Bennett!!
  - LEKT
    - Mike McHenry!!
    - Ray Moses
  - Olympic National Park
  - USGS
  - USFWS
  - University of Washington
  - Washington Conservation Corp

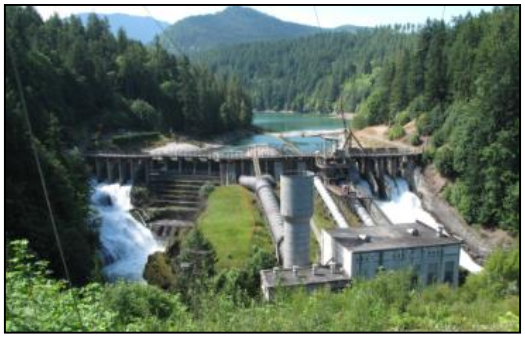
Elwha River



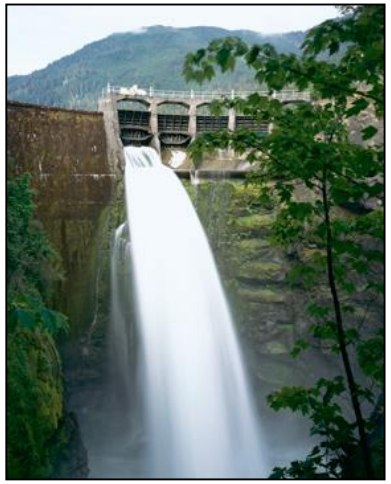
Pess et al. 2008
NW Science

833 km^2 watershed

Elwha Dam
- built 1913
- 32 m tall
- River km 8

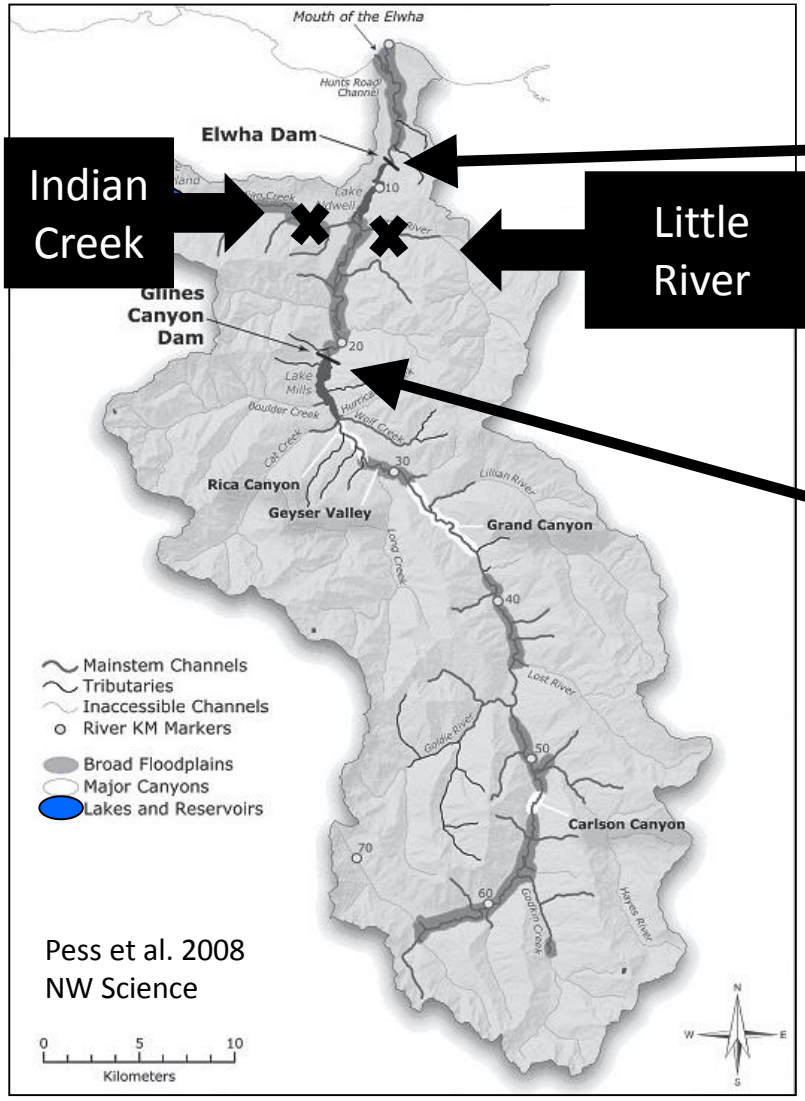


Glines Canyon Dam
- Built 1927
- 64 m tall
- River km 21



115 km of habitat upstream of Elwha Dam site

Elwha River



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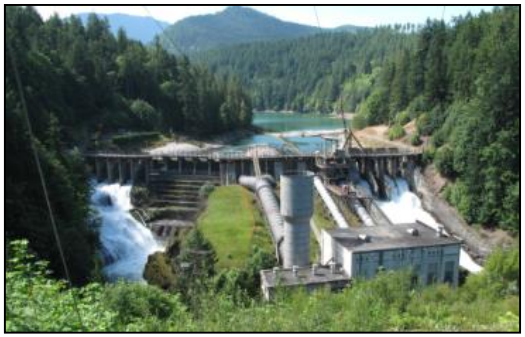

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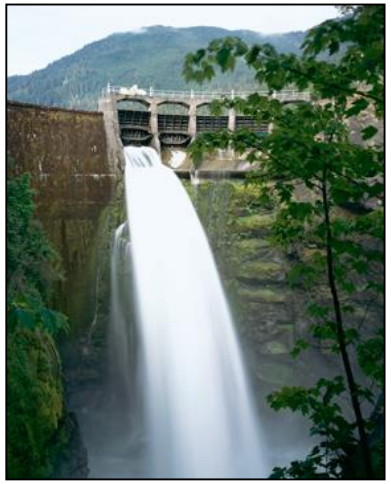


115 km of habitat upstream of Elwha Dam site

Steelhead redd counts after dam removal

- Little River
  - More redds
  - Only 4.5 km long
  - Surveyed 100% of stream
- Indian Creek
  - 8.5 km long
  - Surveyed only 25% of stream
    - Missing redds?

Year	Little	Indian
2012	43	9
2013	47	24
2014	73	36
2015	36	6
2016	28	7
2017	40	17
Total	**267**	**99**

Green box = years when some adults were relocated to the stream

Some adults relocated, others made it volitionally

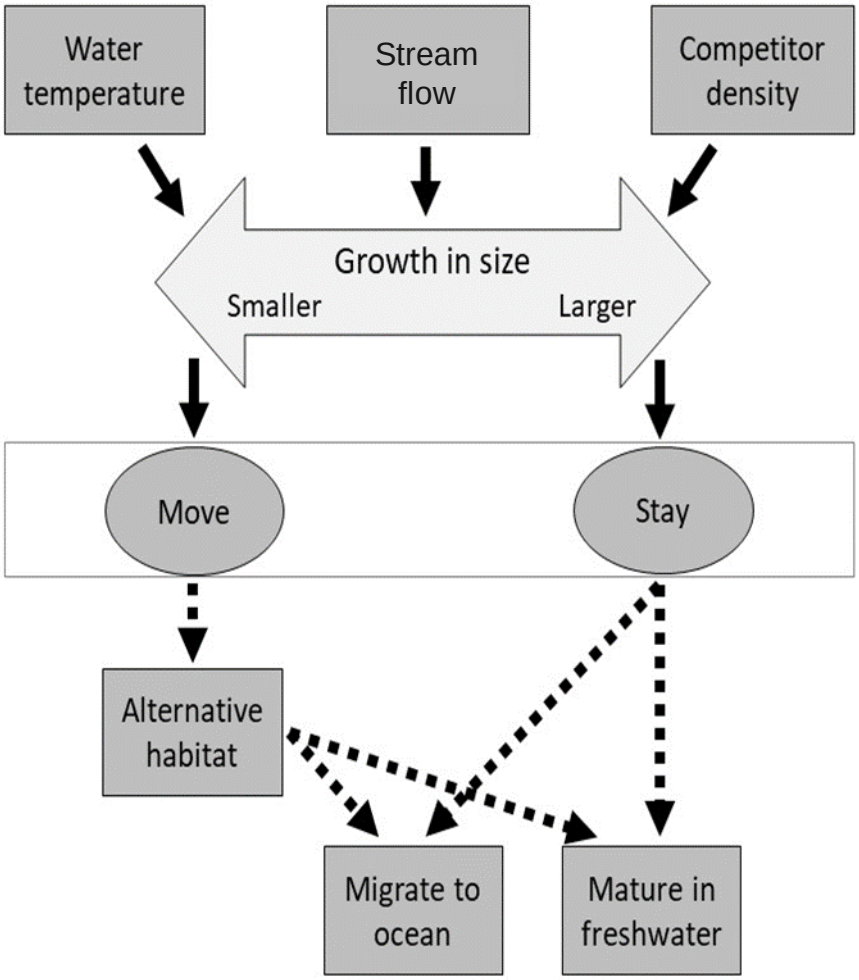
Questions about juvenile steelhead movement

