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South Delta Salmon Smolt Survival Studies



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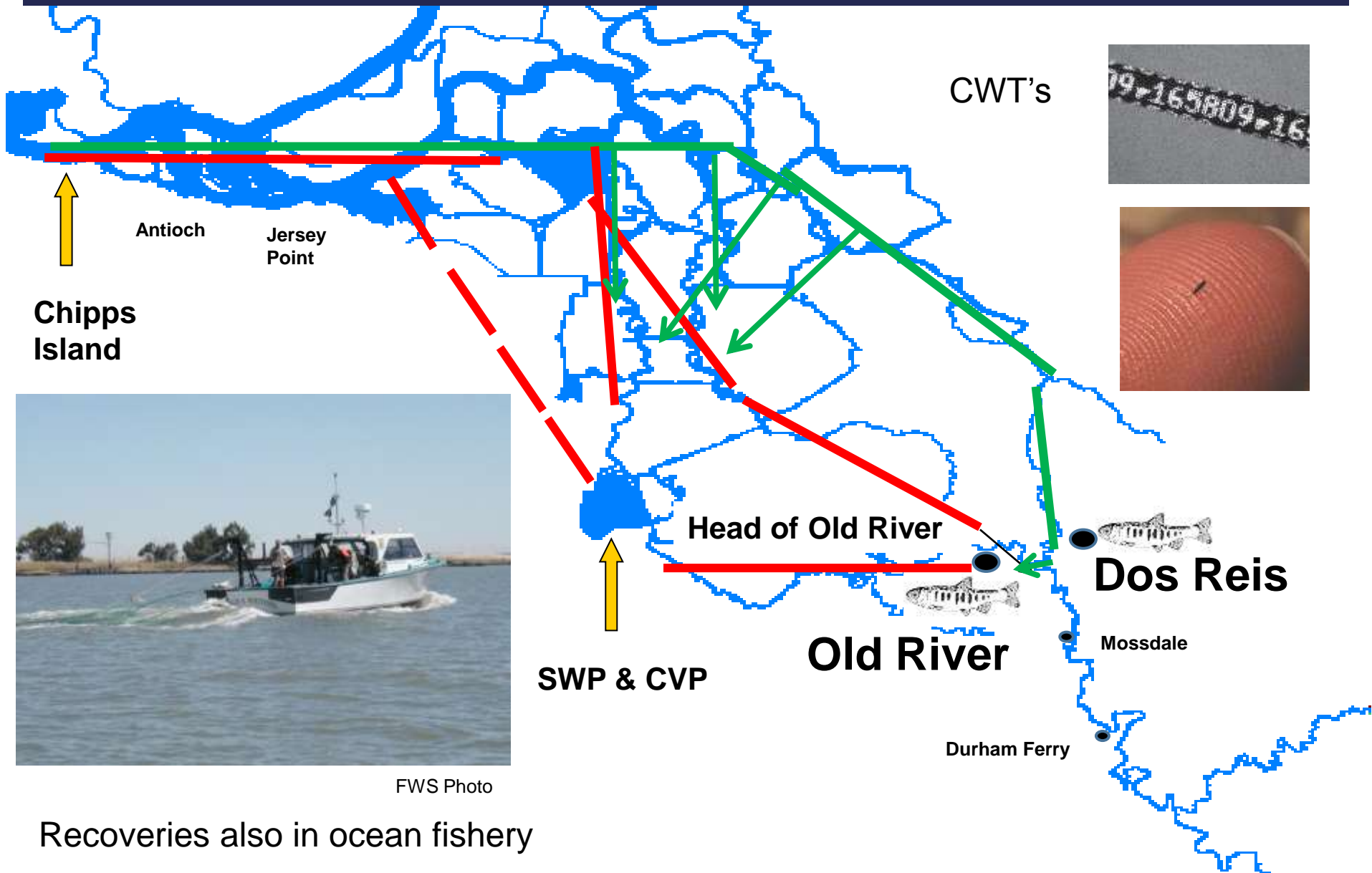
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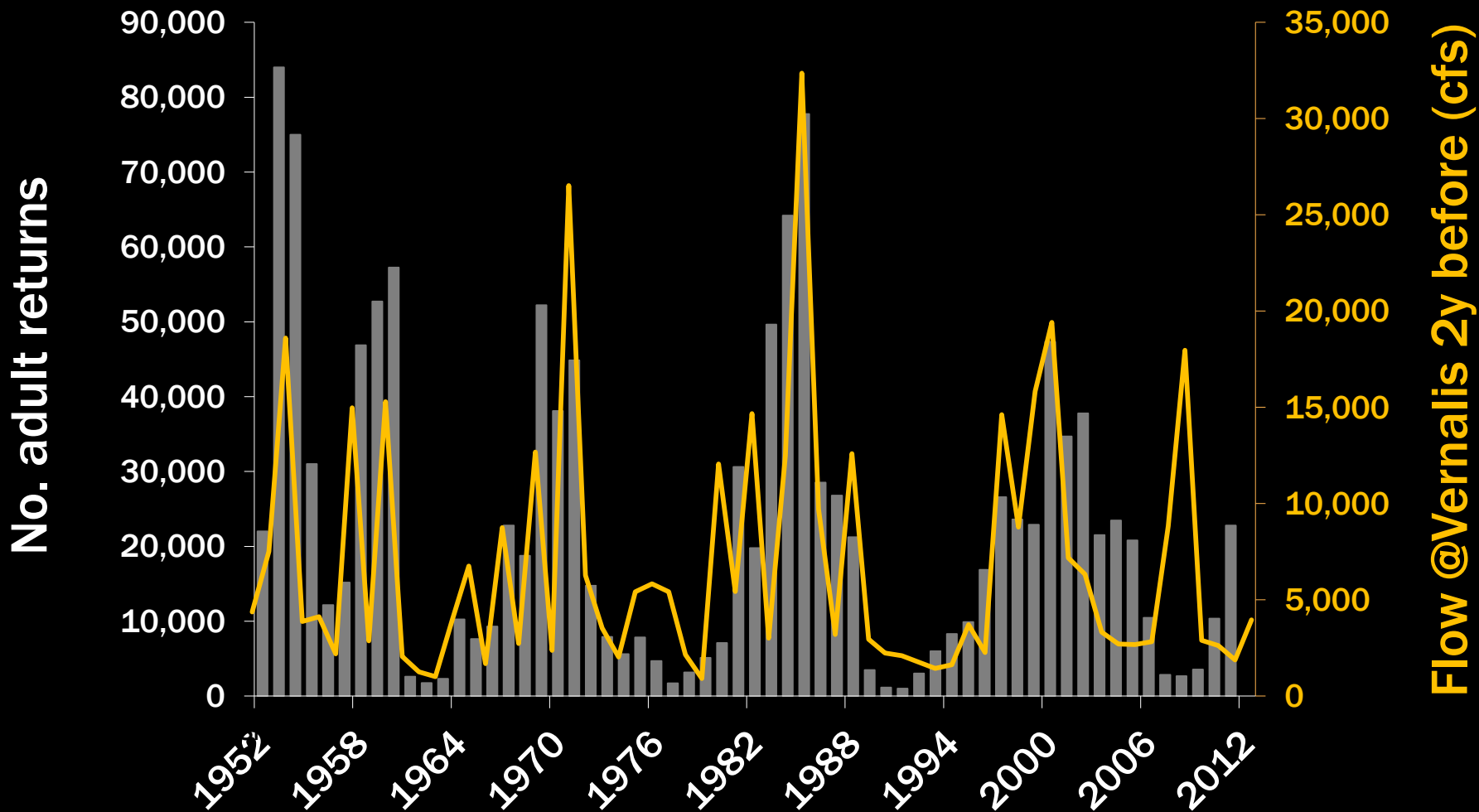
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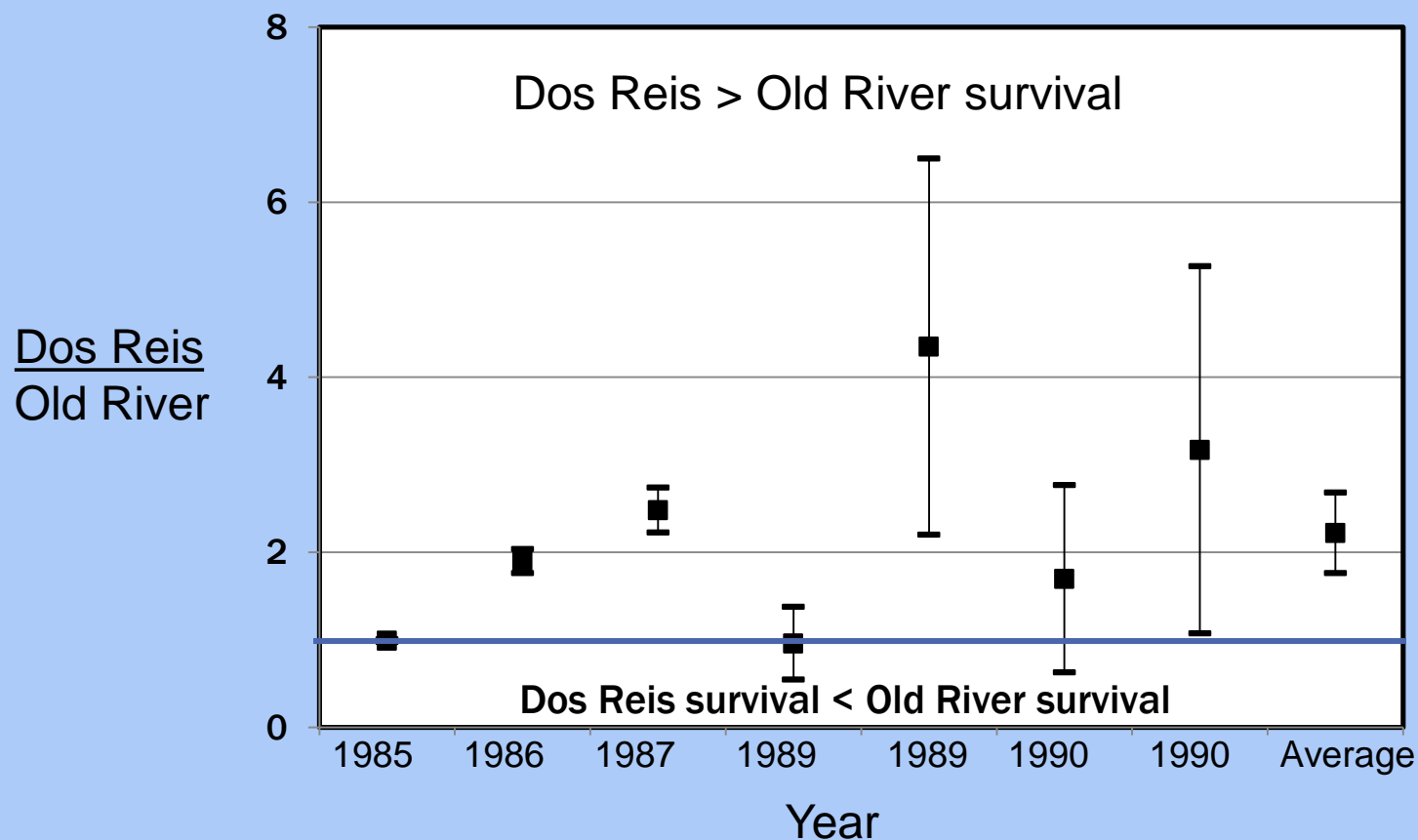
Adult returns in the San Joaquin Basin



