Northeast U.S. flood trends and implications for river herring passage and habitat

Gloucester, MA

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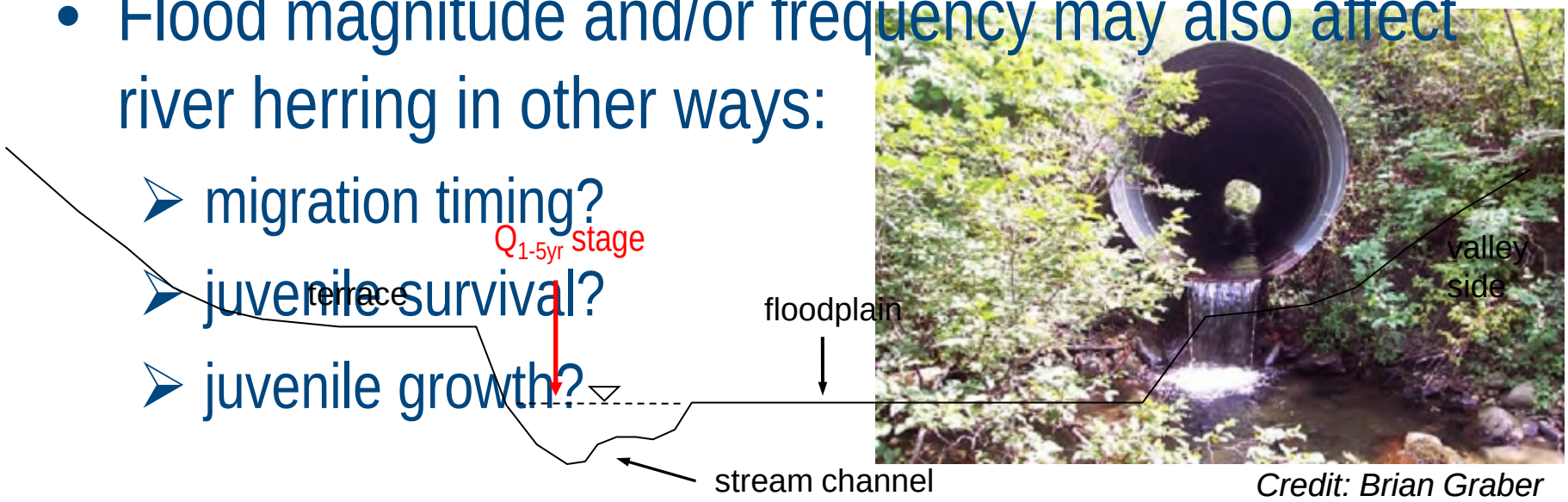
December 15, 2014

River herring and floods?

- Floods affect in-stream infrastructure, in turn affecting passage and habitat
- Floods directly affect stream habitat via influence on sediment transport and alluvial channel size
- Flood magnitude and/or frequency may also affect river herring in other ways:
  - migration timing?
  - juvenile survival?
  - juvenile growth?



