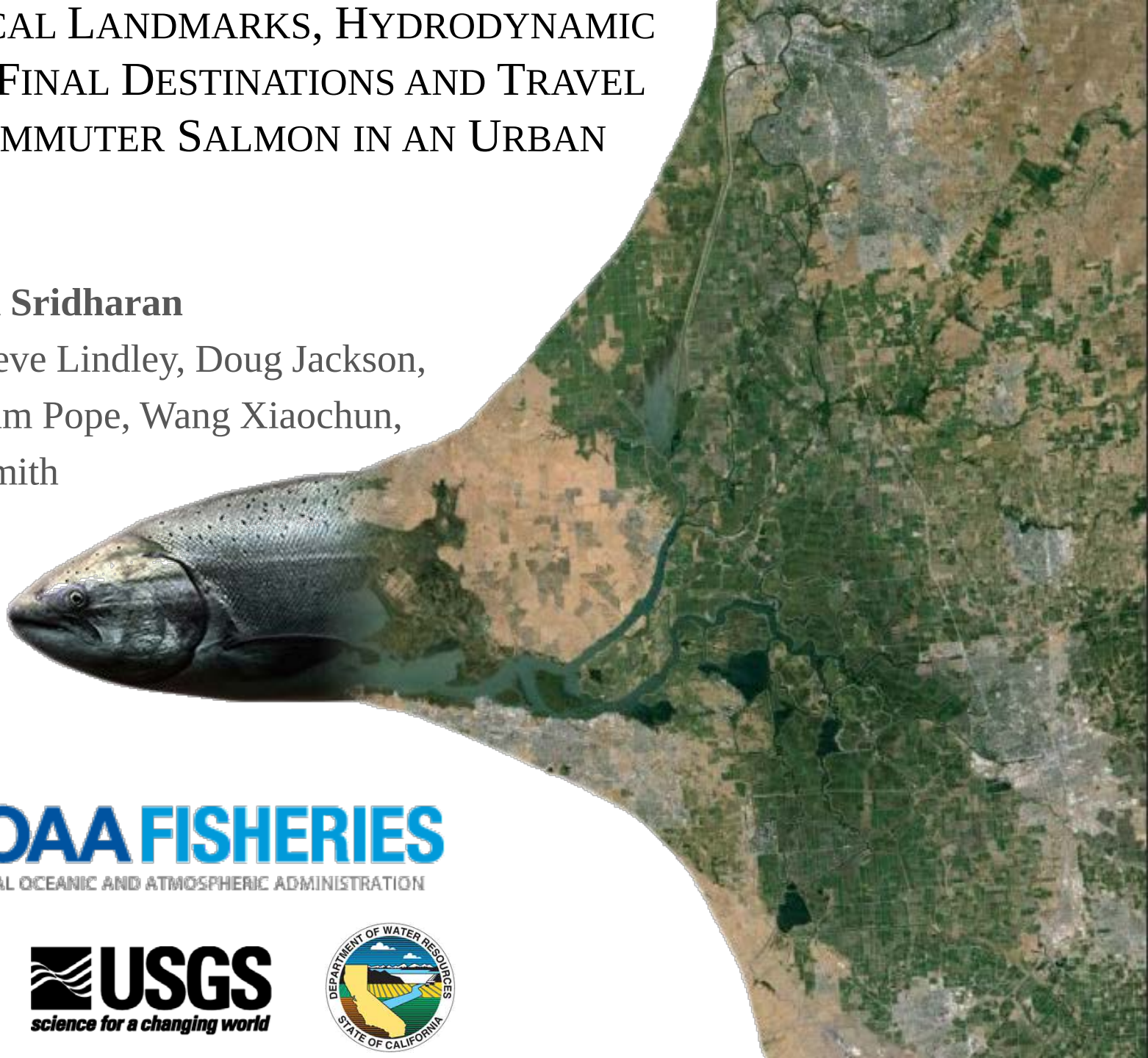
Hydrological Landmarks, Hydrodynamic Transport, Final Destinations and Travel Times of Commuter Salmon in an Urban Estuary

Vamsi Krishna Sridharan

Eric Danner, Steve Lindley, Doug Jackson, Russ Perry, Adam Pope, Wang Xiaochun, Stephen Monismith