Slide courtesy of A. Sturrock

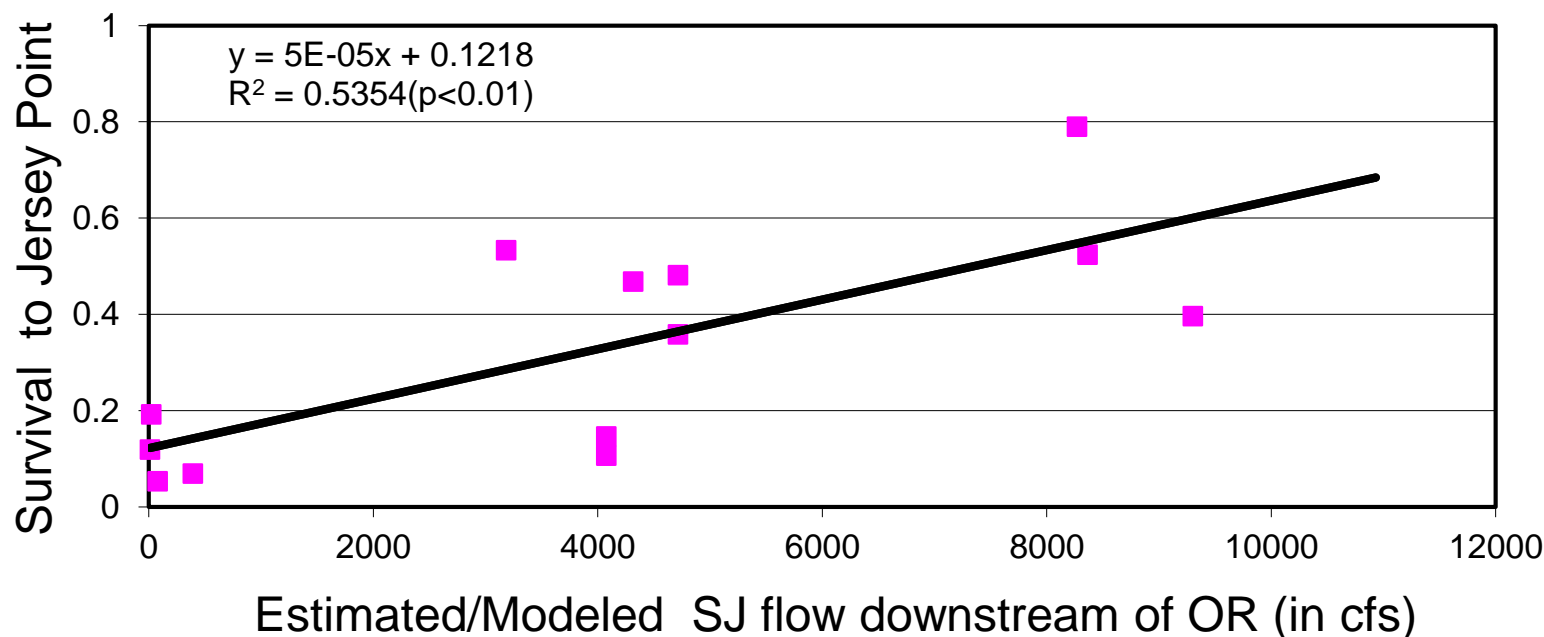
Sources: GrandTab (CDFW), CDEC

Ratio of recovery rates of CWT fish released at Dos Reis and those released in Old River.



