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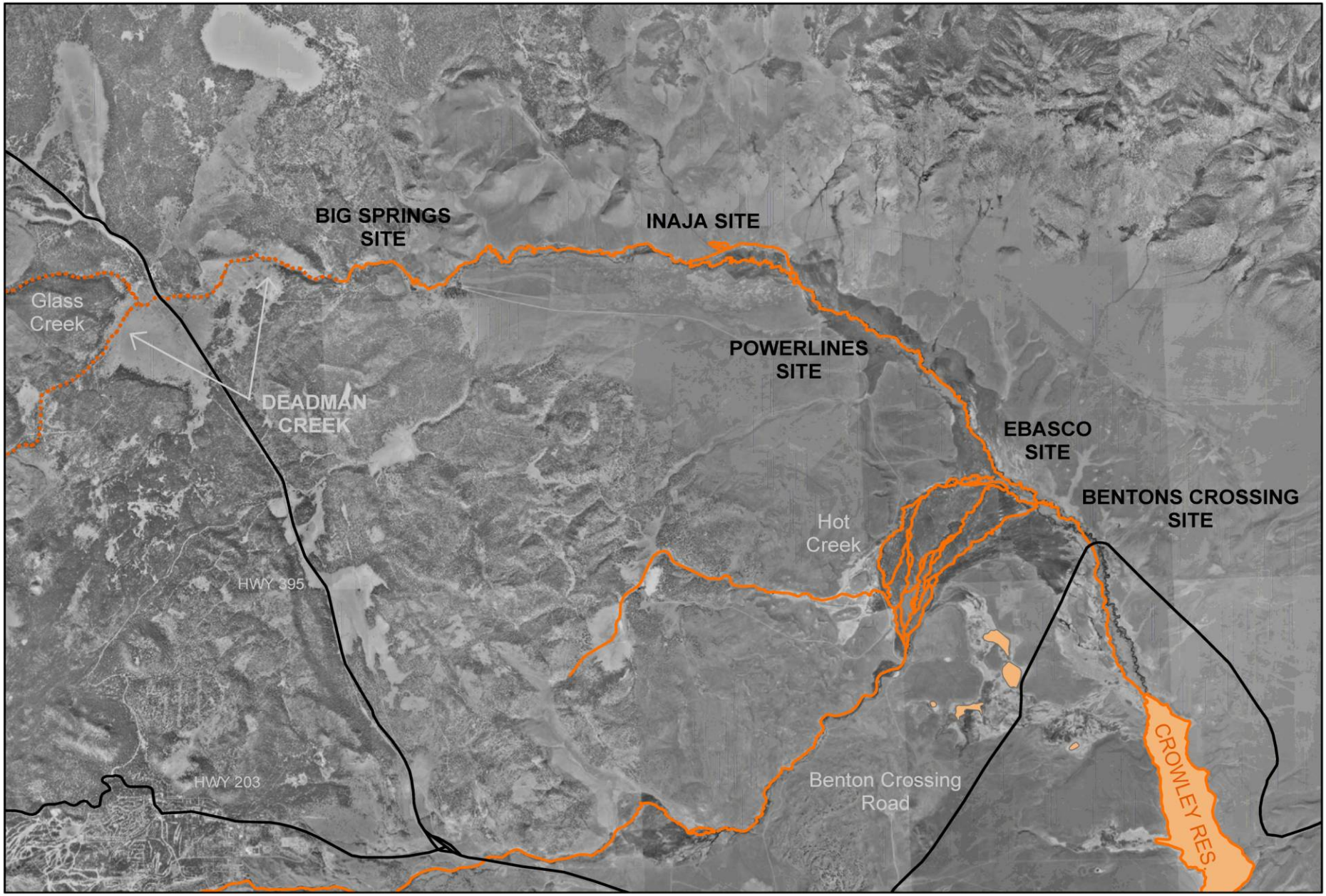
Gradients in Channel Geomorphology Along the Upper Owens River in Relation to the NZMS and the Native Benthic Community