1. Are there differences in proportion of *O. mykiss* that move in Indian Creek and Little River?

2. Are there differences in size of individuals that move?

3. Which factors might influence extent and timing of movement?
   - Water temperature
   - Stream flow
   - Competitor density
   - Size of *O. mykiss*

Conceptual diagram linking environment to movement



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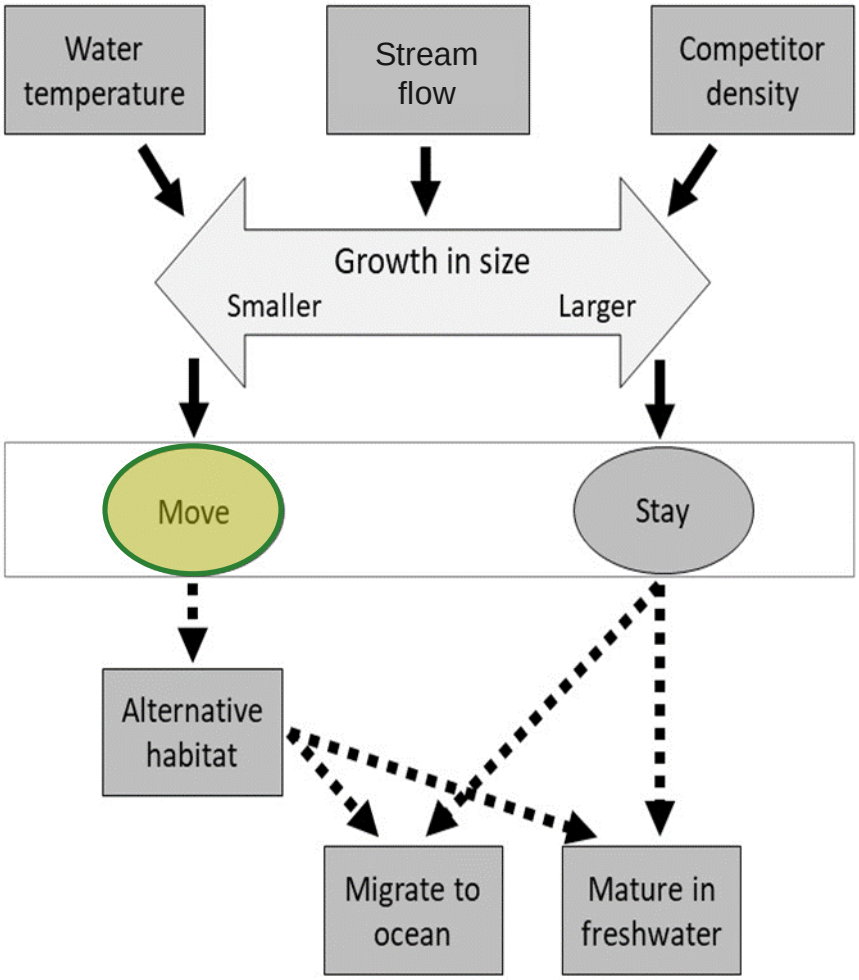

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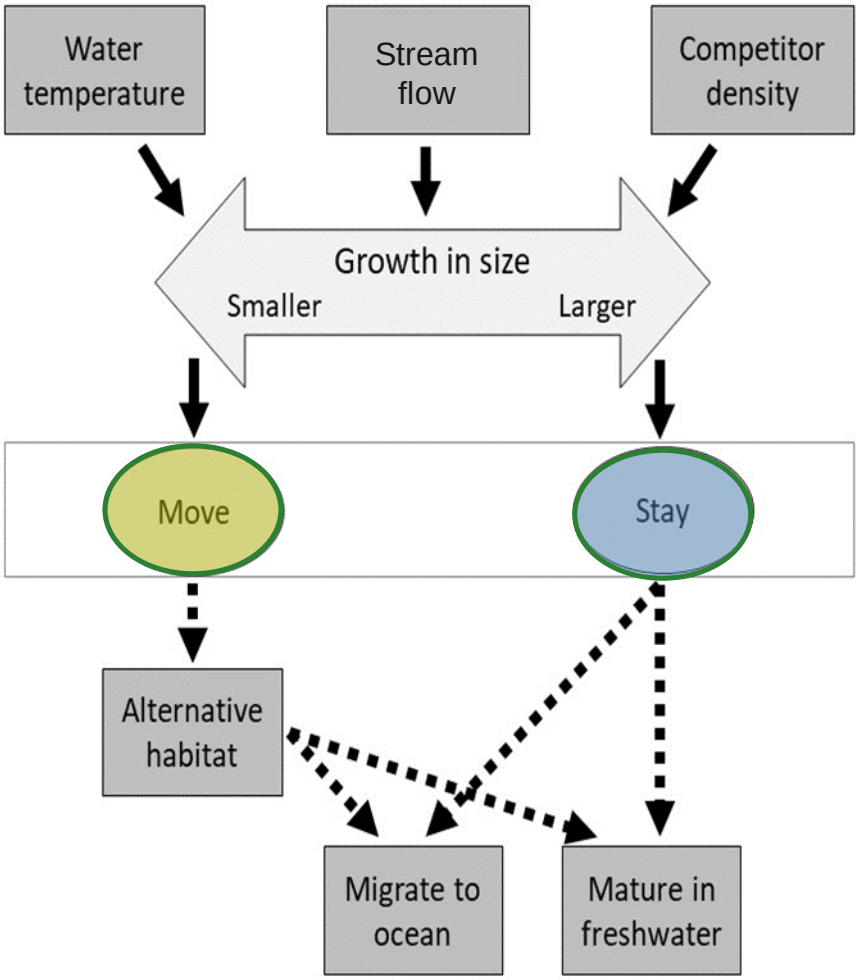
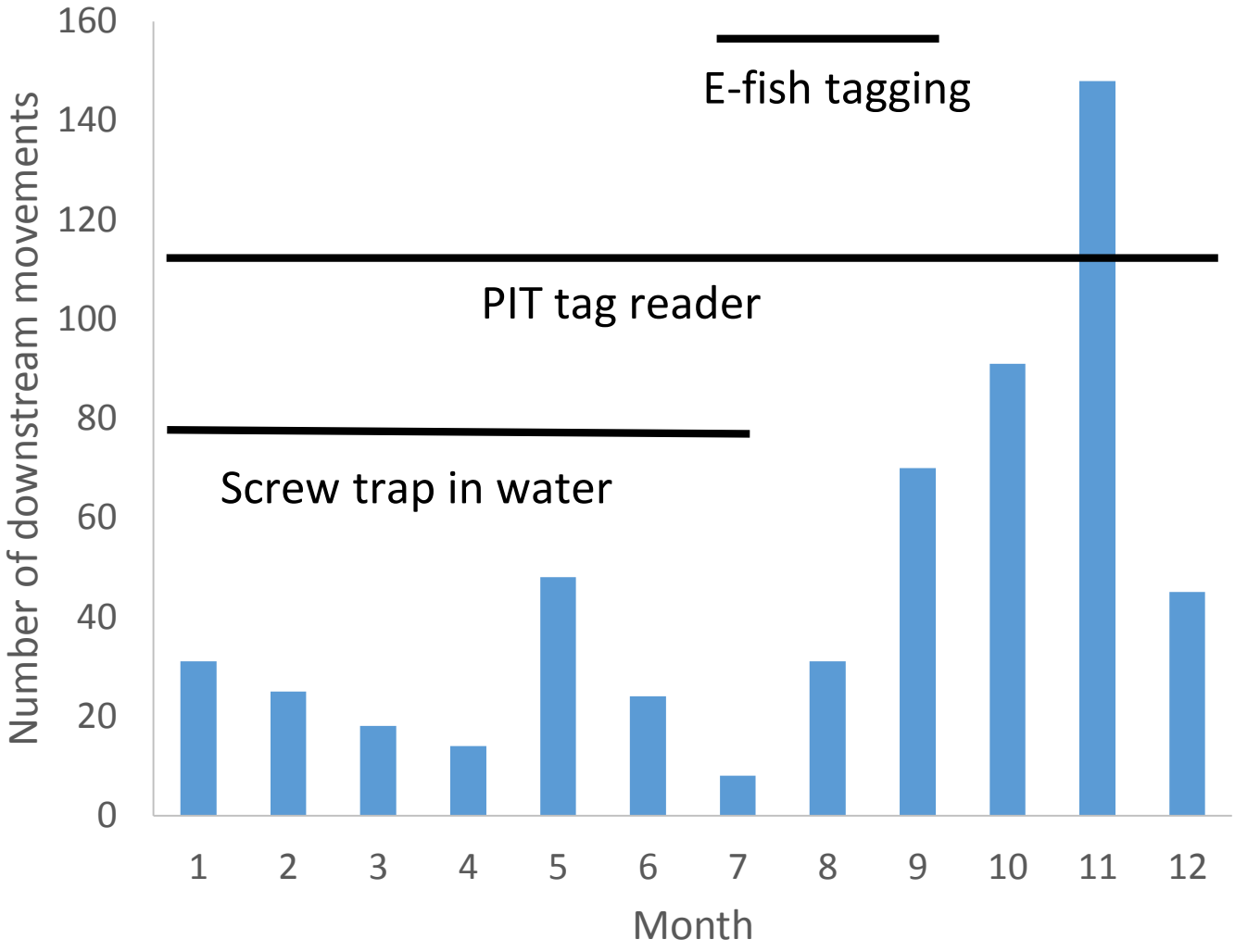