Credit: Brian Graber

Historical trends: Northeast precipitation

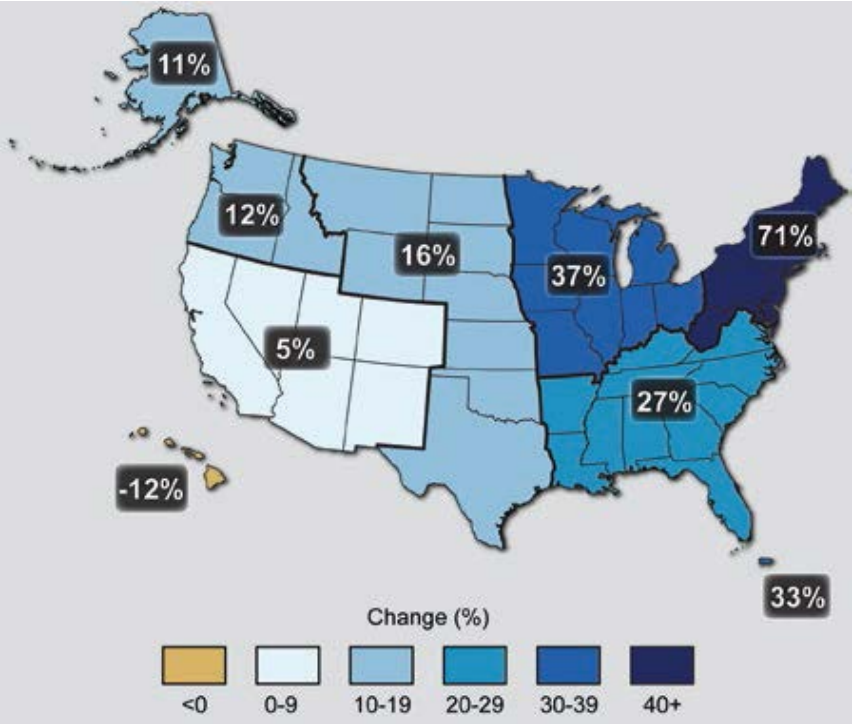
- Increased annual precipitation (as much as 20%) over last century (Peterson et al., 2013)
- Pronounced increase in frequency and intensity of very heavy precipitation

  (Karl et al., 2009;

  Spierre and Wake, 2010;

  Douglas and Fairbank, 2011;

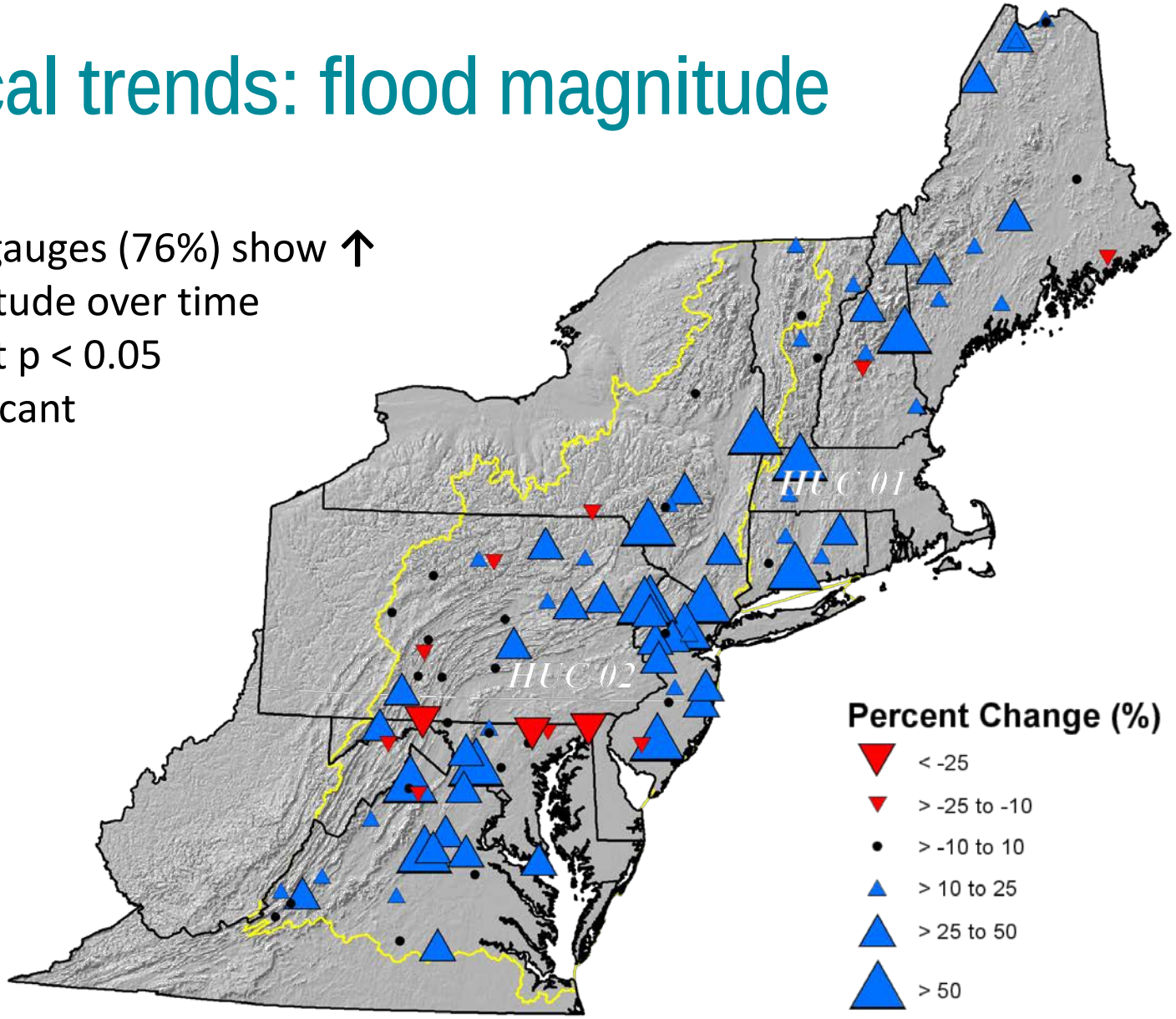
  Kunkel et al., 2013)