Recoveries at Chipps Island and in ocean fishery

Dos Reis/Jersey Point survival versus SJ flow downstream of head of Old River (1989-1991, 1995-1999)



Recoveries at Chipps Island and in ocean fishery

Source: SJRGA, 2007; 2006 VAMP Annual Report

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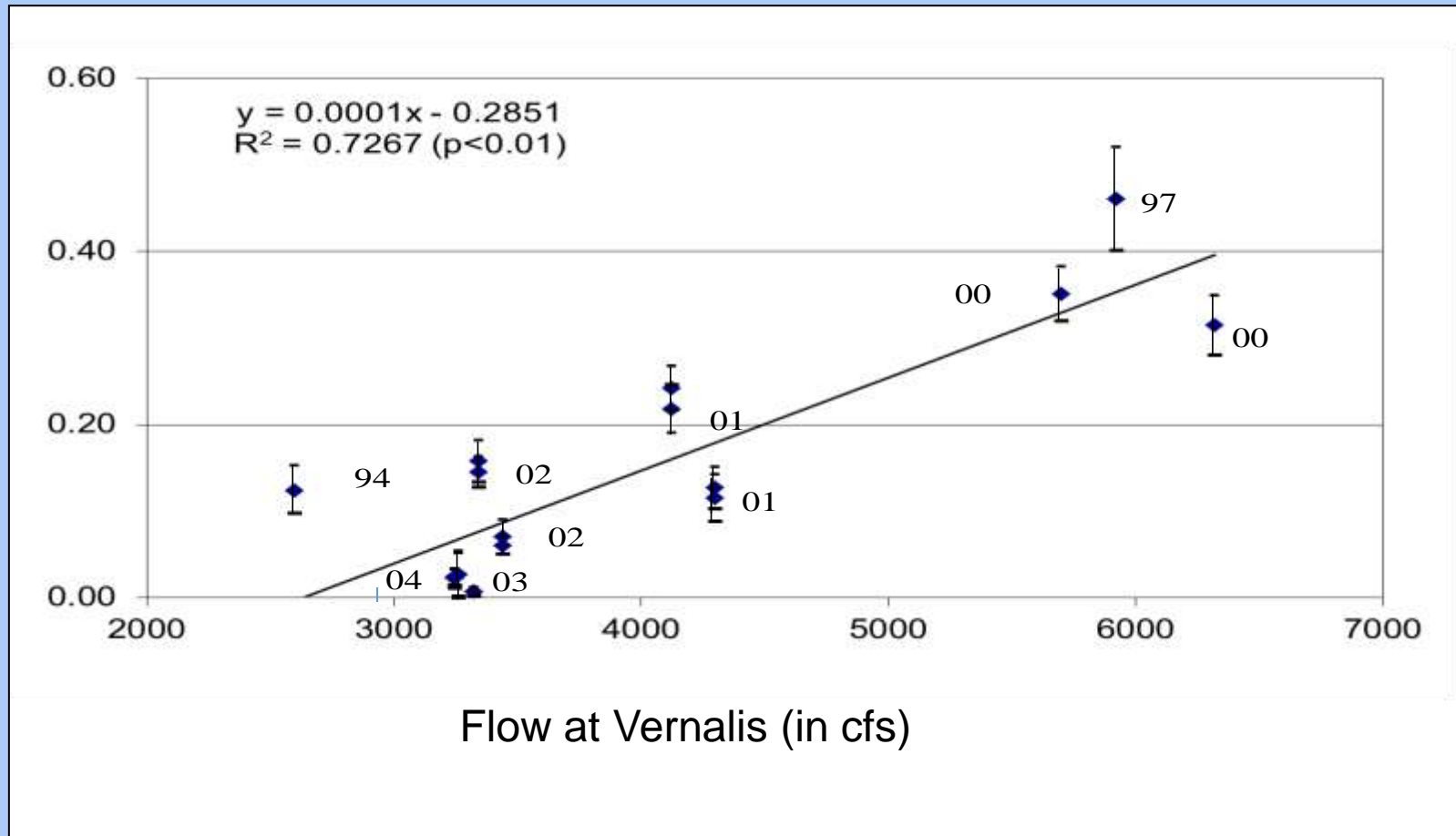
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Physical Head of Old River barrier (with culvert structure in 2001)



Survival from Mossdale or Durham Ferry to Jersey Point versus flow at Vernalis with a physical HORB.

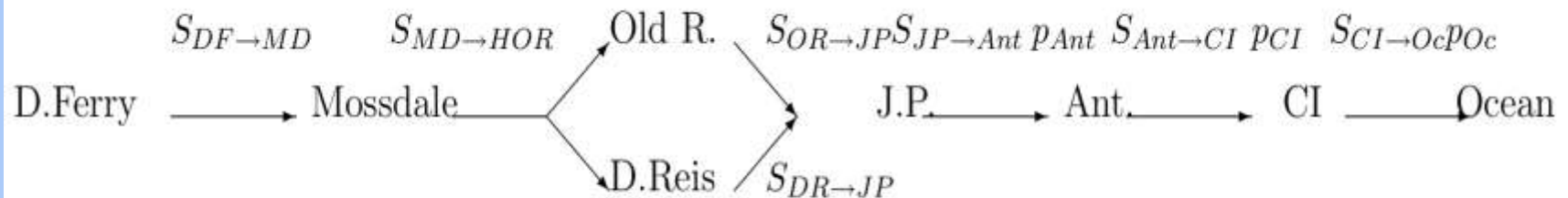
Survival to Jersey Point



Recoveries made at Chipps Island, Antioch and in ocean fishery

Source: SJRGA, 2007; 2006 VAMP Annual Report

CWT Model: Paths+probabilities



Used Bayesian Hierarchical Models – incorporates various levels of uncertainty

“Strongest” effect: increases in flow increased survival in San Joaquin River route

Key finding: Usually higher survival in San Joaquin River than in Old River
but lots of environmental variation

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Transition to acoustic tags to estimate survival

HTI Acoustic Tag



VEMCO acoustic tag



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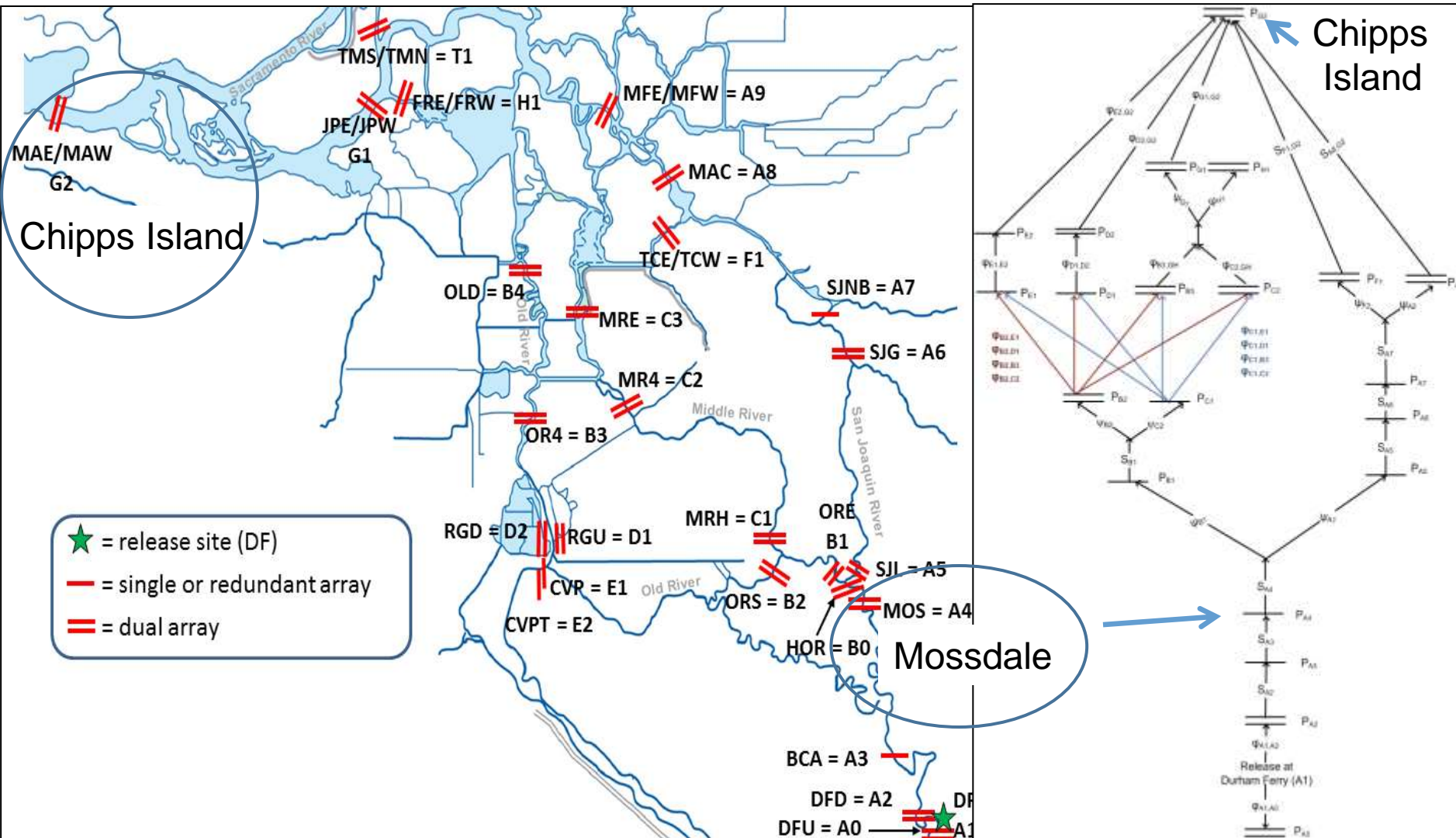
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Receiver Array and mark-recapture model (2012)