Methods for tagging and detecting fish movements

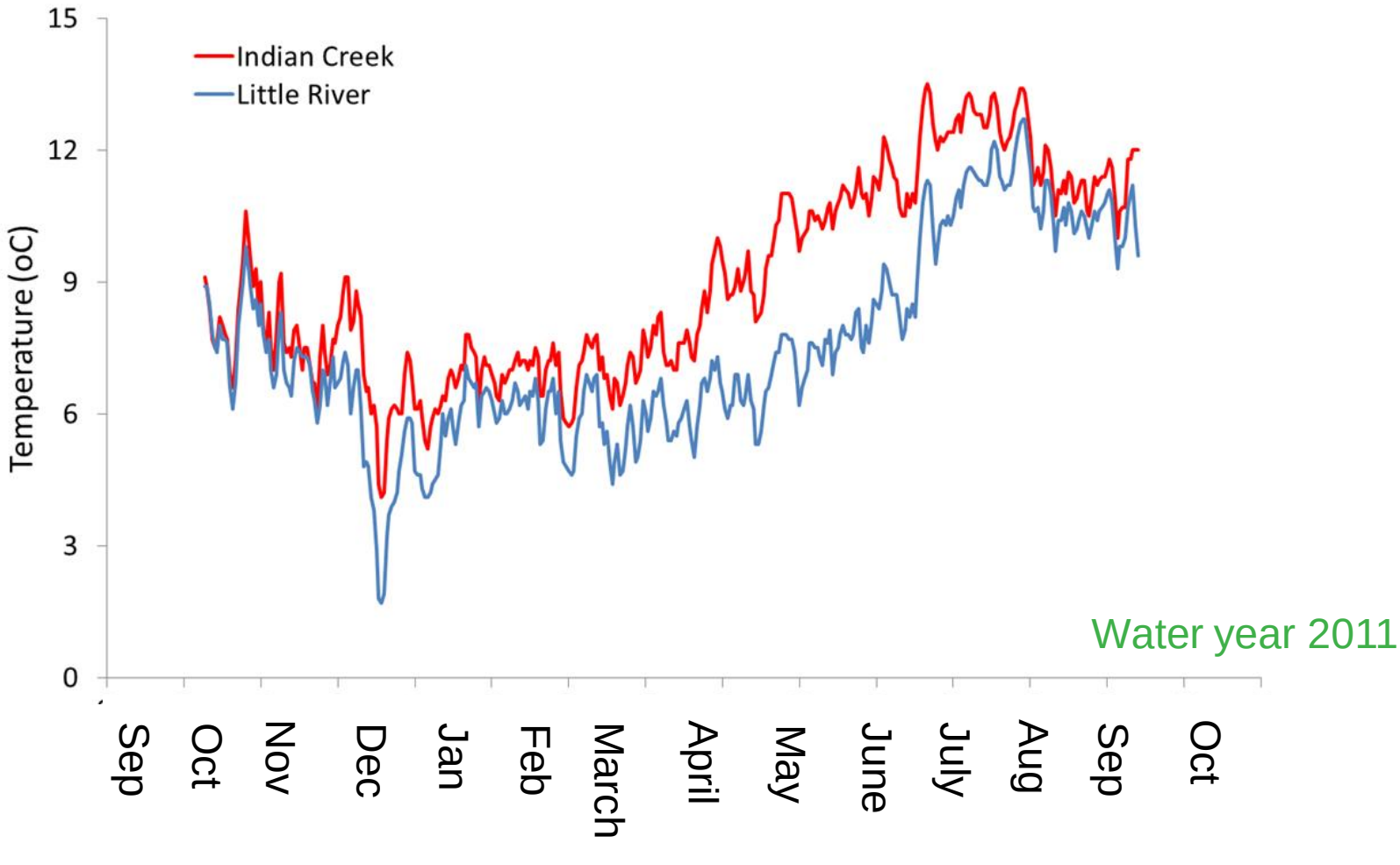


- 3-pass electrofishing with block-nets
- Tagged all *O. mykiss* over 55 mm in length

- PIT readers
- Located at rkm 0.4 on Little River
- Located at rkm 1.0 in Indian Creek

- Smolt traps
- Located at rkm 0.6 on Little River
- Located at rkm 0.9 on Indian Creek

Are there differences in water temperature?