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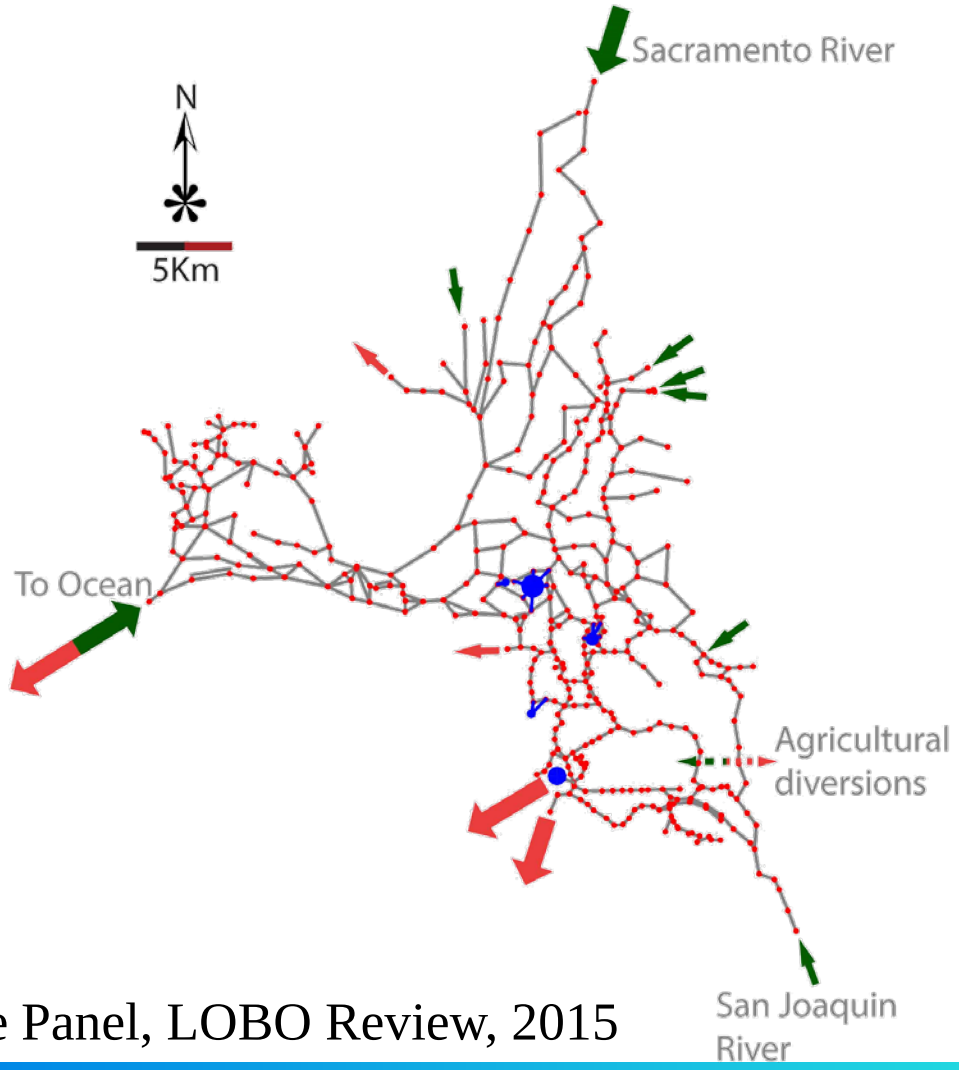
Organization

- Motivation
- Model description
- System hydrodynamics
- Salmon fate mechanics
- Conclusions