Similar receiver networks in 2008 & 2011 (no JP in 2010)



Use of Predator Filter (2009-2012)

- **Assumption:** All tag detections from live study fish
- **Removal of detections from “predators” based on:**
 - Behavior patterns: travel time, residence time
 - Environmental conditions: river flow, water velocity, river stage
 - detections at all sites
- **Assumptions**
 - Salmon smolts unlikely to move against flow
 - Salmon smolts are actively migrating downriver
 - May move upriver temporarily with flow

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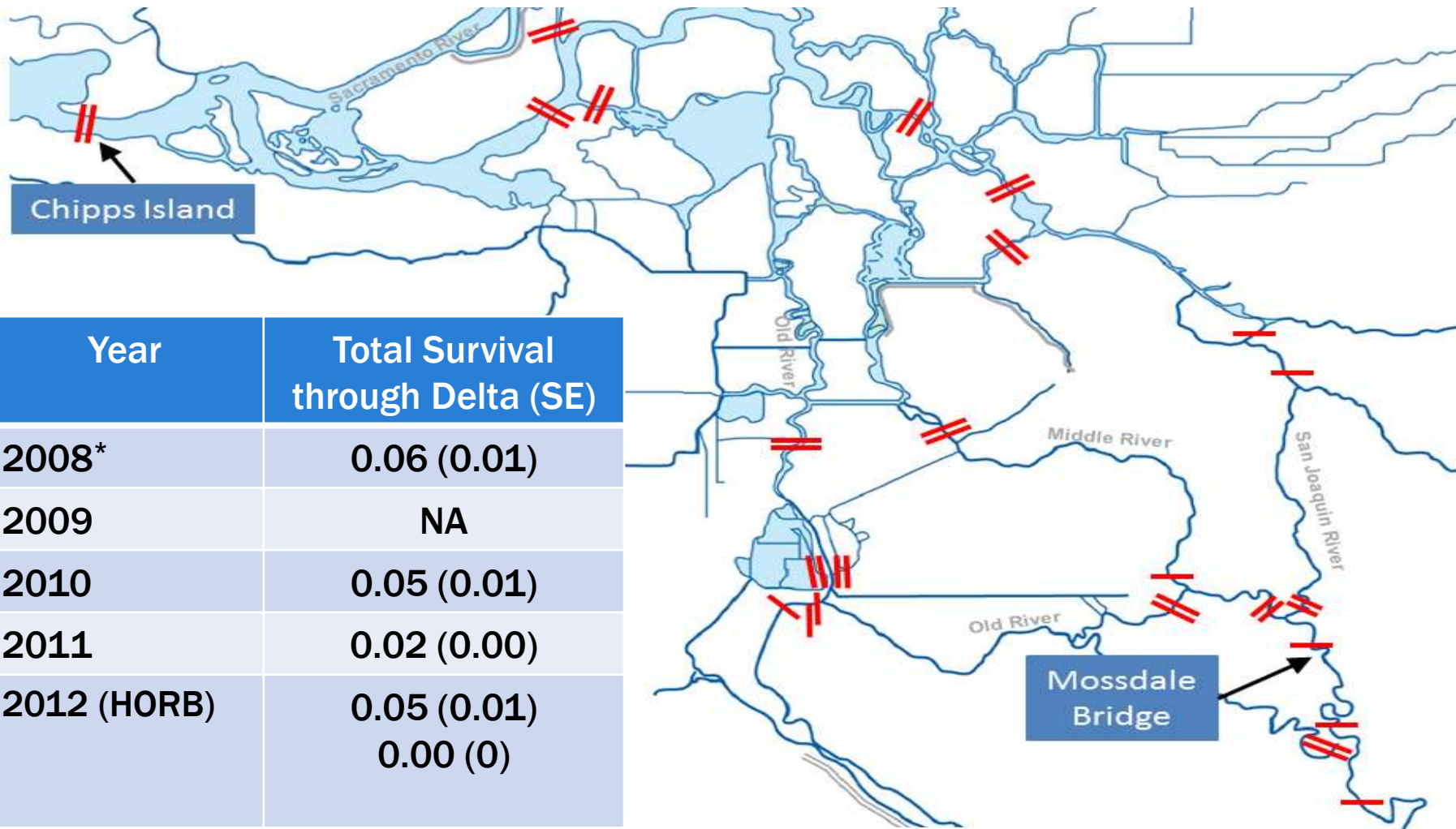
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Survival from Mossdale to Chipps Island



* minimum estimates of survival due to high tag failure, but no predator filter applied

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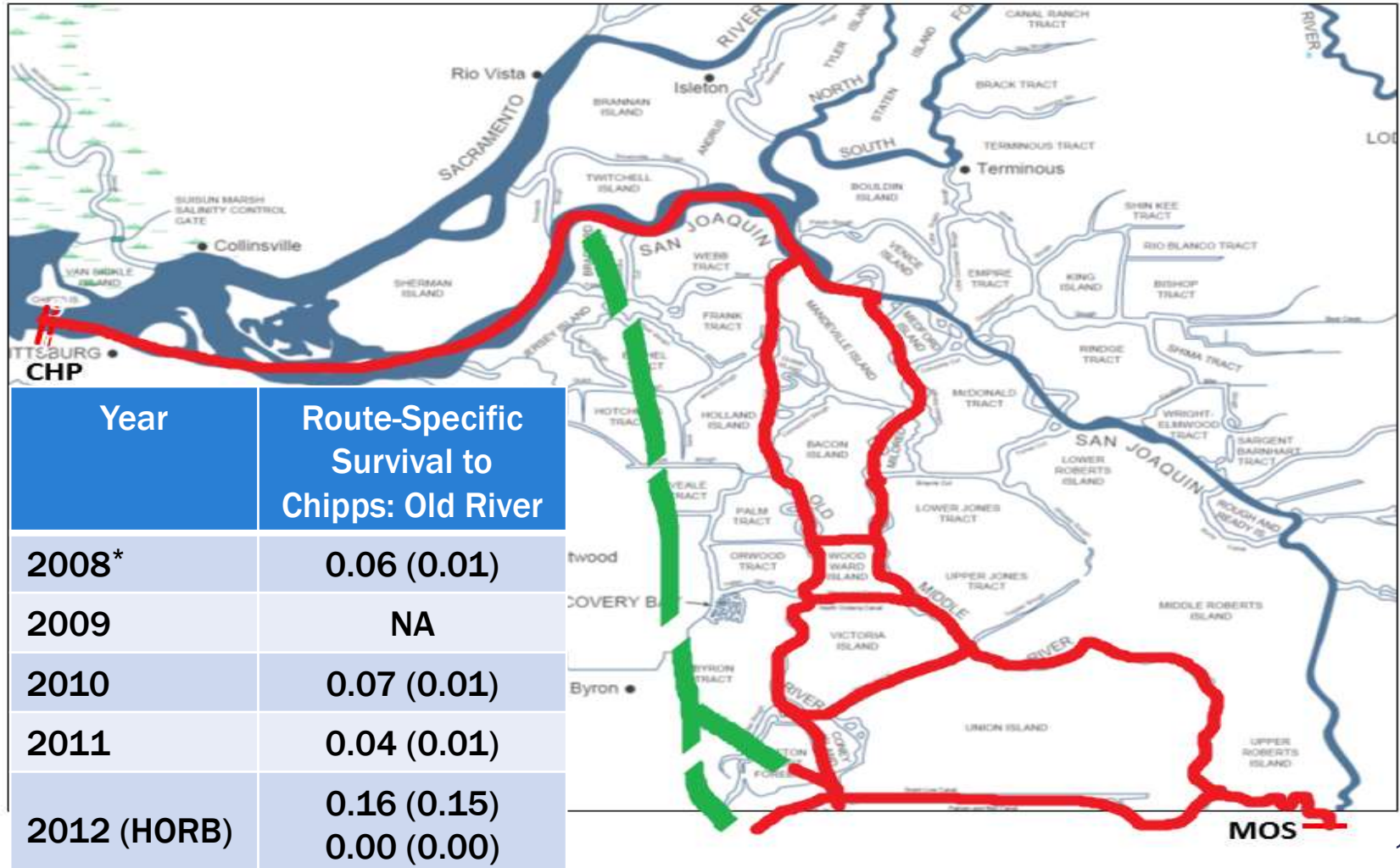
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Survival (per km) from Mossdale to Chipps Island