David Herbst and Robert Lusardi



UPPER OWENS RIVER WATERSHED

Legend

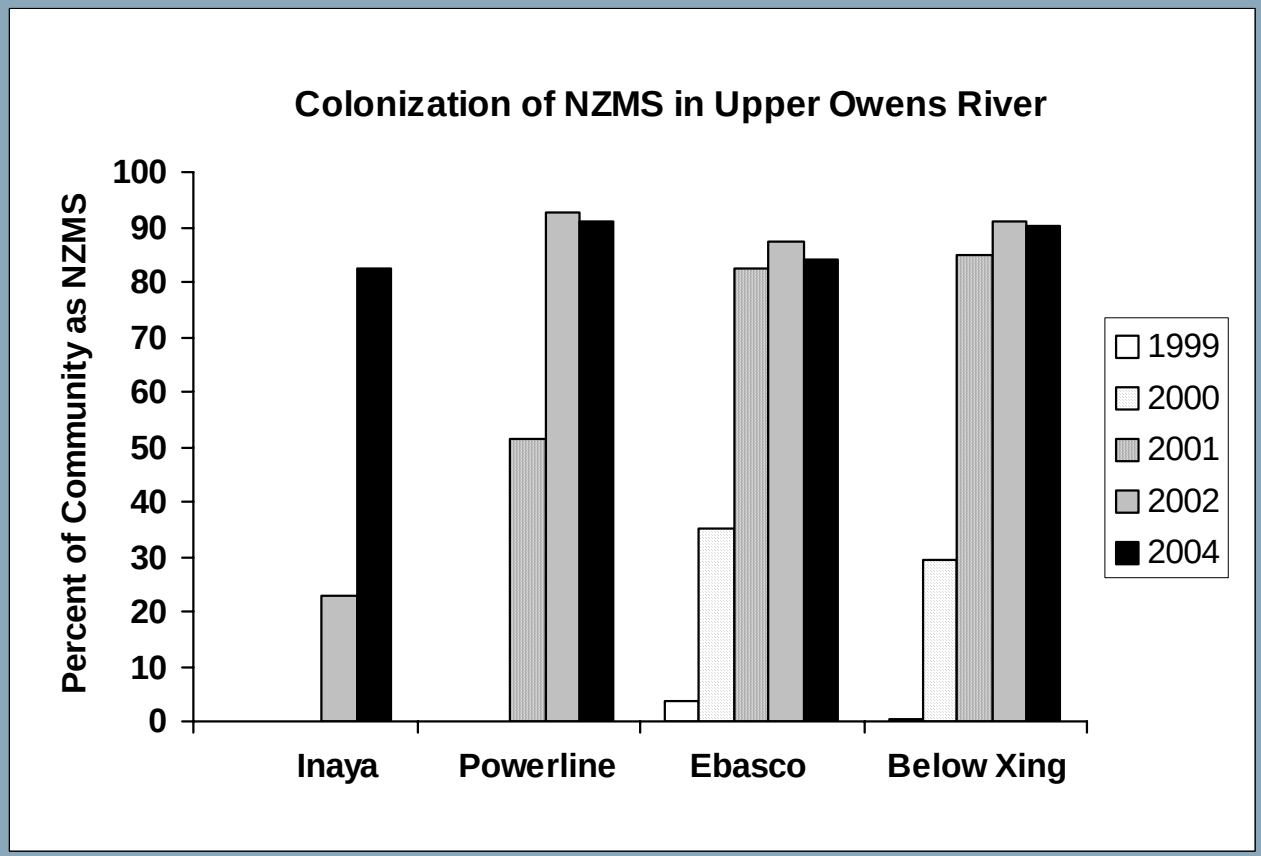
N

Rivers

Roads

Reservoirs and Lakes

History of NZMS colonization of the Upper Owens River



- Within 2-3 years of initial colonization at any given site, NZMS accounts for >80-90% of the total community
- EXCEPT at Big Springs: Minimal NZMS colonization (above disturbances)