MODEL DESCRIPTION

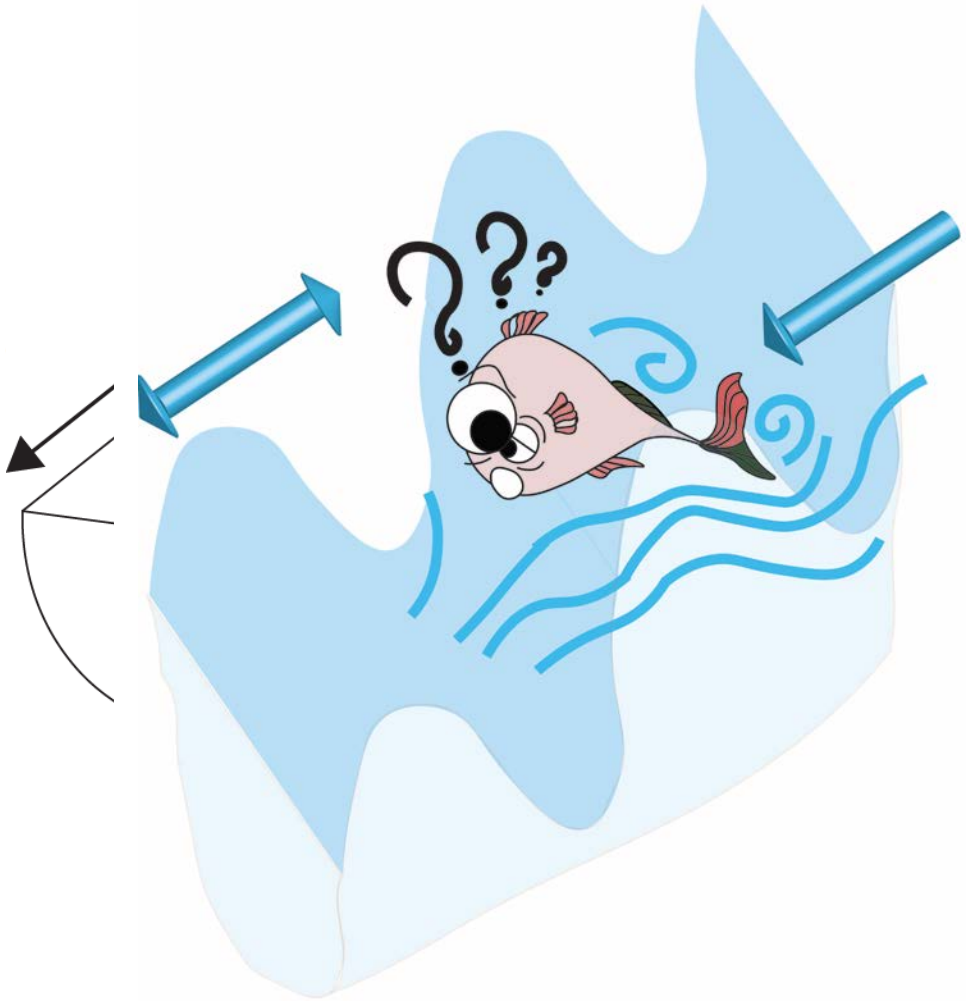
Enhanced Particle Tracking Model (ePTM)



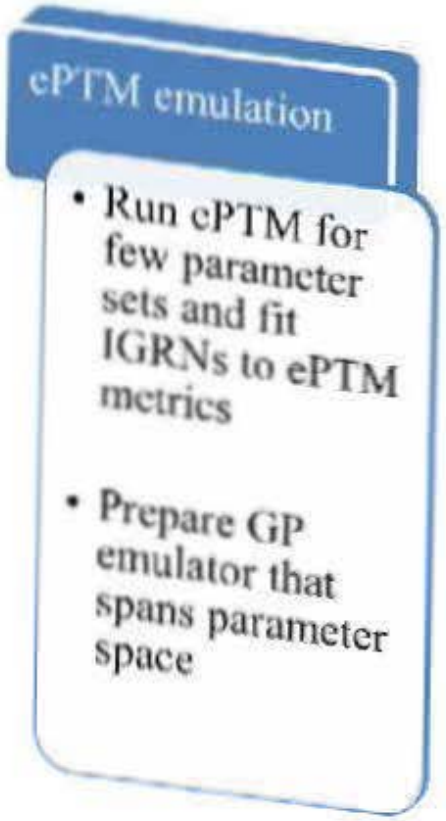
Source: Delta Science Panel, LOBO Review, 2015

Enhanced Particle Tracking Model (ePTM)