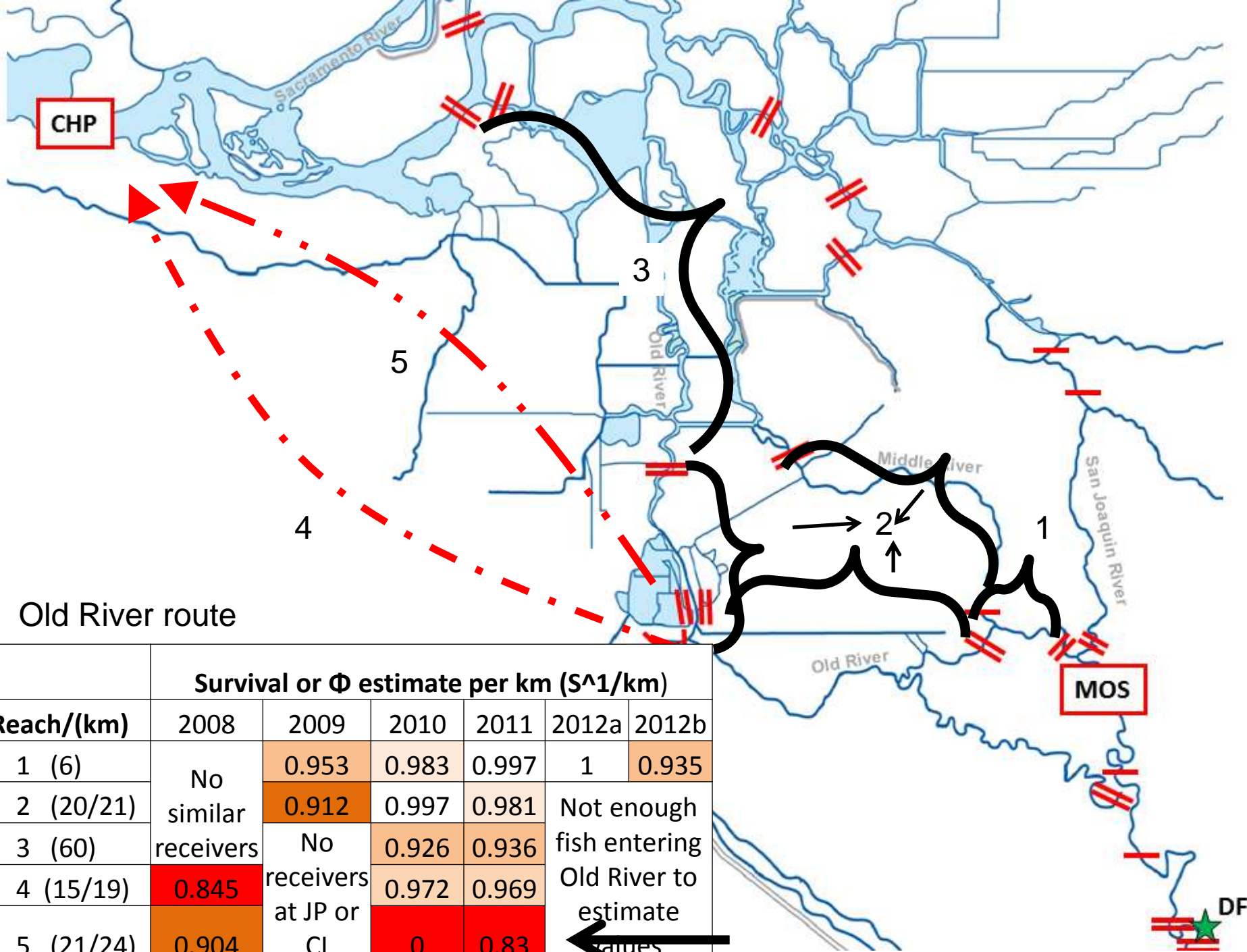
Year	2008	2009	2010	2011	2012a	2012b
Mossdale to Chipps Island (91 rkm)	0.97		0.968	0.958	0.968	0

Survival per km	Total Survival from Mossdale to Chipps Island
0.83	0
0.88	0
0.90	0.0001
0.92	0.0005
0.93	0.0014
0.95	0.0094
0.96	0.0244
0.97	0.0626
0.98	0.1591
0.985	0.2528
0.989	0.3655
0.99	0.4007
0.995	0.6337
0.997	0.7608