Melillo et al. (2014) after Karl et al. (2009)

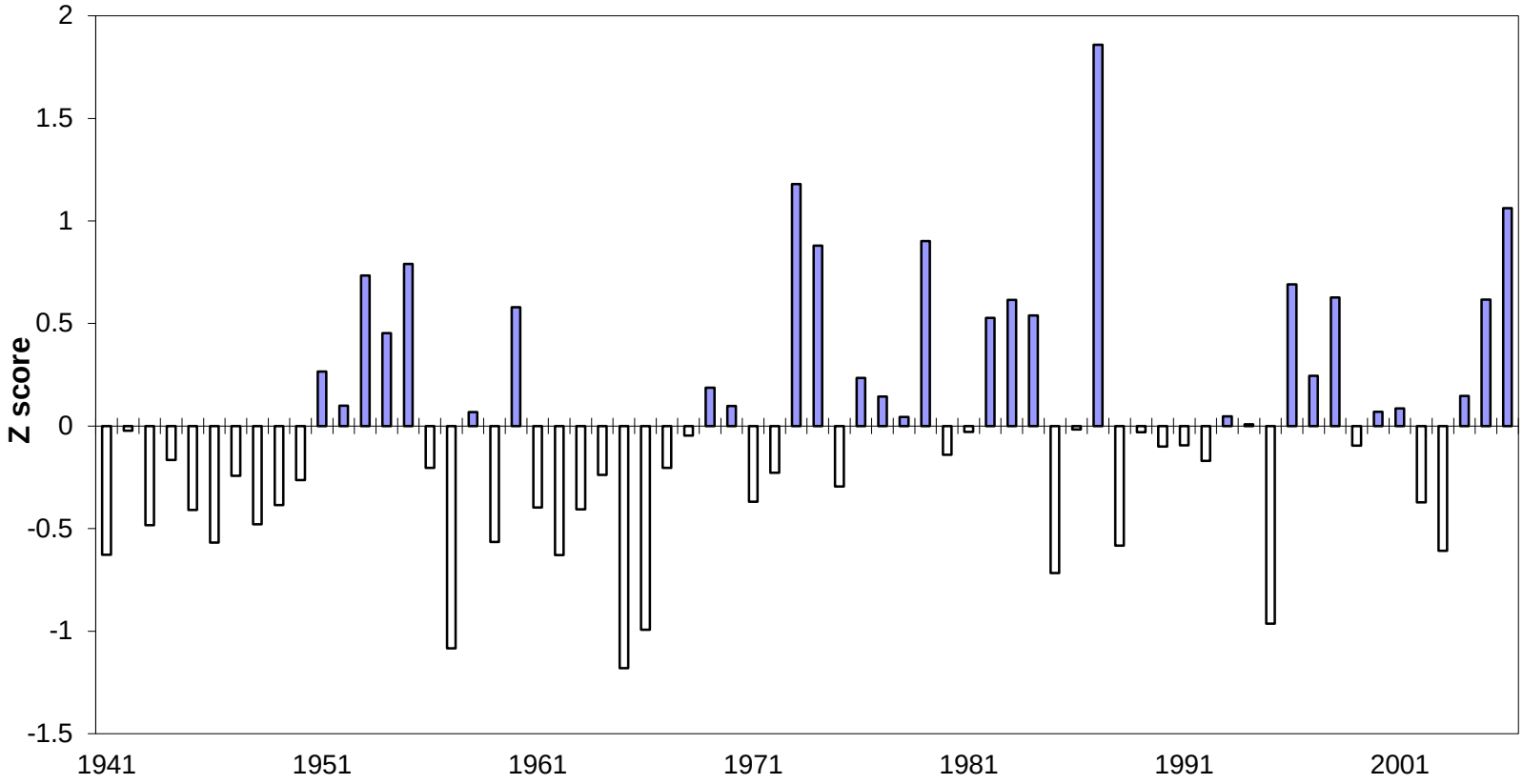
Historical trends: flood magnitude

- 78 of 103 gauges (76%) show ↑ flood magnitude over time