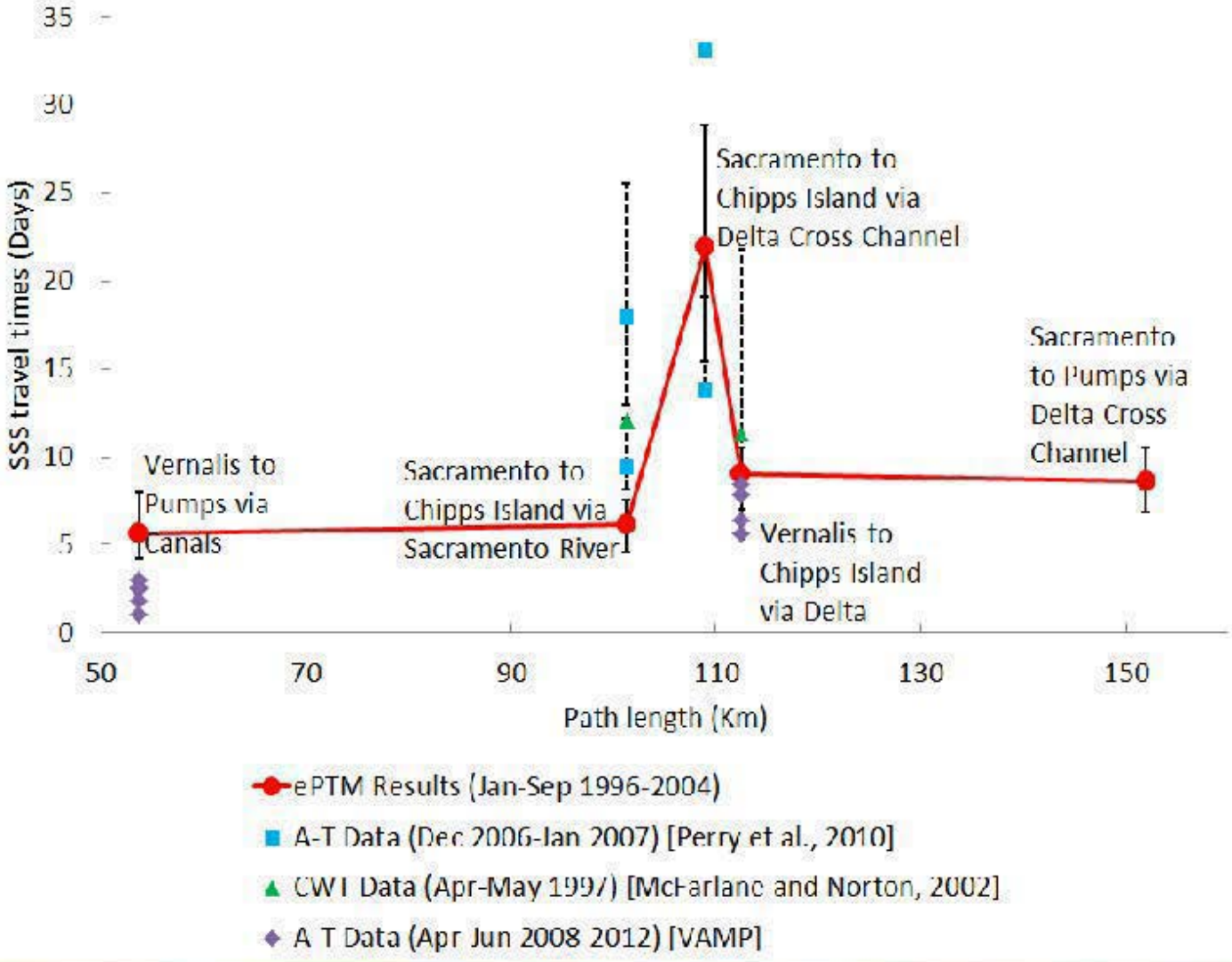
- Swimming
  - Selective Tidal Stream Transport
  - Probability of swimming during the day
  - Probability of confusion
- Predation Mortality (X-T model) [Anderson et al., 2005]
  - Mean free path length between predation events
  - Random predator encounter speed