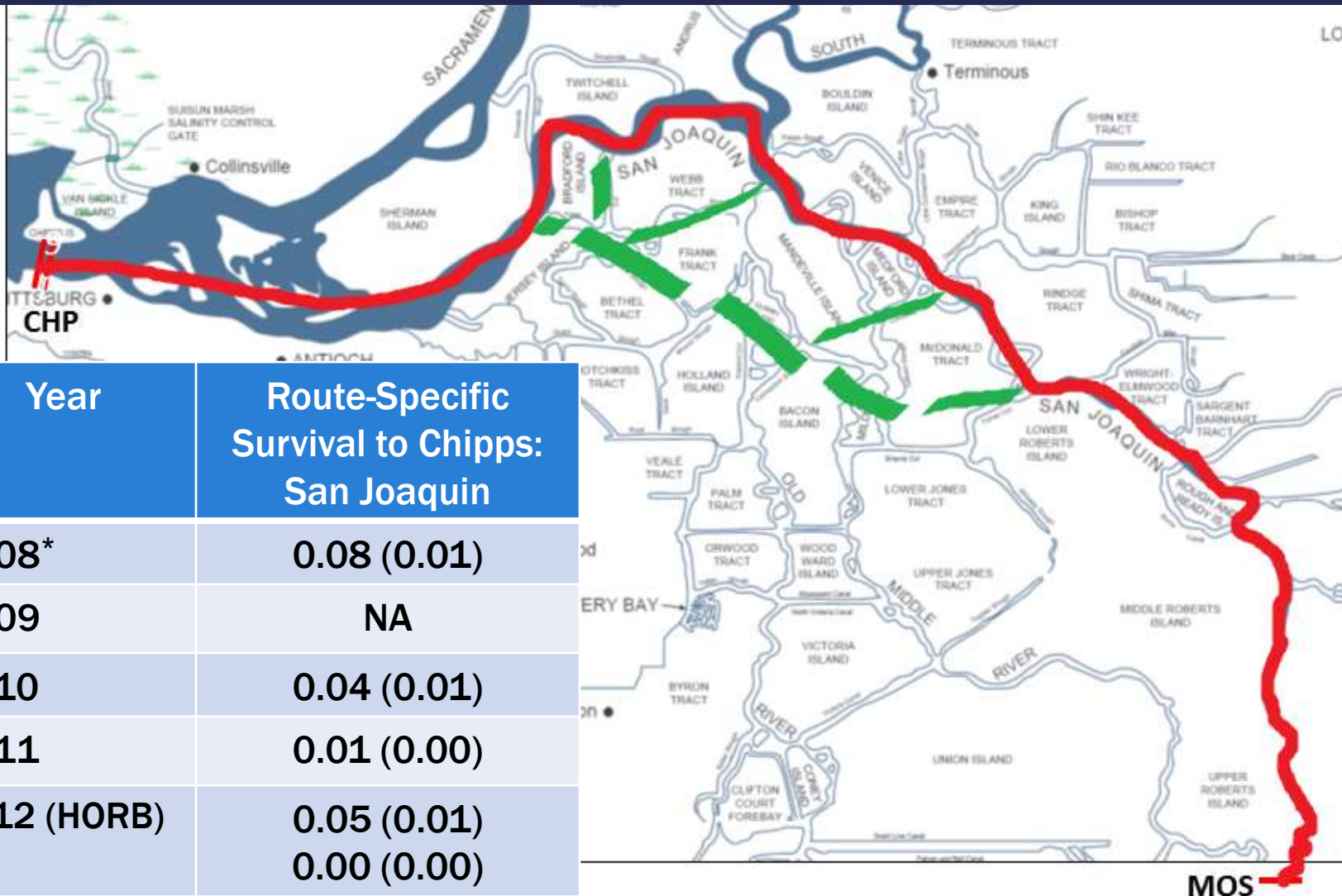
SURVIVAL TO CHIPPS ISLAND: OLD RIVER



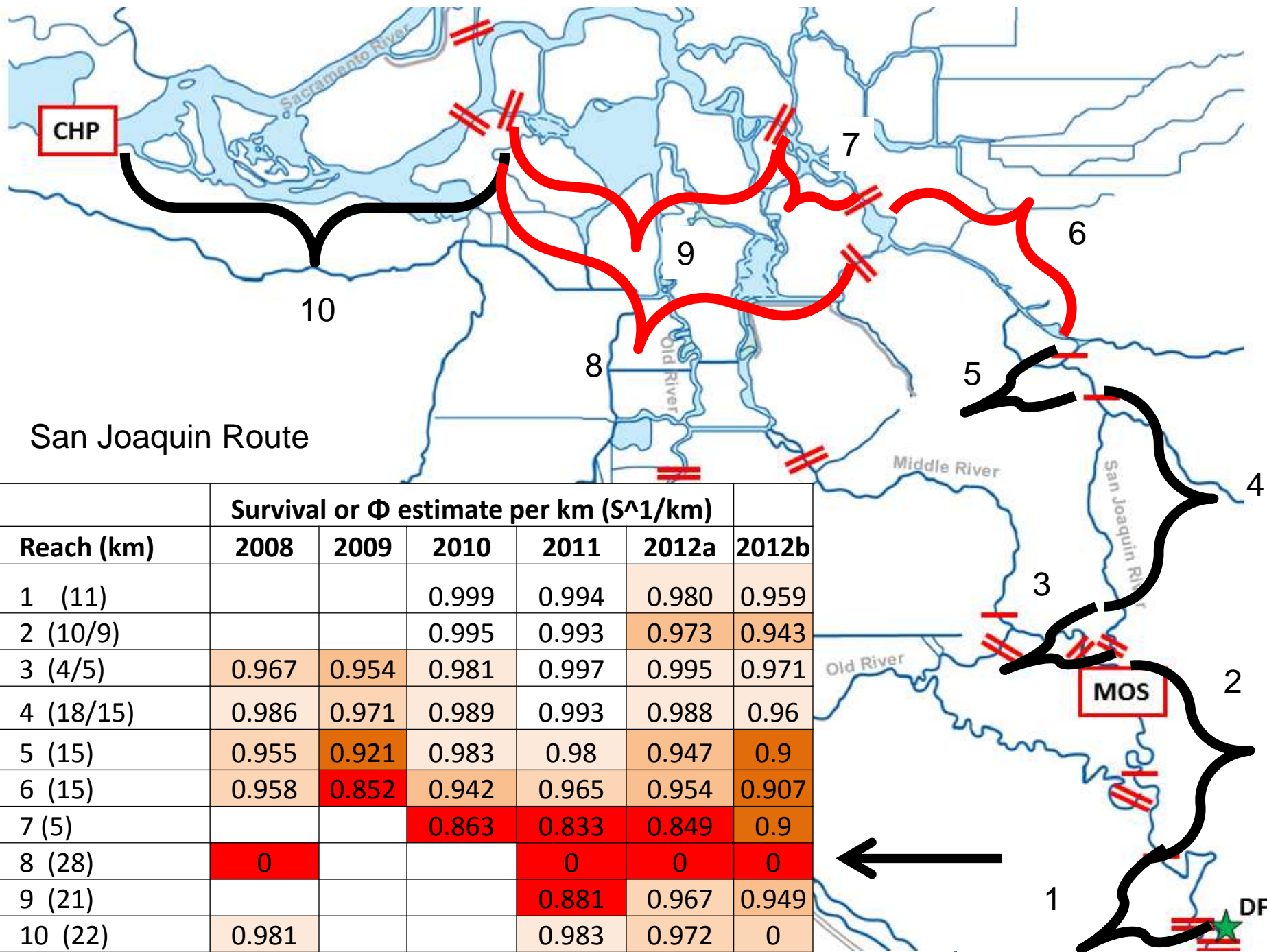
= * minimum estimates of survival due to high tag failure, but no predator filter applied