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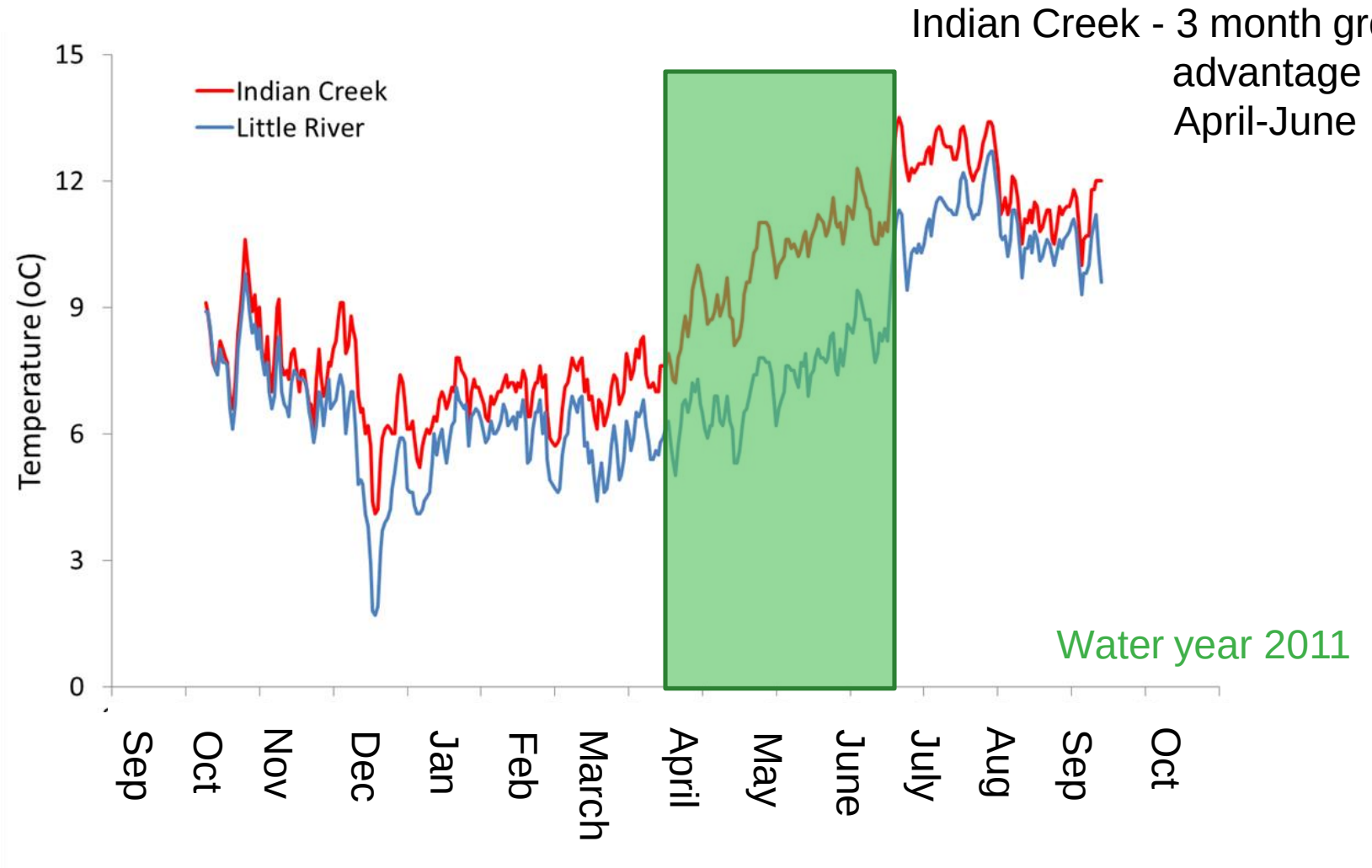
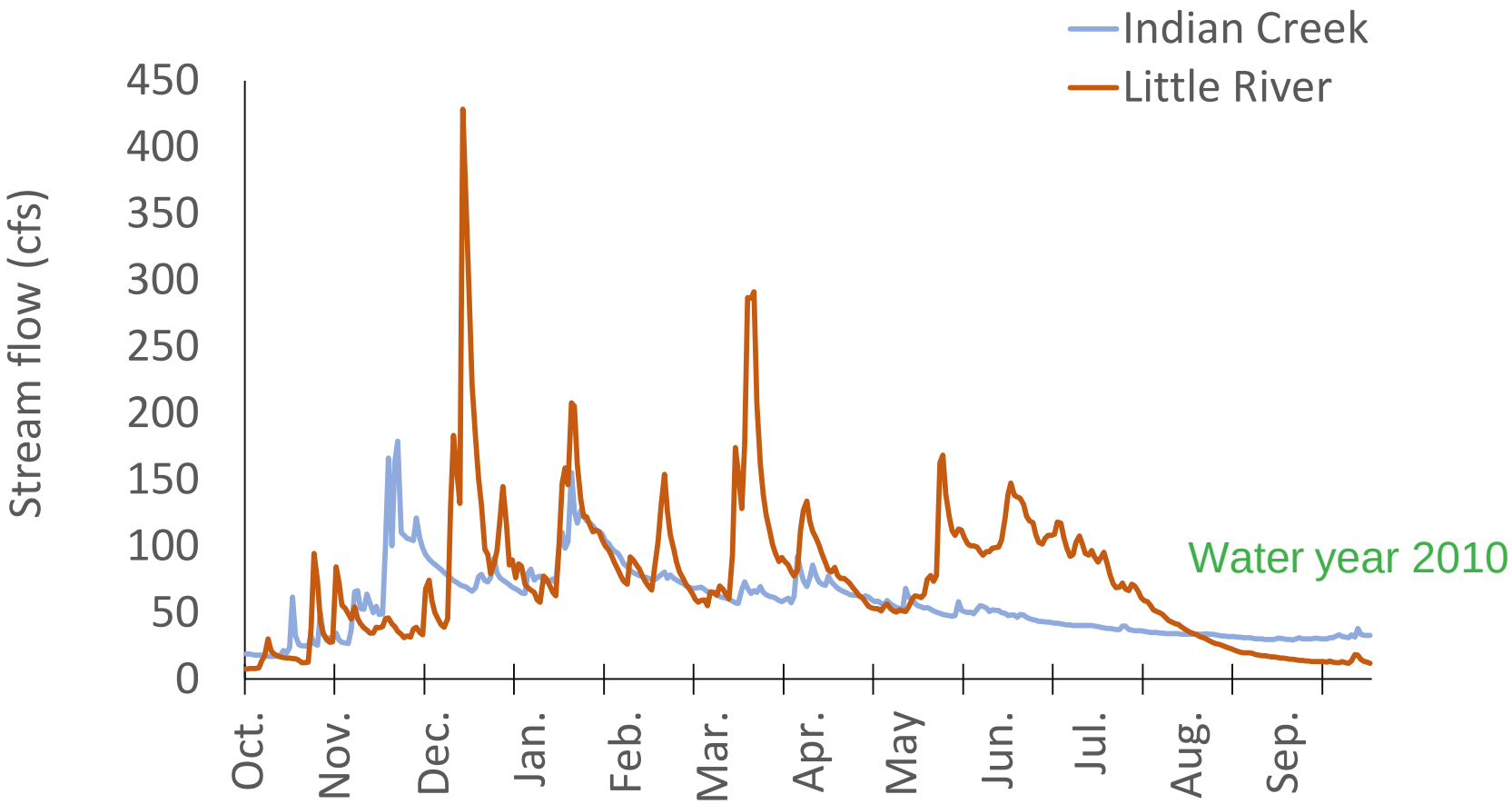


Are there differences in stream flow?