Calibration



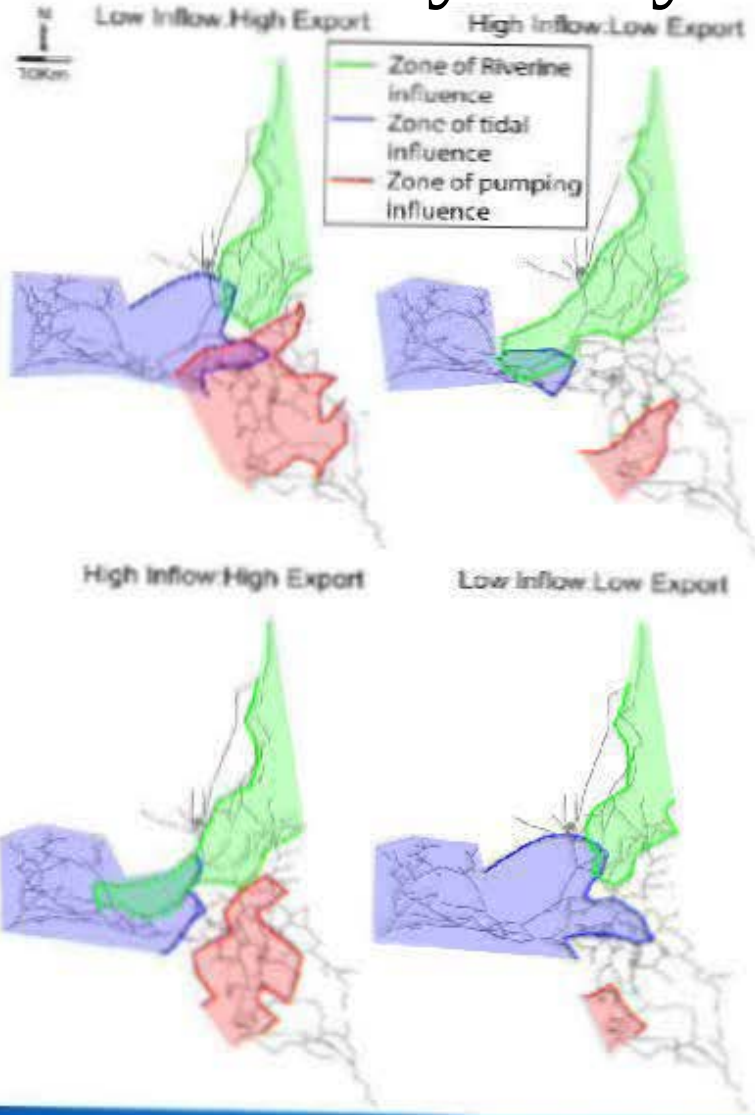
Validation

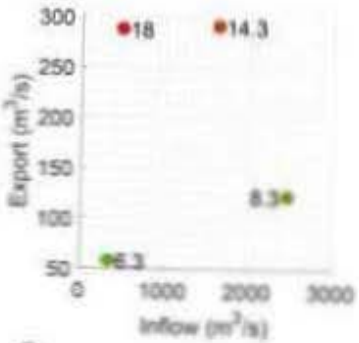

SSS travel times (Days)
35
30
25
20
15
10
5
0
50
70
90
110
130
150
Path length (Km)
Vernalis to Pumps via Canals
Sacramento to Chipps Island via Sacramento River
Sacramento to Chipps Island via Delta Cross Channel
Vernalis to Chipps Island via Delta
Sacramento to Pumps via Delta Cross Channel
ePTM Results (Jan-Sep 1996-2004)
A-T Data (Dec 2006-Jan 2007) [Perry et al., 2010]
CWT Data (Apr-May 1997) [McFarlane and Norton, 2002]
A T Data (Apr Jun 2008 2012) [VAMP]