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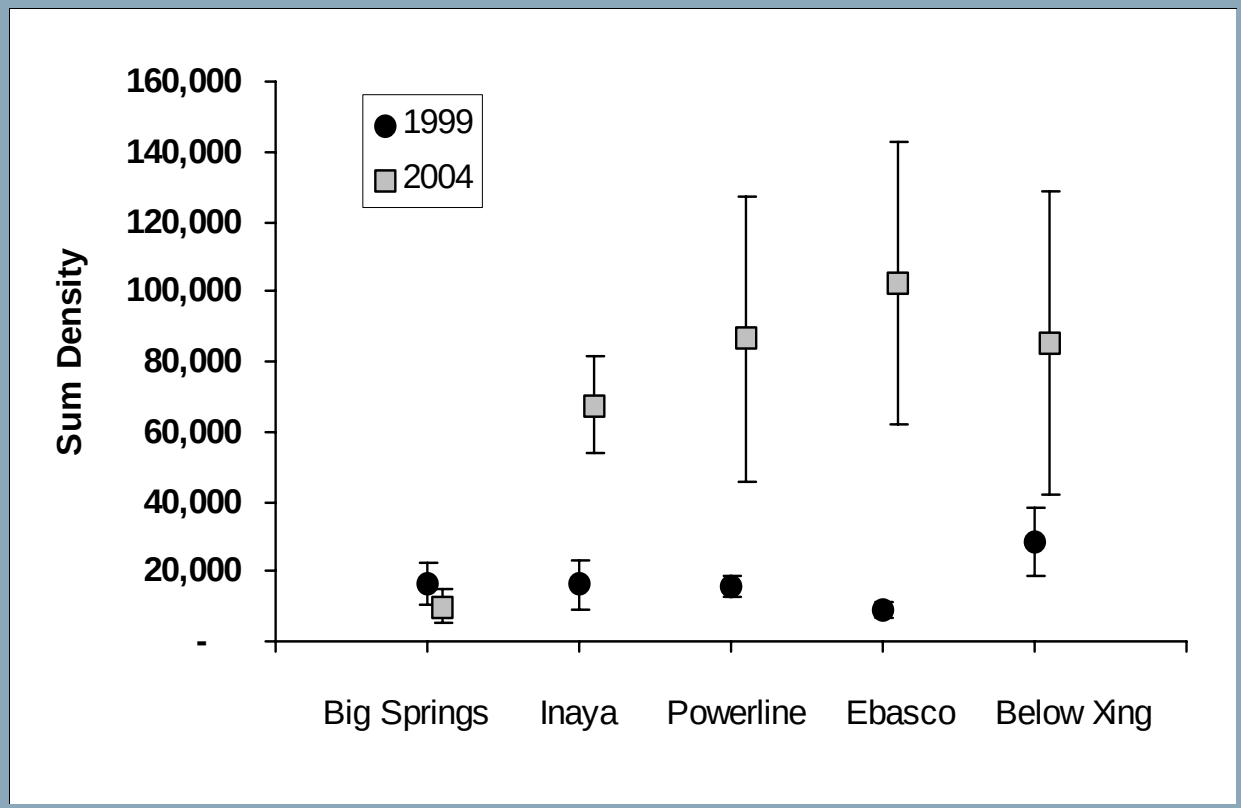
Invasion of the Upper Owens River by the NZMS (1999 vs. 2004)



- EBASCO Site, initial NZMS < 3% of community
- By 2004, population densities between 50-100,000 m^{-2}
- Big Springs remains stable in total density