SURVIVAL TO CHIPPS ISLAND: SAN JOAQUIN

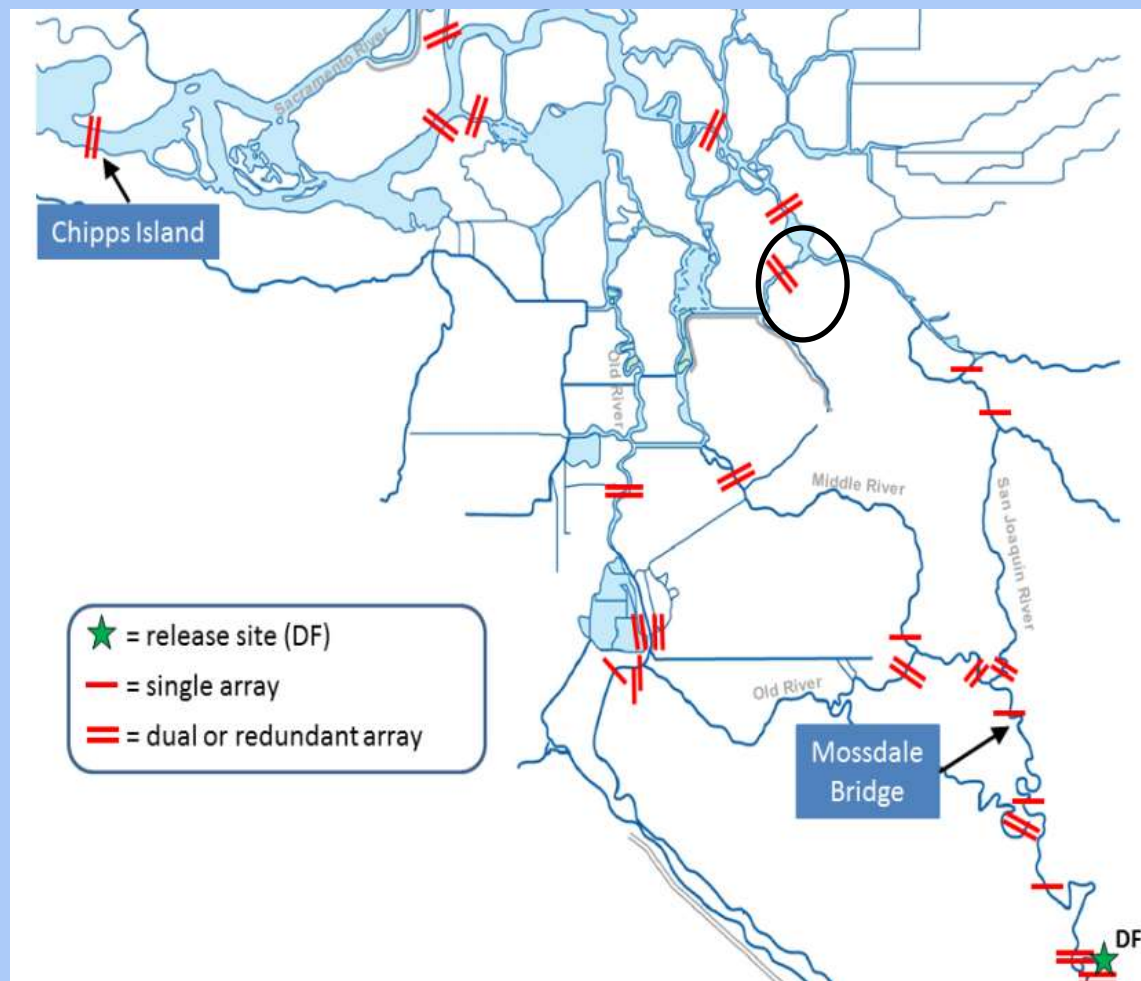


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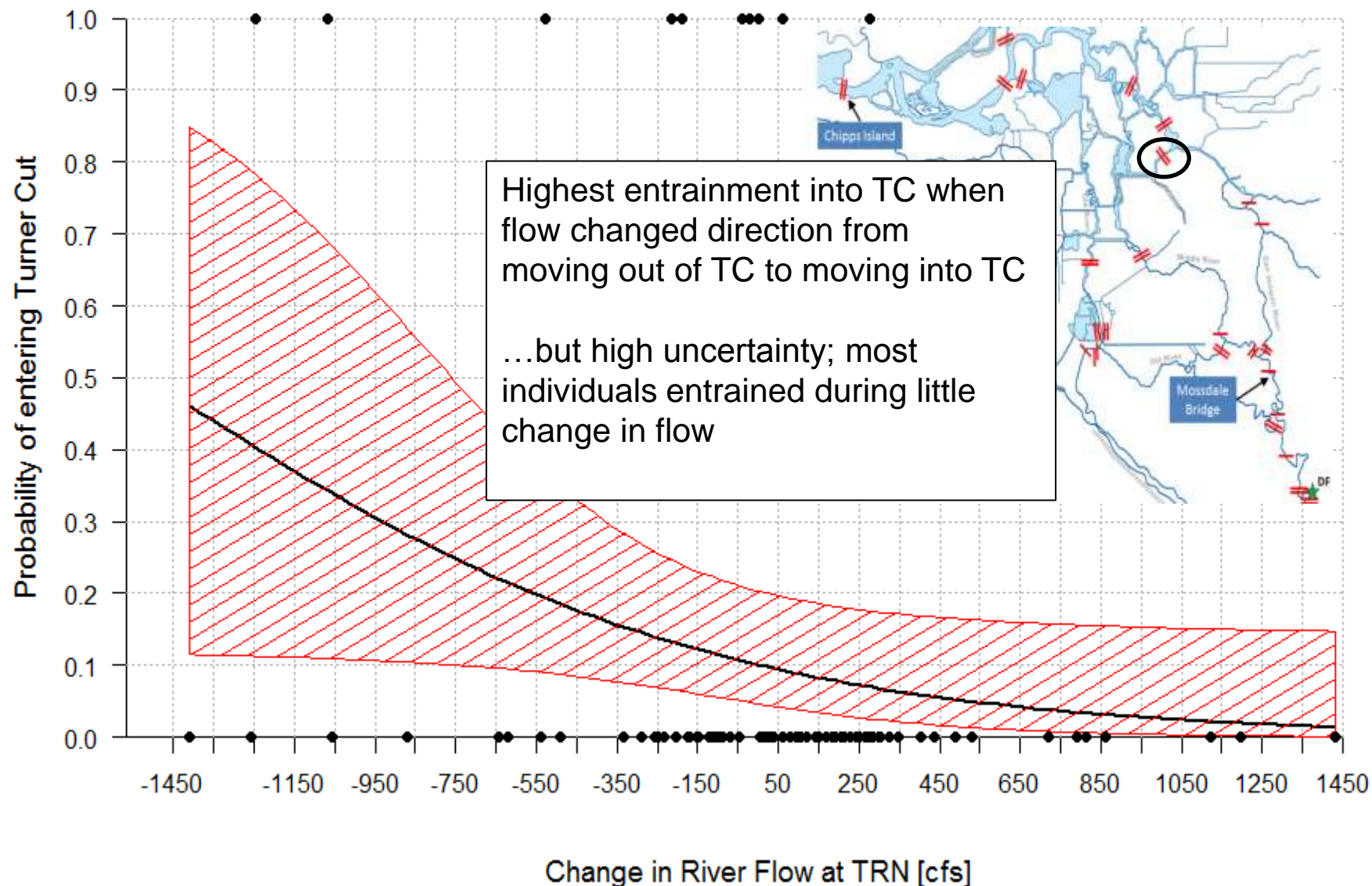


PROPORTION OF TAGS ENTERING TURNER CUT

Year	Proportion entering Turner Cut (SE)
2008	0.10 (0.02) 0.04 (0.01)
2009	0 0
2010	0.09 (0.03)
2011	0.21 (0.02)
2012	0.11 (0.03) 0.16 (0.11)