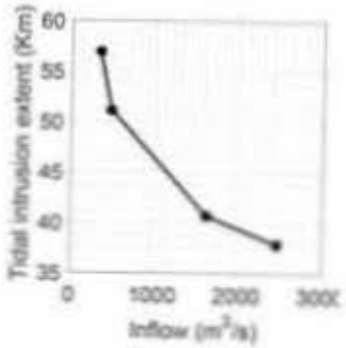

42

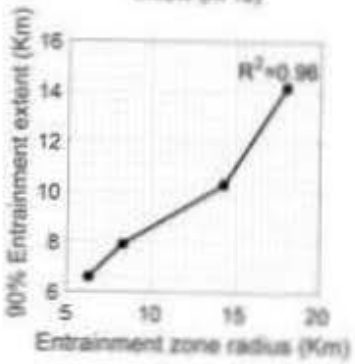

N
10Km
Sacran
Strait
Ve

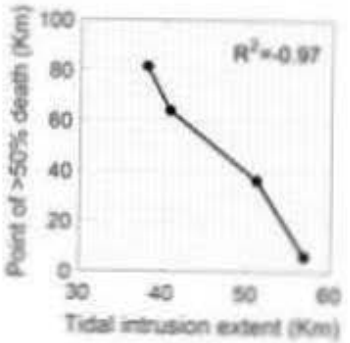
Zones of hydrodynamic influence



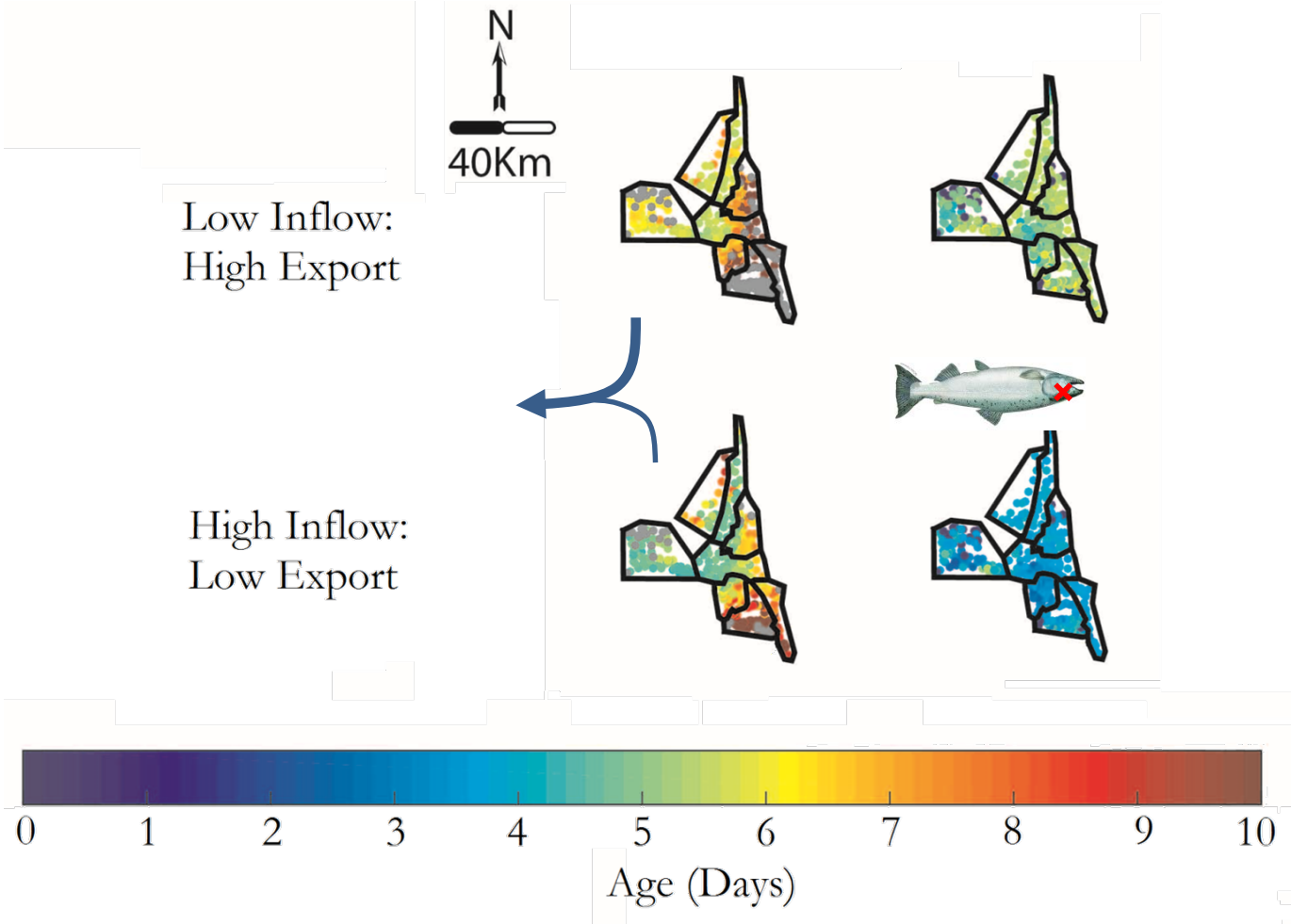




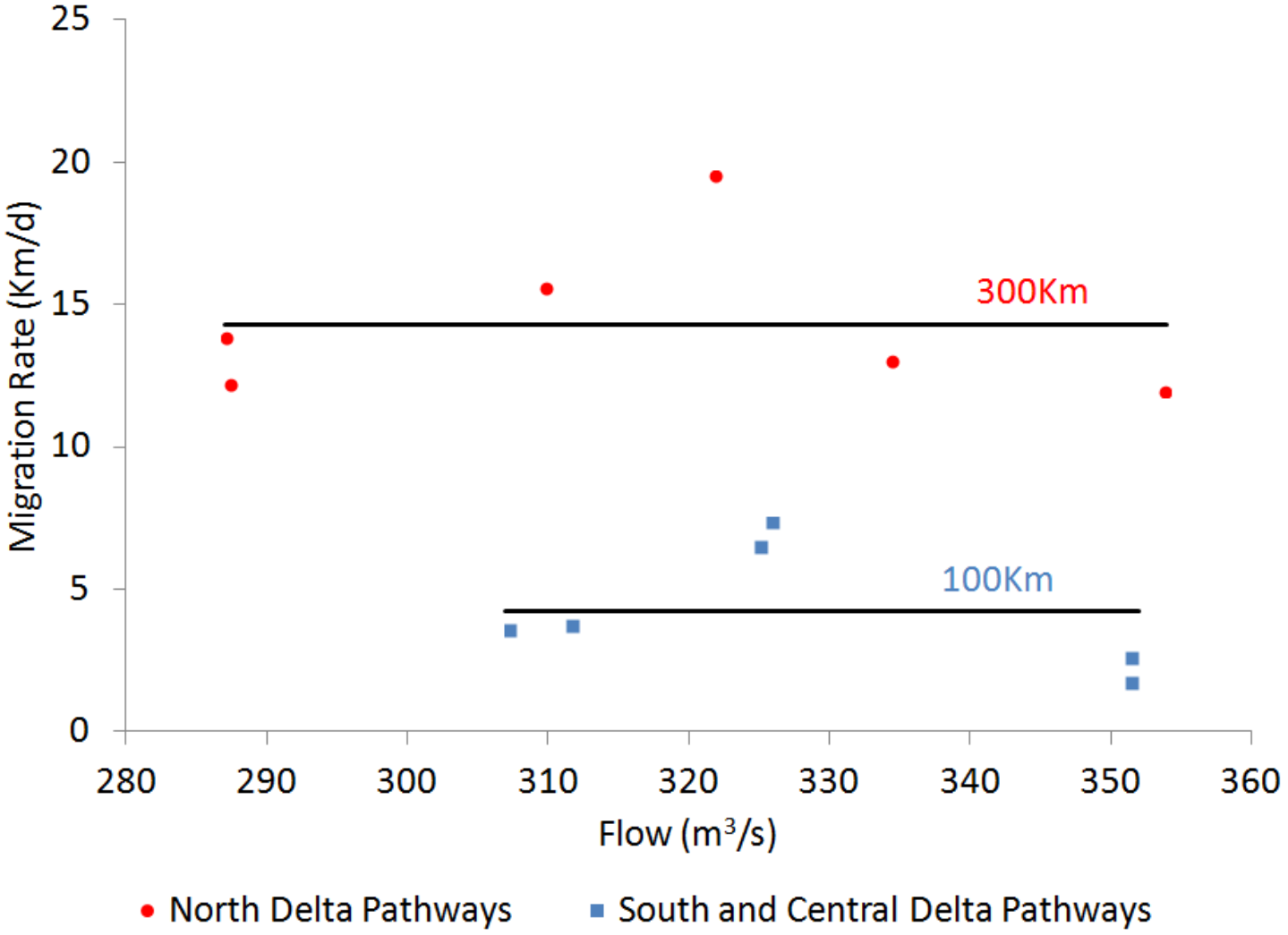




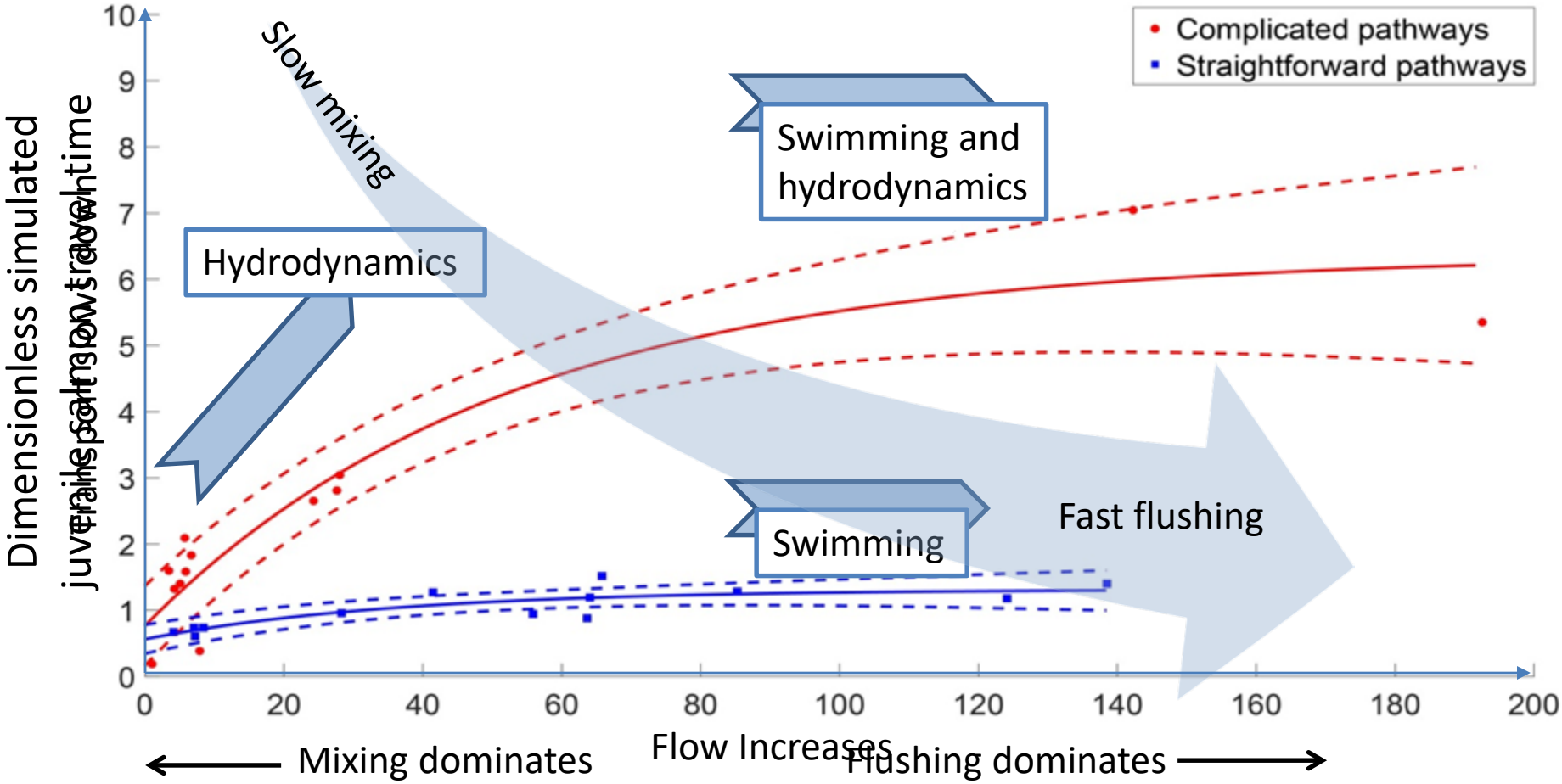
Spatial and temporal patterns of fate



Death (and life?) mechanics



Fish travel hydrodynamics



Conclusions

- Hydrology, water use and predation affect Salmon Fate
- Strong spatial correlation exists between hydrological landmarks and Salmon fate
- Higher inflow results in more salmon outmigrating via Chipps Island, export flow dictates salmon entrainment at the pumps to a lesser extent
- Salmon death mechanics are correlated with inflow: at low flows, salmon are more confused and more likely to be predated upon, at high flows, they swim quickly downstream and fewer die by predation
- Outmigration time correlates with transport path lengths and hydrological regime
- Swimming dominates in simpler pathways, while hydrodynamic transport and mixing are also important in more complex pathways

Thank You

Juvenile Chinook Salmon in the American River (Michael Beakes)