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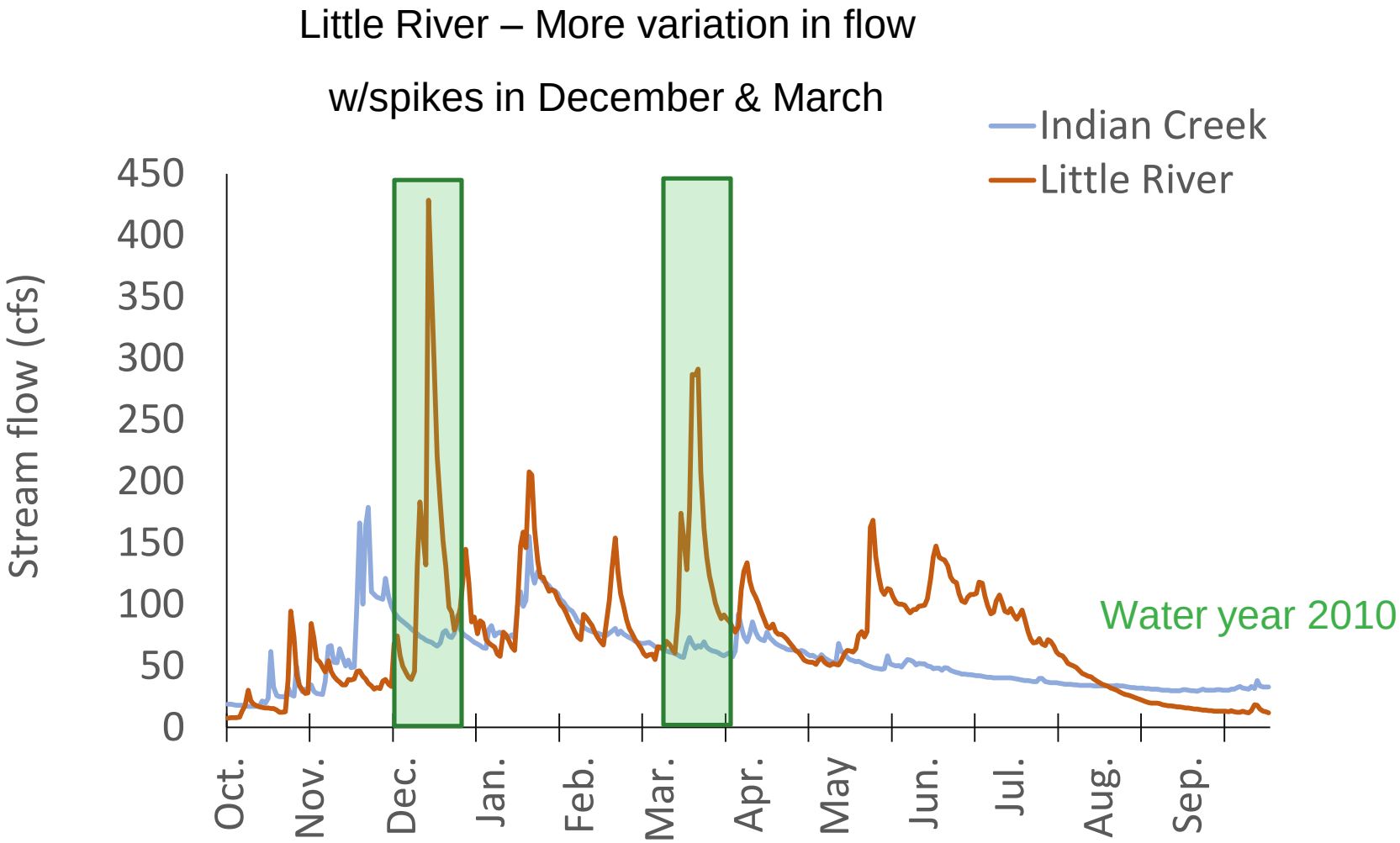
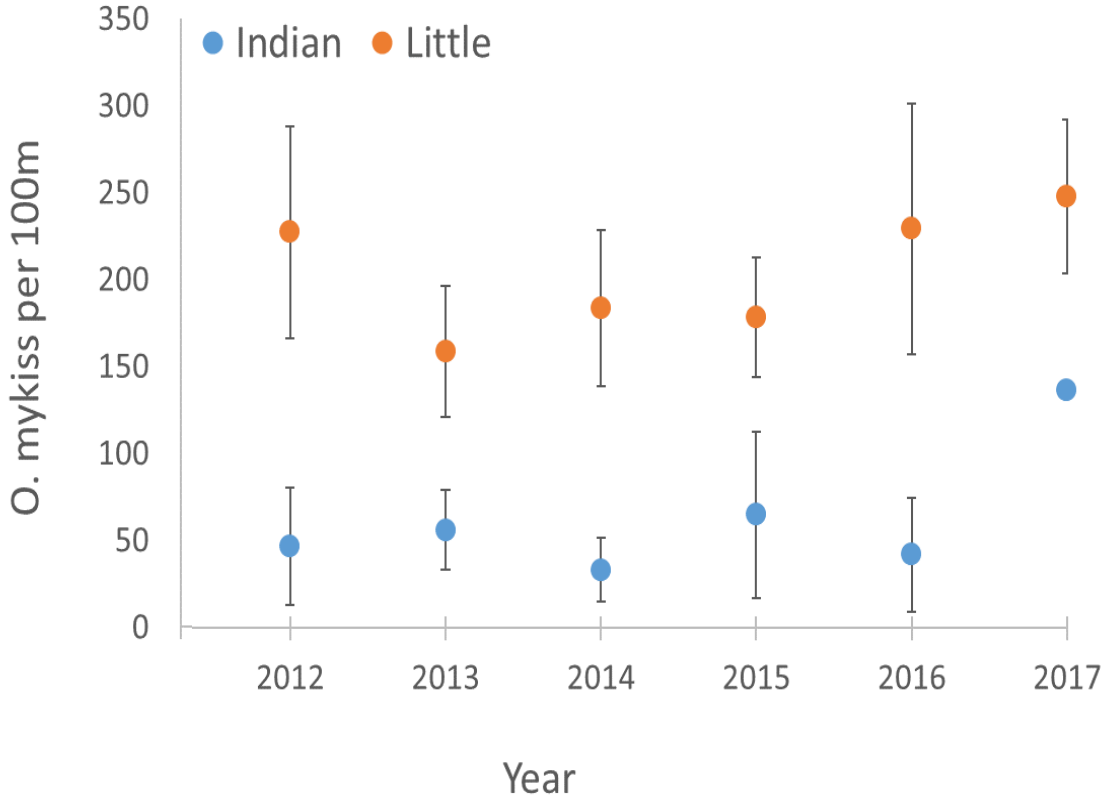


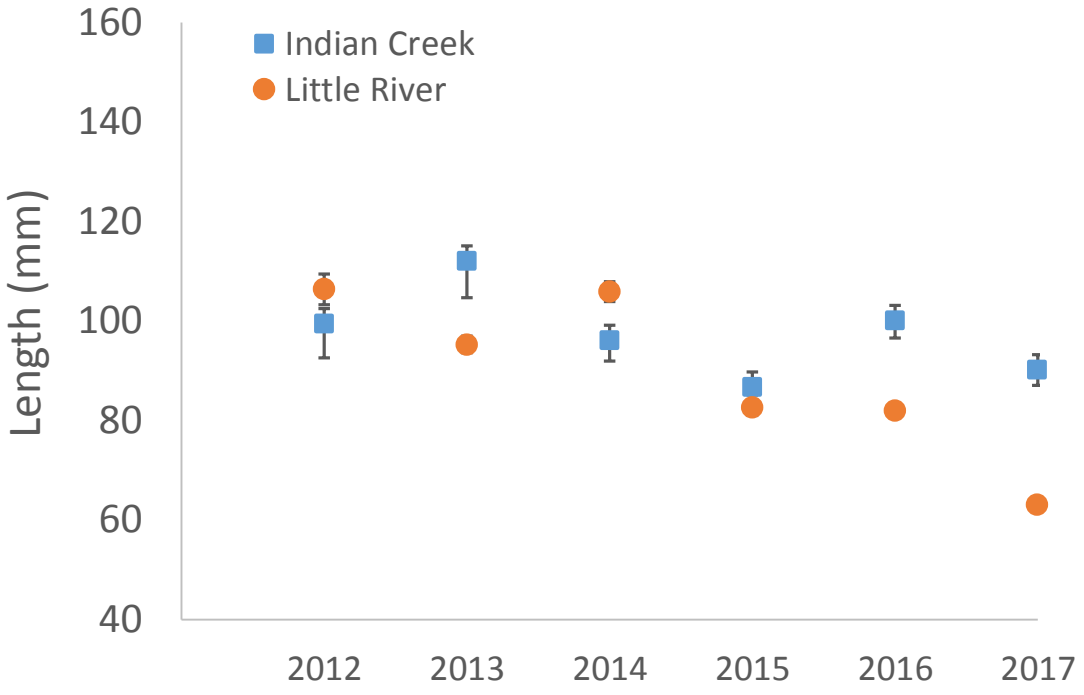
Are there differences in density?