Probability of being diverted into Turner Cut in 2012



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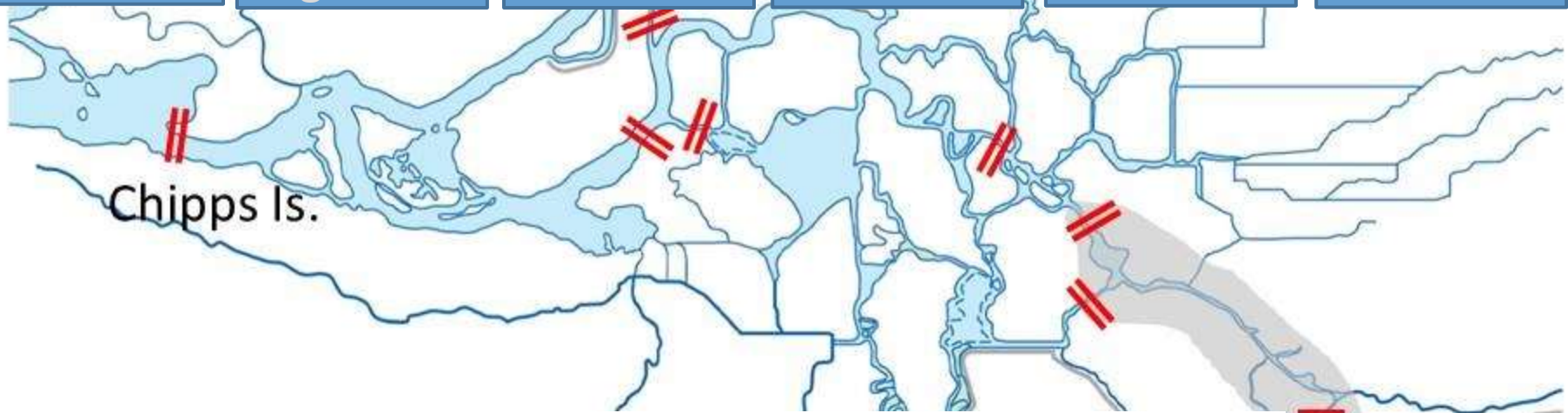
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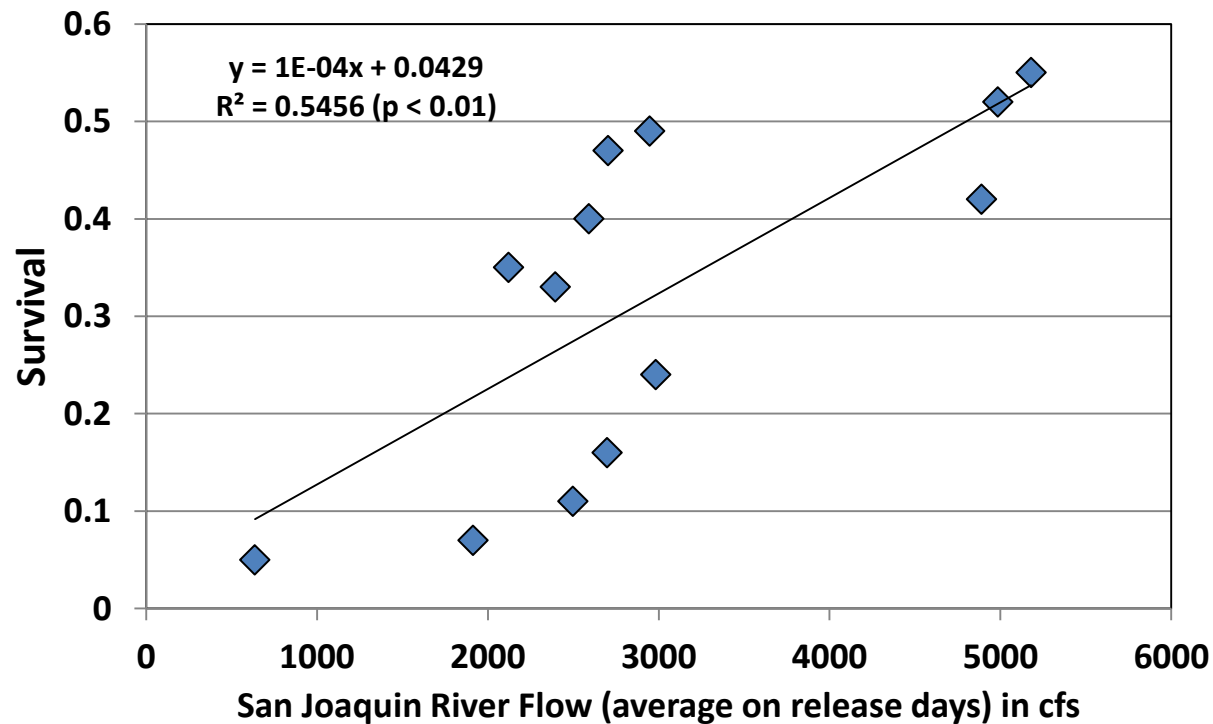
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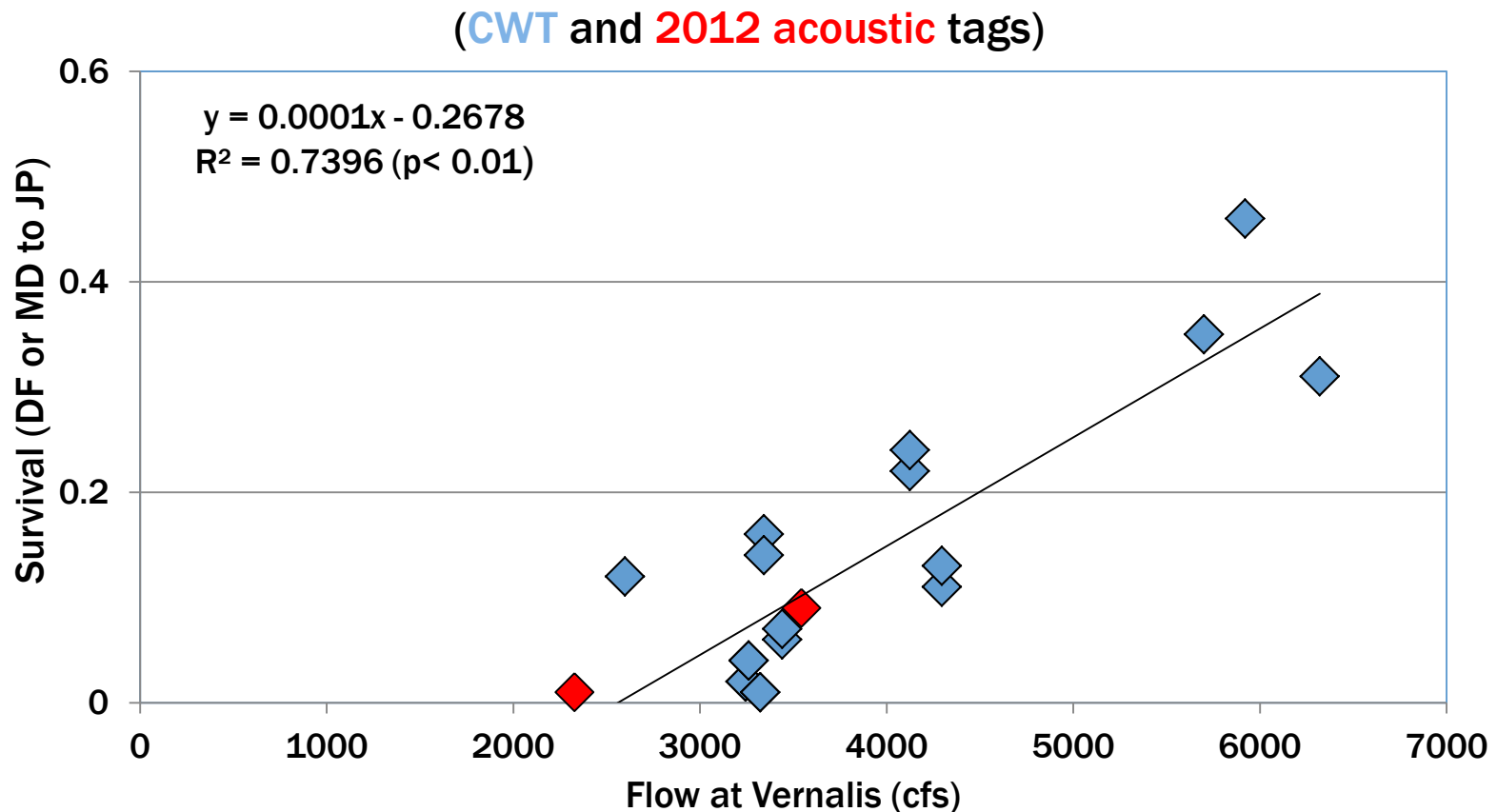
Next steps



South Delta - Route A: Survival versus flow in San Joaquin River at Lathrop



Comparison of survival to Jersey Point with HORB



Conclusions

Survival through the Delta using AT's has been poor

There are mortality hot spots in both the San Joaquin River and Old River routes.

SWP and Turner Cut have especially high mortality

The probability of being diverted into Turner Cut is related to flow at the junction

Increased flow appears to improve survival in the San Joaquin River to the Turner Cut/Channel Marker junction.

In 2012, with the physical HORB installed, survival was consistent with relationship between survival and flow with CWT's and the HORB.

NEXT STEPS

Begin to build multi-year models and test hypotheses to determine why survival is so poor and identify potential management solutions

However -

2015 – Partial study funded

2016 – No study planned – no funding identified;

Acknowledgements

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