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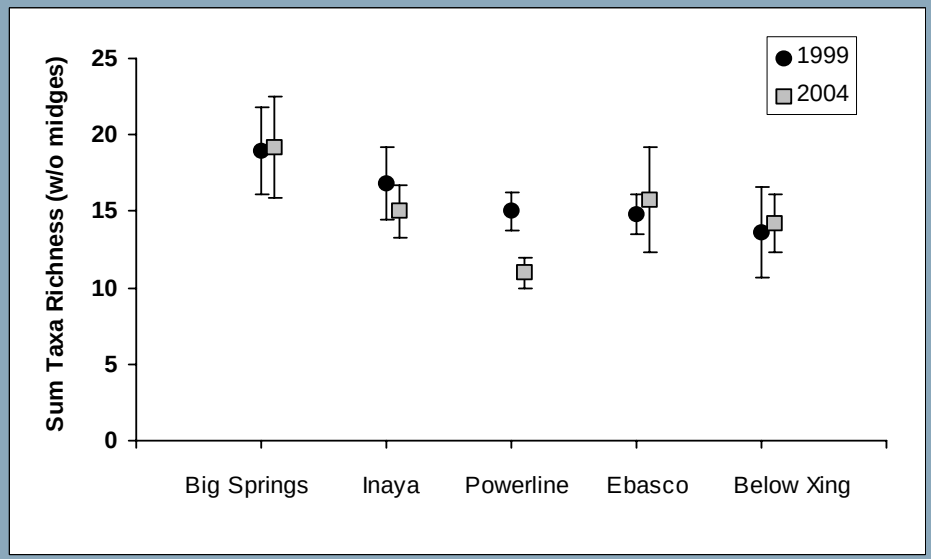
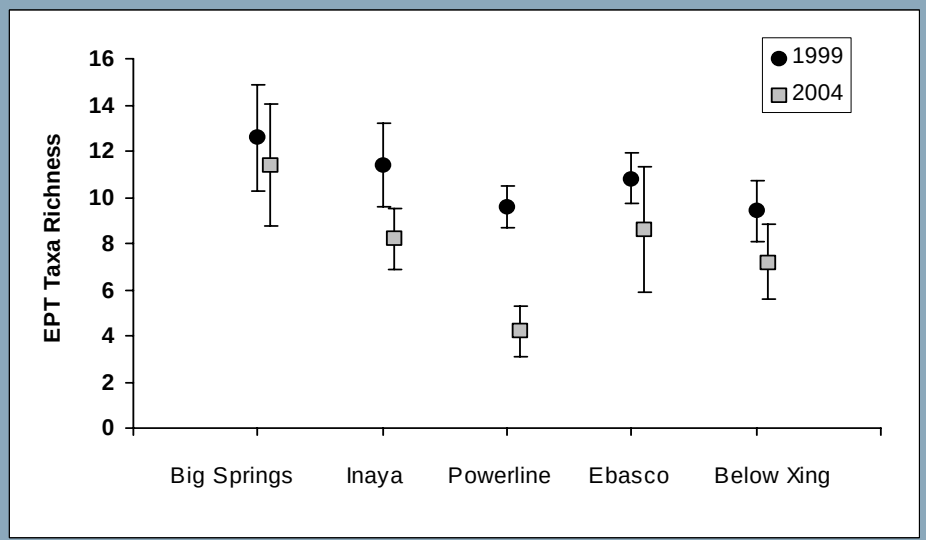


- Total Richness metric remains relatively unchanged between 1999 and 2004



- EPT Richness metric decreased at all sites between 1999 and 2004 except Big Springs which remained stable (NZMS at Big Springs account for less than 5% of total community)

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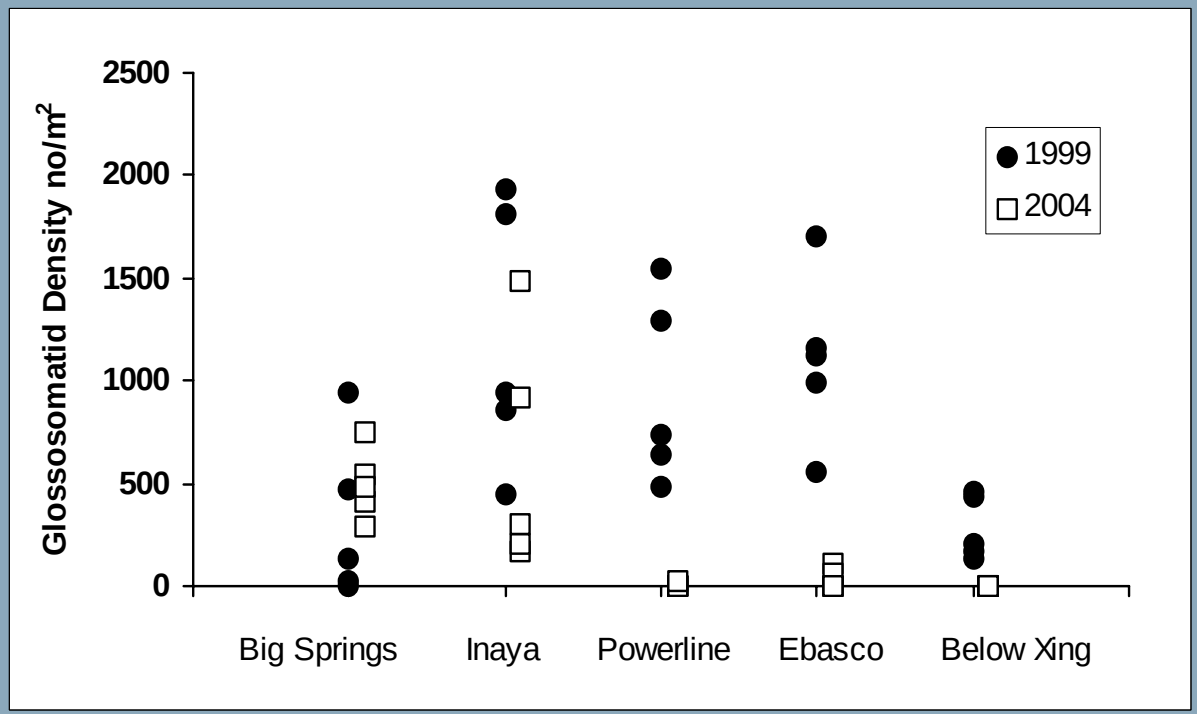