- Little River
  - Density higher than Indian
    - More redds
  - Increasing trend since 2013
- Indian Creek
  - Relatively stable, but large increase last summer

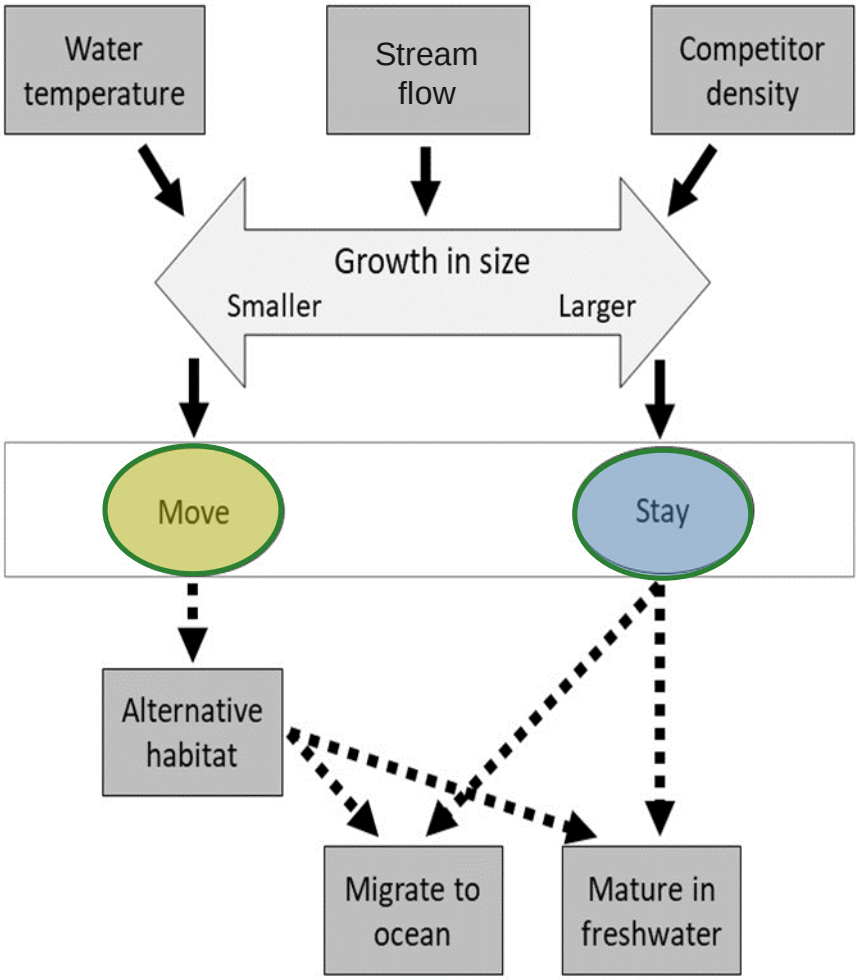


Are there differences in length of age-1+ *Mykiss*?

- Little River
  - Decreasing mean length over time
  - Significantly shorter in four of six years
- Indian Creek
  - Similar mean lengths among years



More movers in Little River than Indian Creek?



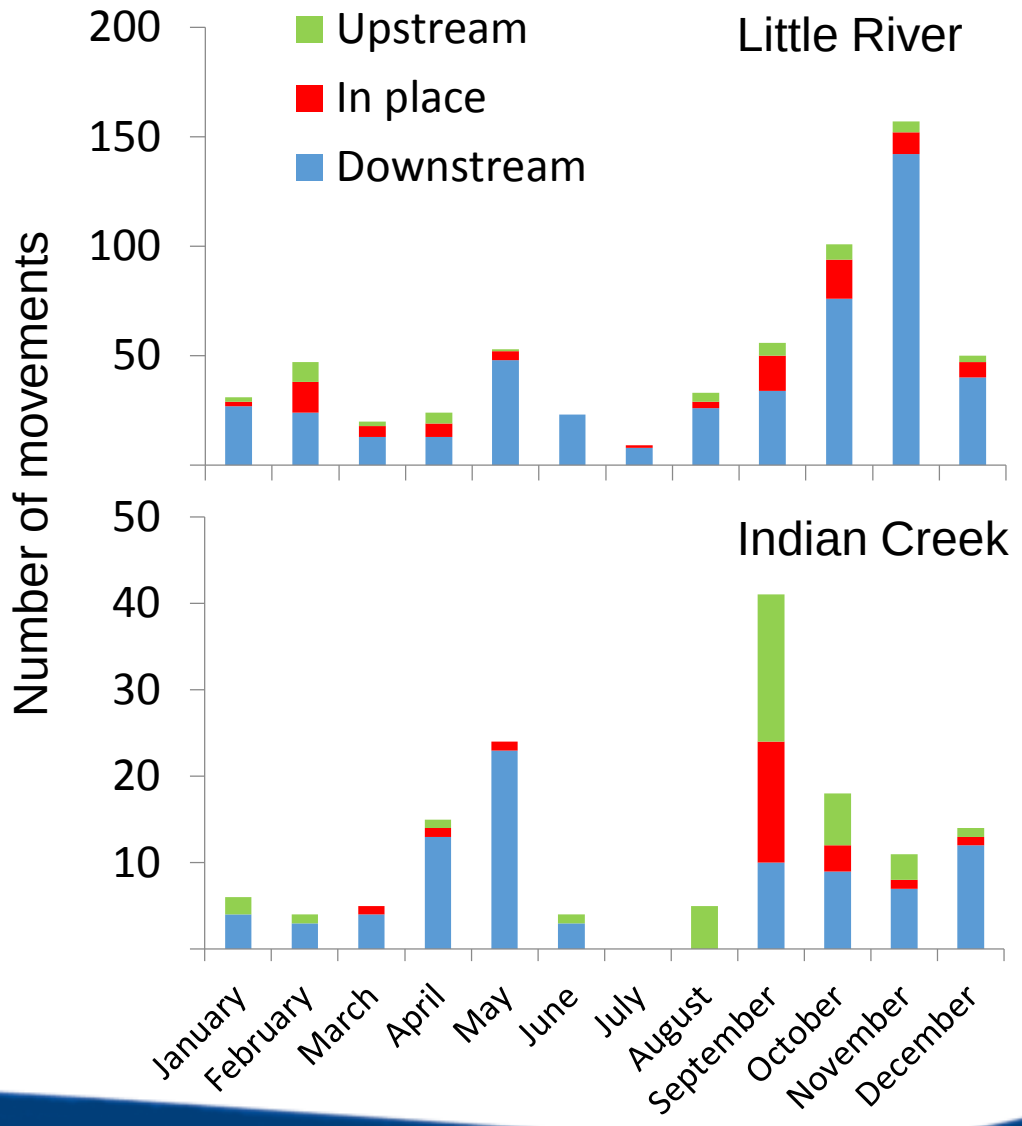
Did proportion and type of movers differ among streams?

- Little River
  - 1,427 fish tagged
    - 37% moved
  - High proportion of DS movers
- Indian Creek
  - 579 tagged
    - 20% moved
  - DS also most common, but more US movers than Little

Movement type	Little	Indian
Upstream	7.3%	24.8%
In Place	14.2%	14.8%
Downstream	78.1%	59.1%
Total	**606**	**149**

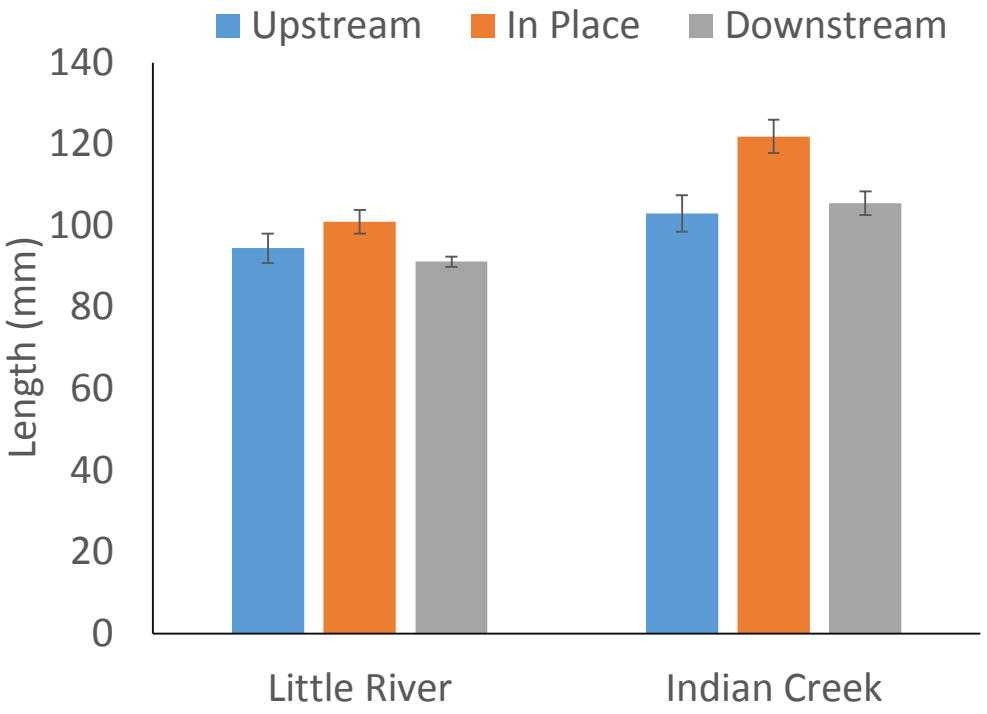
Are there differences in timing of movements?