- 18 (17%) at $p < 0.05$
- field significant



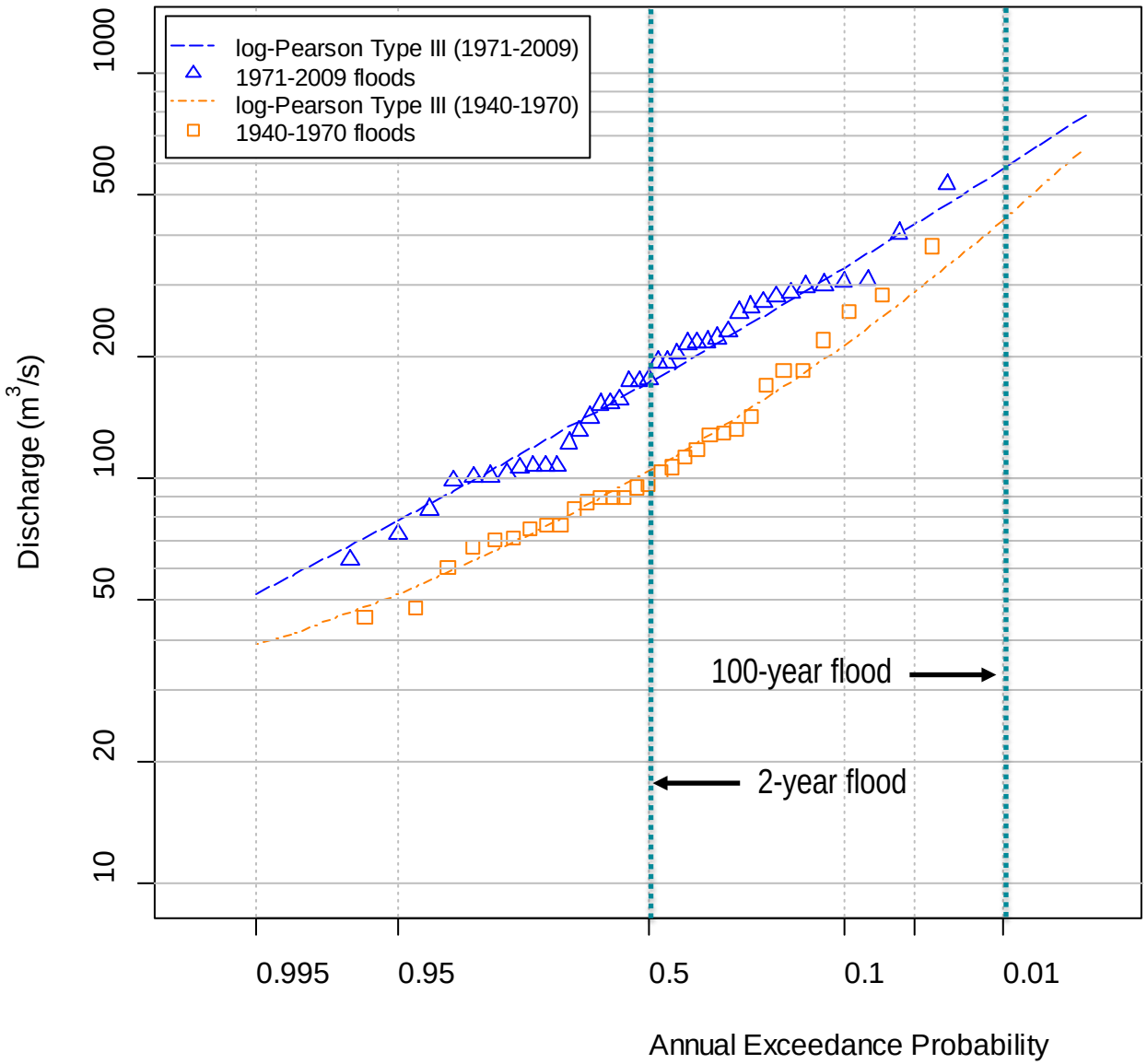
after Collins (2009) and Armstrong et al. (2014)