- Glossosomatid caddis densities displaced at sites exposed longest to high NZMS densities (1999 vs. 2004)
- Increase in Hydroptilid caddis suggests that filamentous algae becoming dominant as diatom periphyton are depleted by NZMS

The decline in EPT richness is exhibited as the elimination of *Paraleptophlebia* and *Rhithrogena*, along with large declines in *Brachycentrus*, *Hydropsyche*, *Serratella* and *Isoperla* from downstream sites while Big Springs remained mostly unchanged

Control of the NZMS: Habitat Quality?

- Disturbance along Upper Owens River Gradient between all sites, except Big Springs.
  - Downstream habitats altered by land use activity (grazing) and flow augmentation (Mono Basin tunnel) causing geomorphic disruptions
  - Big Springs remains relatively undisturbed and has not shown the same NZMS expansion compared with other sites

- NZMS as indicator for habitat disturbance with restorative design implications.
  - NZMS will dominate native invertebrate community (where water conductivity permits) where aquatic habitat is already compromised because of bank erosion, sedimentation, Ag return flows, high water temperatures, and specifically, where native community may already be stressed.

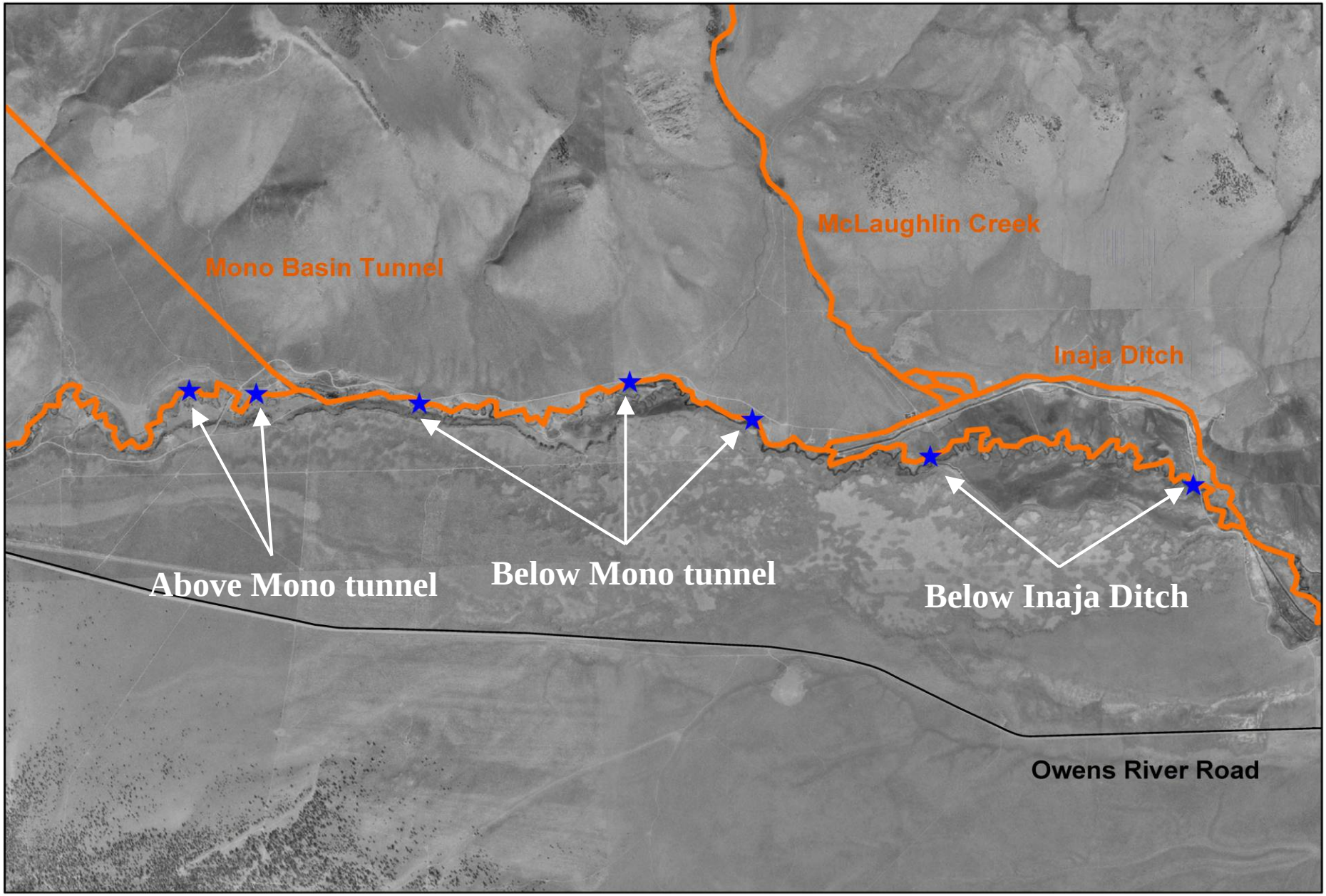

Figure 1:
Upper Owens River
Transect Study Sites

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Geomorphic Changes in the Upper Owens River

- Currently examining the potential connection between geomorphic disturbance and NZMS population densities. Can the NZMS be used as an indicator for degraded aquatic habitat?

- Co-located sample sites investigating changes in channel morphology due to Mono Basin Export Tunnel (flow augmentation) and changes in macroinvetebrate community.

- Will NZMS populations above the Mono Basin Tunnel be less prolific than directly below the tunnel?

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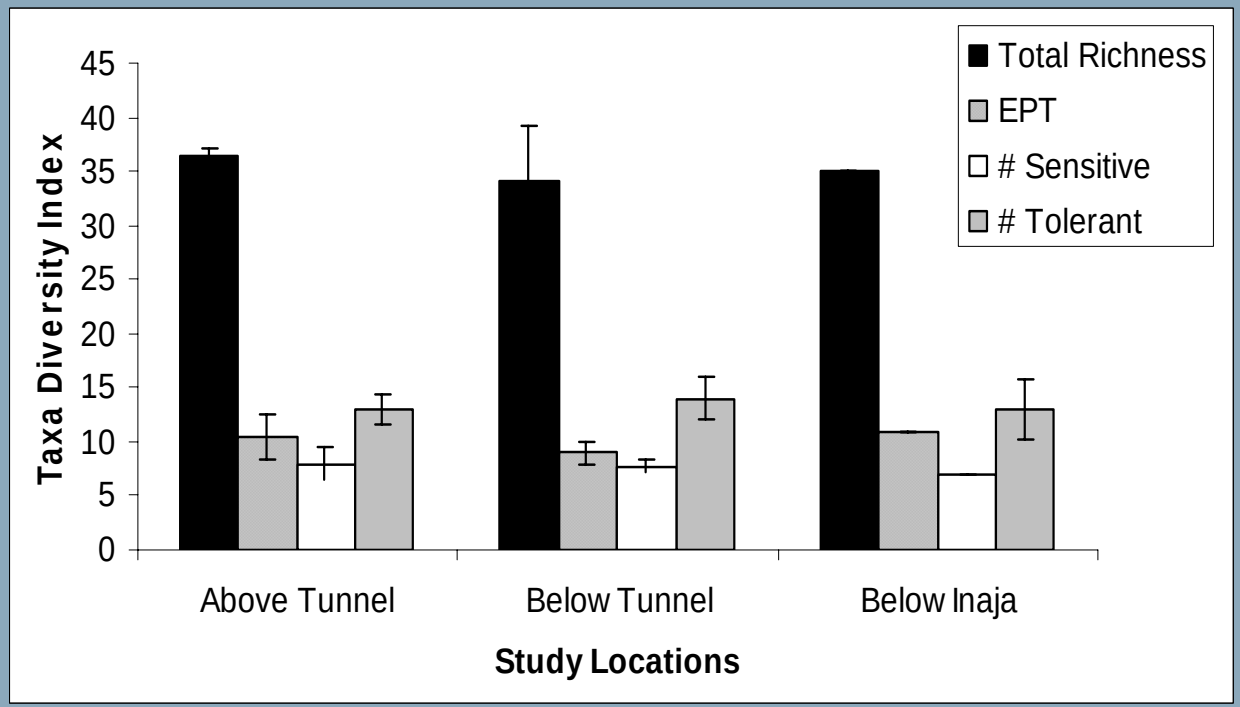