- Little
  - Some DS movement every month
  - DS movers big peak in fall
- Indian
  - No DS in summer
  - DS peaks in spring
    - Smolts
  - Most US in Sept



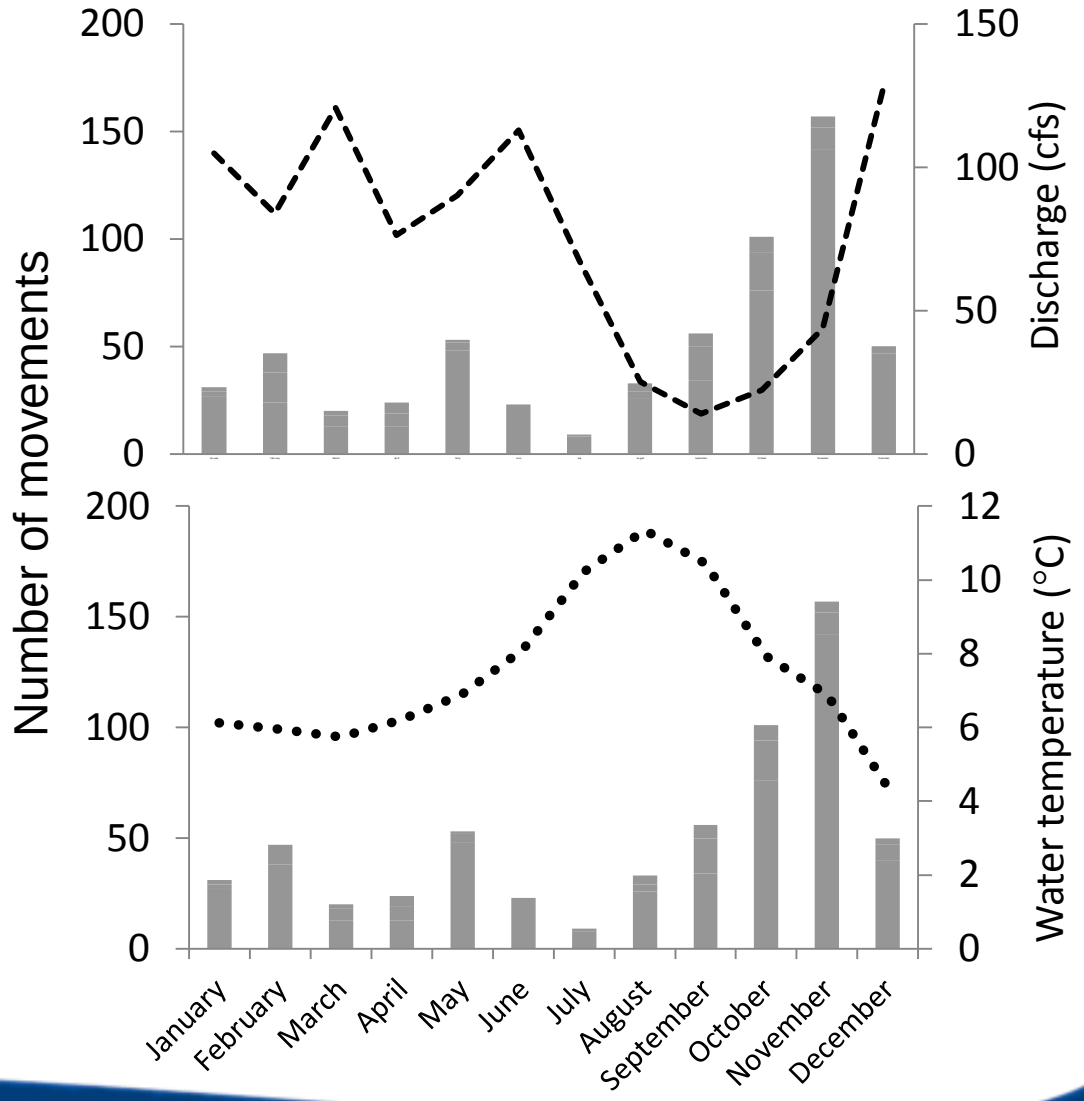
Are there differences in length among movers?

- Little
  - DS are smallest
  - In place are largest
- Indian
  - US movers are smallest
  - In place are largest



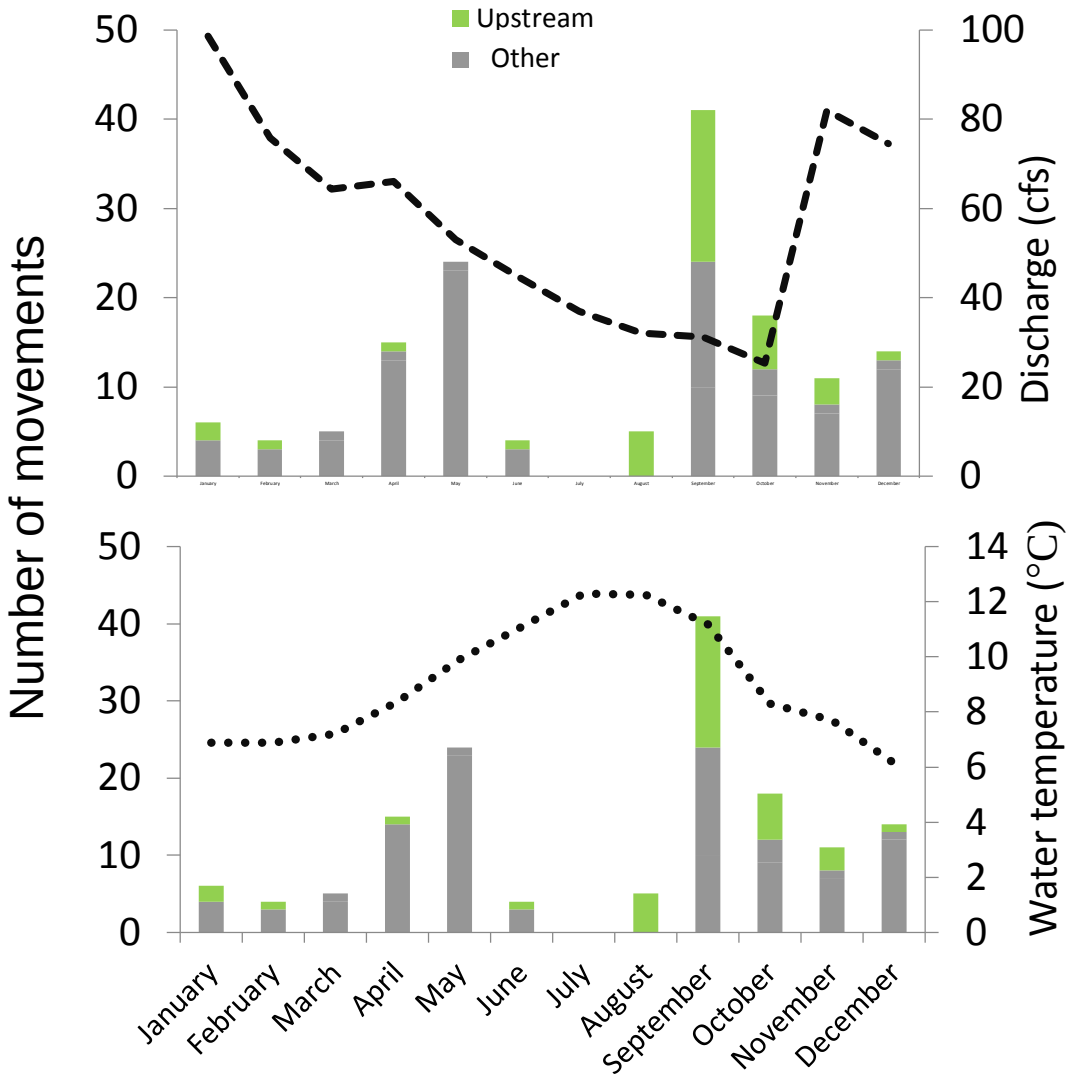
Little River – stream flow and water temp effects?