Average Standardized Departures for 23 New England Flood Series



after Collins (2009)

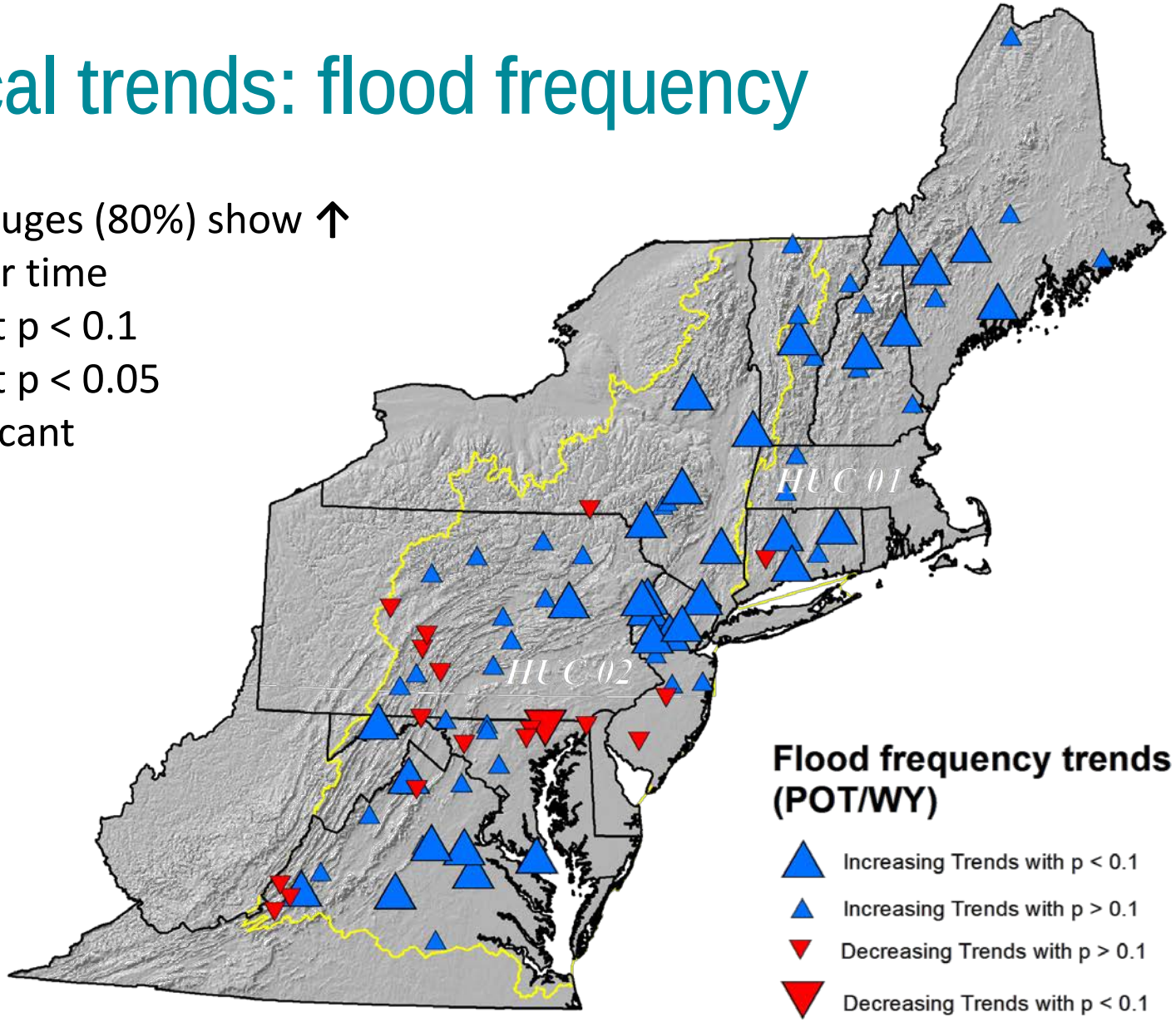
North River at Shattuckville, MA
USGS Gauge No. 01169000