- Preliminary data suggests little difference between reaches.
- Other disturbance variables (grazing vs. export tunnel)
- NZMS continue to colonize upstream. Is population stable at site locations?
- Further data collection should provide answers as to ‘will colonization slow above the tunnel vs. below the tunnel?’

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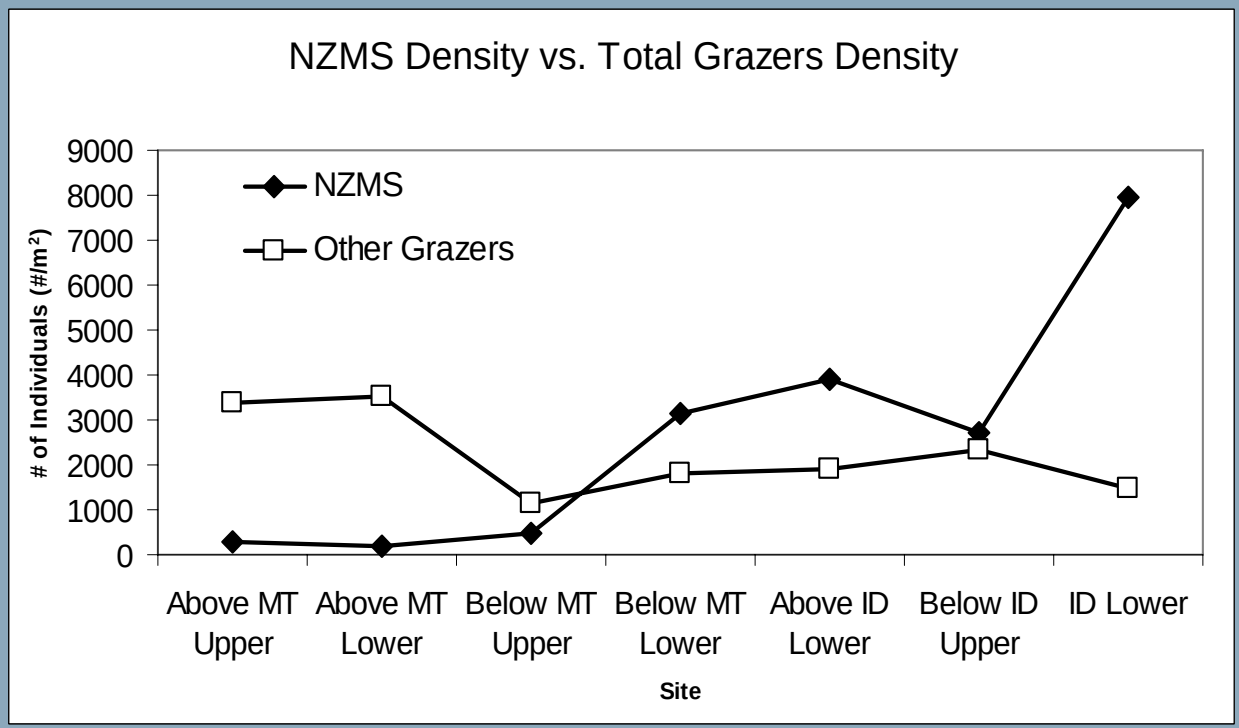

- Data continues to suggest that non-native NZMS displace other native grazing invertebrates along the Upper Owens River.

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Conclusions:

- NZMS displaces many native invertebrates along the Upper Owens
- While conductivity is permissive at Big Springs, land use/flow disturbance is absent and the NZMS has not expanded. Does habitat quality control NZMS impact?
- Preliminary invertebrate data from test sites shows little difference between reaches (above tunnel, below tunnel, etc) most likely because grazing overshadows flow augmentation, no change in channel morphology, or NZMS continuing to expand upstream
- Further data collection should provide answers to “can we use the NZMS as an indicator for degraded aquatic habitat?”