- Fall movement
  - Builds from Aug – Nov
  - Occurs prior to big flow increase
  - Coincides with declining temps
- Smaller peaks in Feb. and May
  - Movement occurs prior to flow change



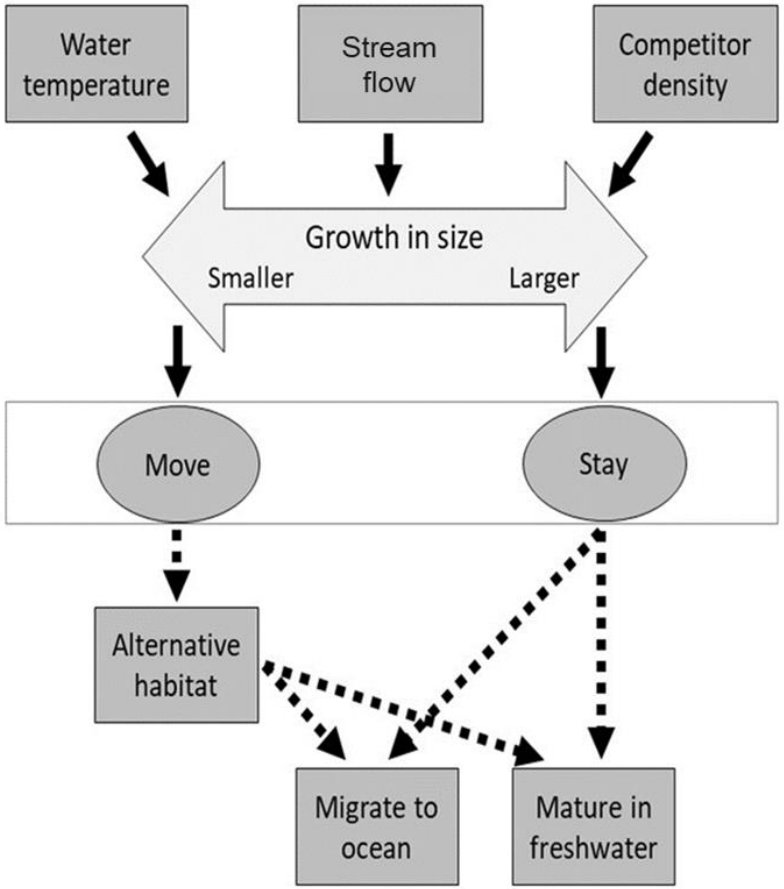
Indian Creek – stream flow and water temp effects?

- Fall movement
  - Almost half are US movers
    - Small decrease in flow and temp?
- DS movement March-May
  - Coincides with declining flow and increasing temp
  - Smolts



Preliminary results

- Differences in proportion of movers?
  - Little River more movers
    - Colder temp, higher density
  - Indian, more upstream movers



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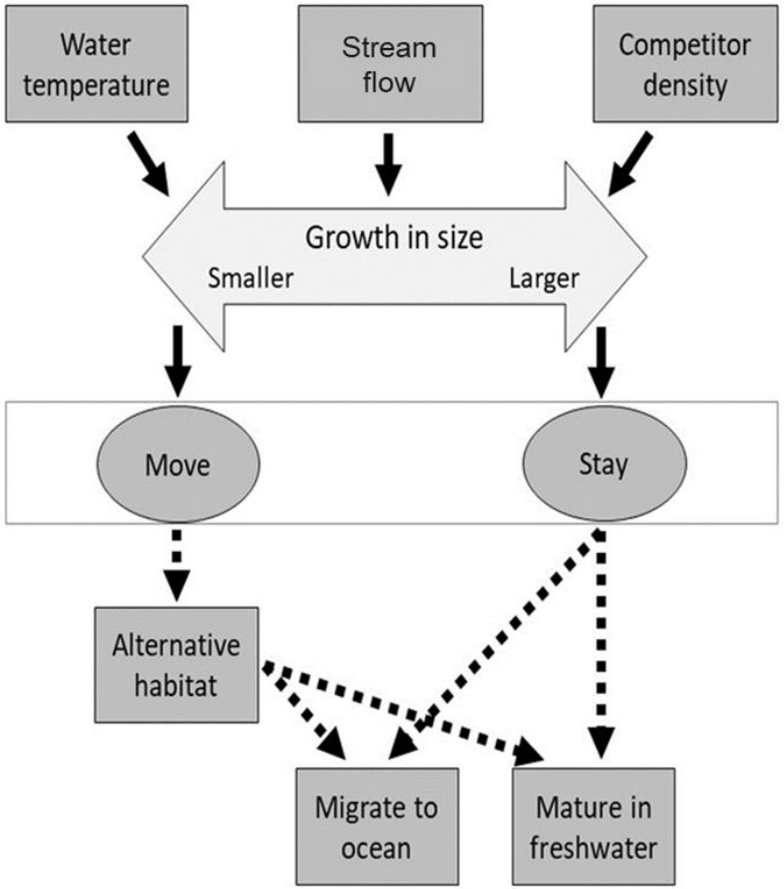
- Movers smaller in both streams
  - In place fish larger



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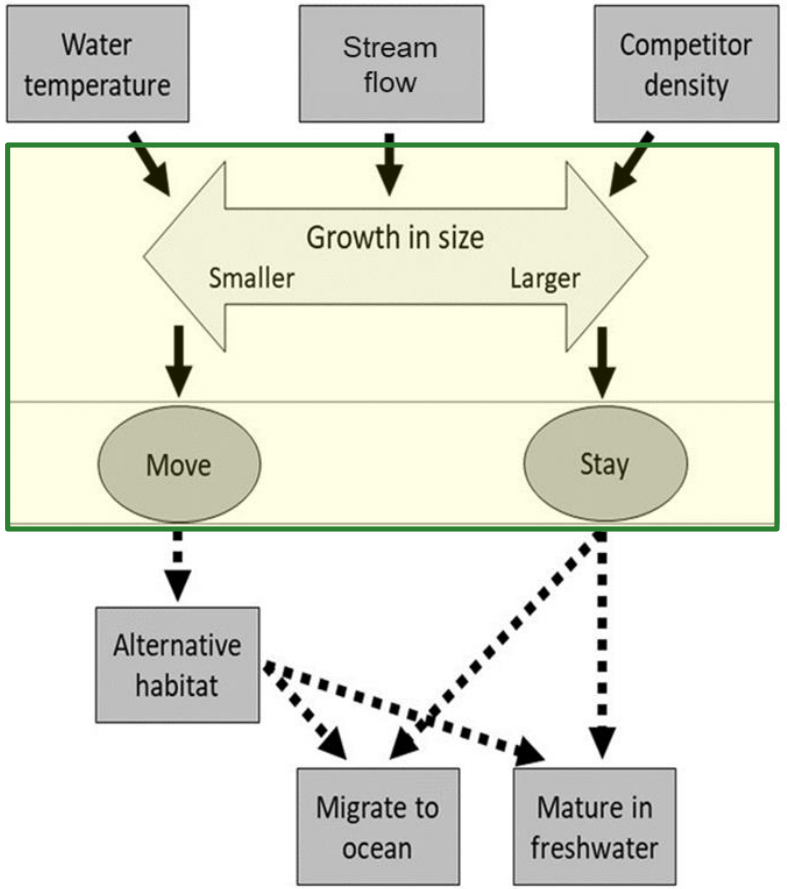

When, where, and why are they moving?

- Little River
  - Moving DS every month
    - Colder temps, higher densities = reduced opportunity for growth?
  - DS movement peaks in fall
    - Increasing flow, declining water temperatures

- Indian Creek
  - Short peak of movement in September
    - But nearly as many go US as DS
  - Smolt emigration in spring
    - Coincides with declining flow, increasing temp

Thank you!