after Collins (2009)

Historical trends: flood frequency

- 72 of 90 gauges (80%) show ↑ POT/WY over time
- 32 (36%) at $p < 0.1$
- 22 (24%) at $p < 0.05$
- field significant

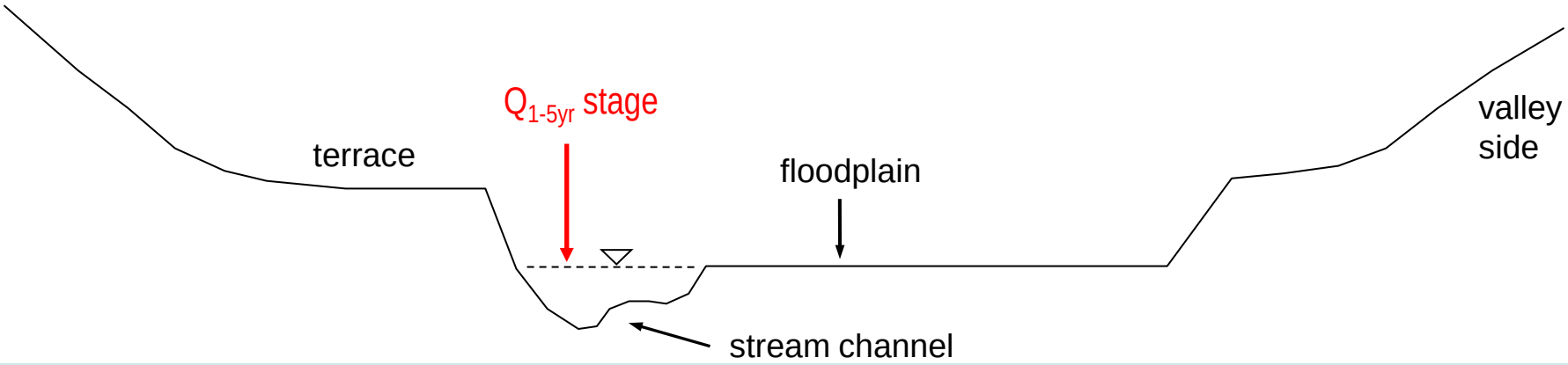


NOAA FISHERIES

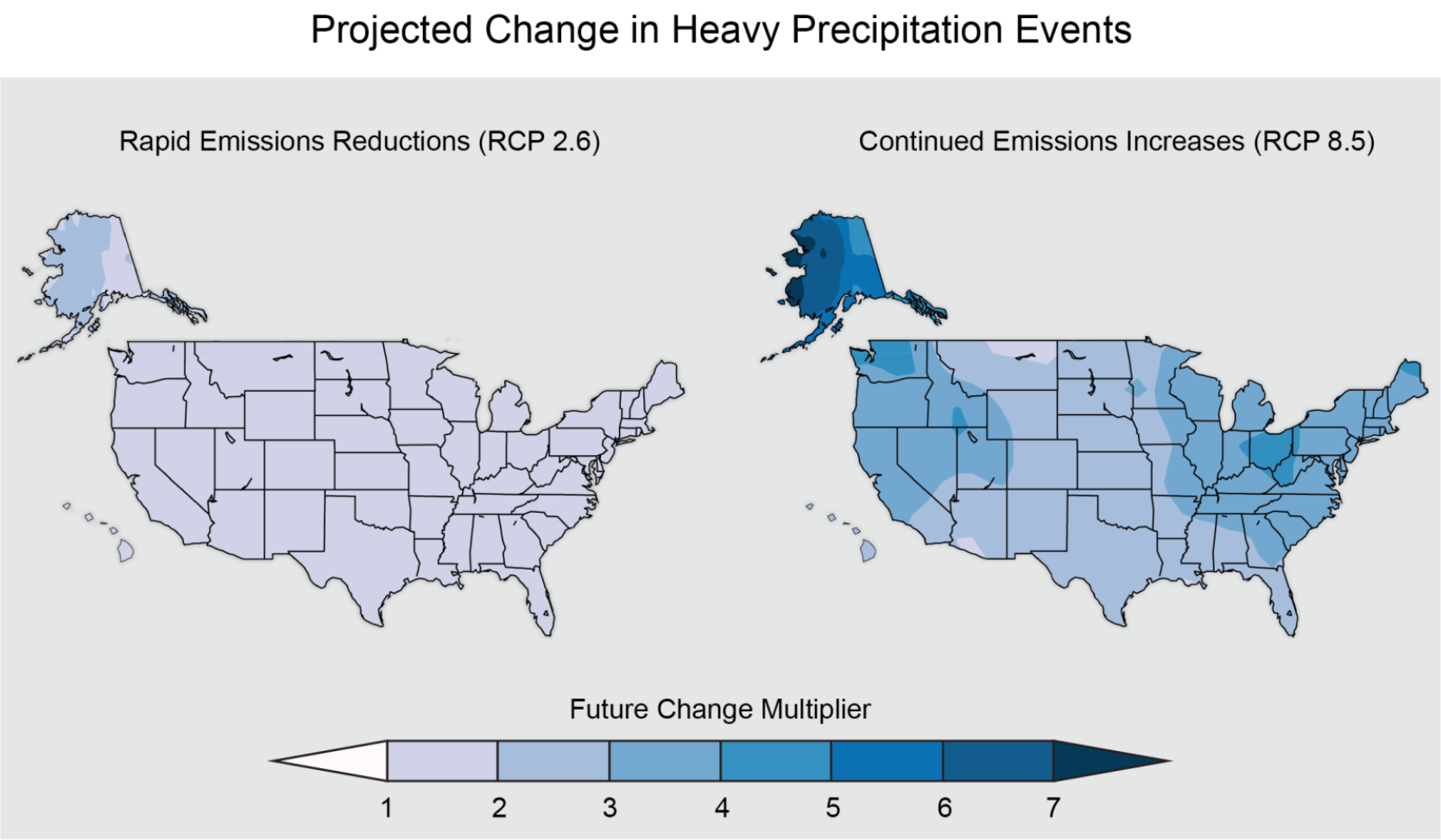
after Collins (2009) and Armstrong et al. (2014)

Flood frequency and stream habitat

- Alluvial channel size is determined by small, frequent floods—1 to 5 year recurrence intervals (Wolman and Miller, 1960)
- Our data show small floods increasing in magnitude AND frequency, suggesting NE alluvial channels should be enlarging



Northeast hydroclimate projections



Melillo et al. (2014)

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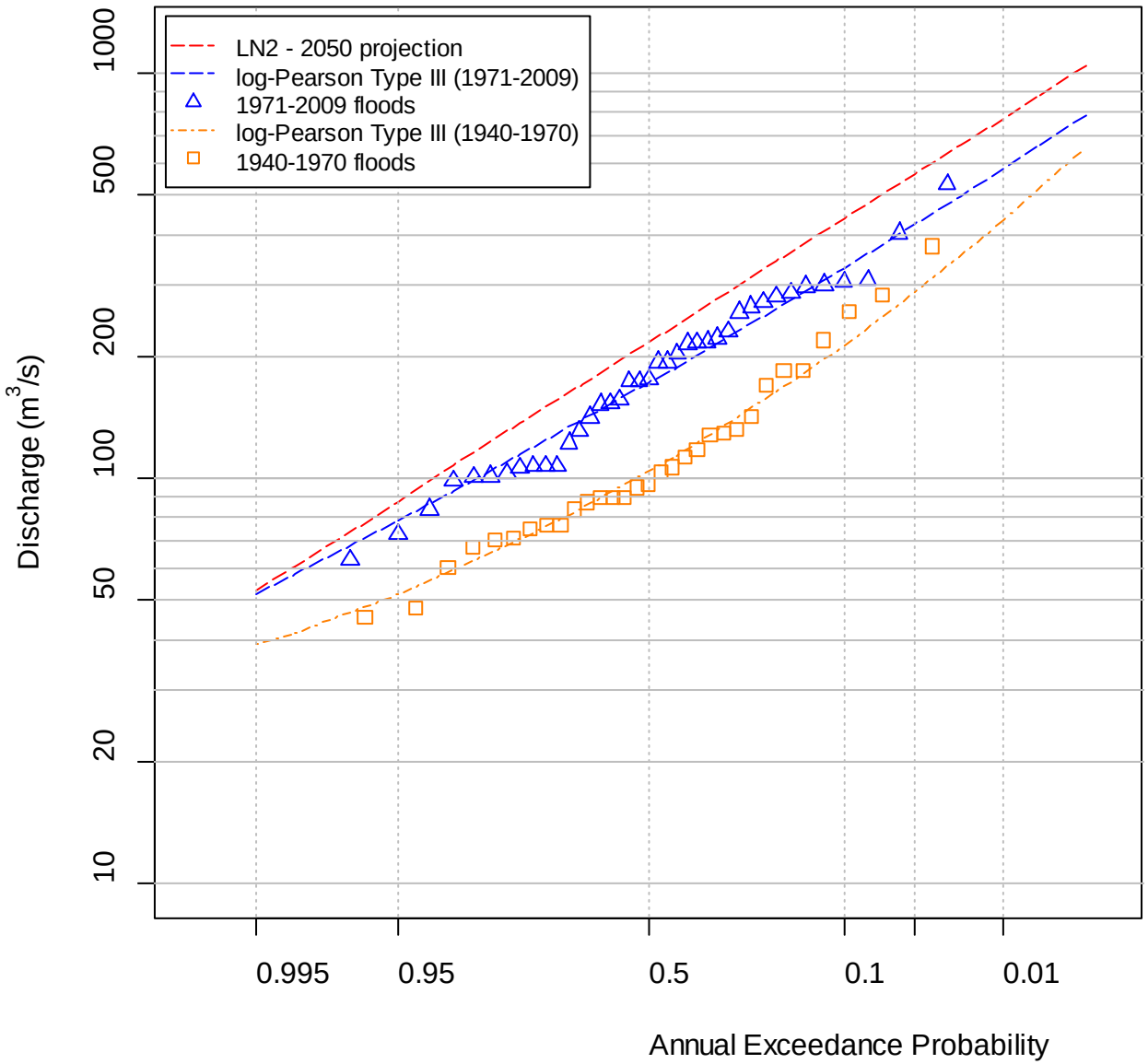

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after Collins (2009) and Vogel et al., (2011)

Summary

- Historical trends in flood magnitude and frequency have direct and indirect affects on river herring passage and habitat
- Projected increases in heavy precipitation suggest further increases in floods and associated impacts
- We know little about how changes in floods affect migration timing, juvenile survival, or juvenile growth
- We know little about historical changes, or future projections, in flood timing for the Northeast

Questions?