TRIBPIT: ESTIMATING SALMONID COHORT SURVIVAL DURING JUVENILE MIGRATION

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COHORT SURVIVAL: INTRODUCTION

- Historical focus of survival monitoring: annual migration through hydrosystem
  - System survival
  - LGR-LGR SAR
- Great! But
  - Misses survival to hydrosystem
  - How to relate migration performance to brood year?
    - Variation in age at initiation of migration

COHORT SURVIVAL: INTRODUCTION

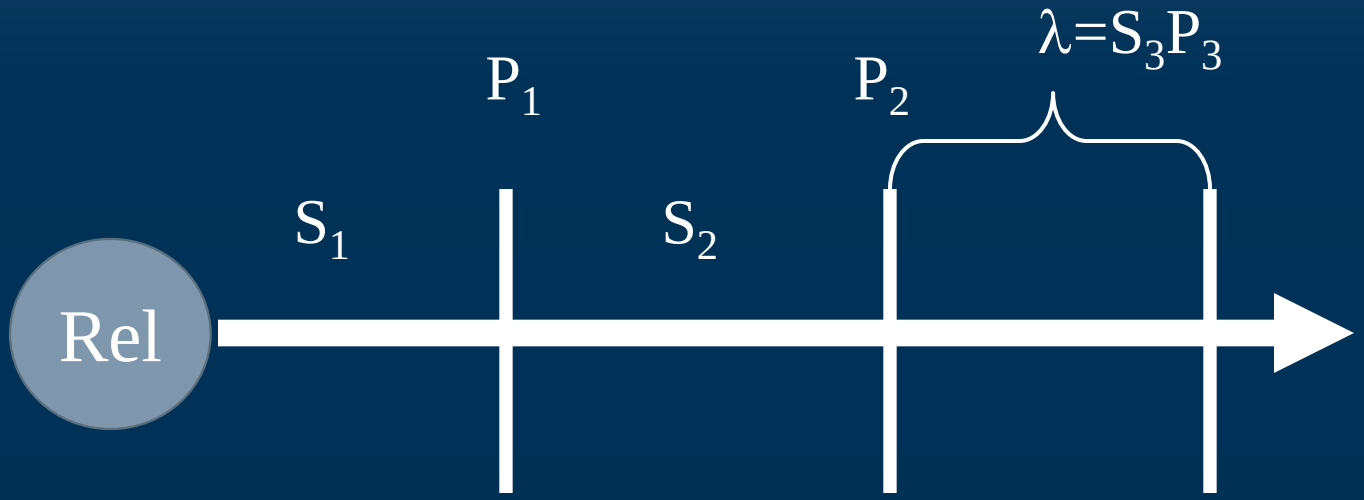
- Cohort survival: probability of subyearling fish surviving to eventually reach …
  - Mainstem river
  - Hydrosystem
  - McNary Dam (etc.)
- Defined for cohort from a brood year
  - Accounts for variation in age at migration
  - Includes
    - Initiation of migration
    - Survival from rearing (tagging) grounds to hydrosystem

OUTLINE

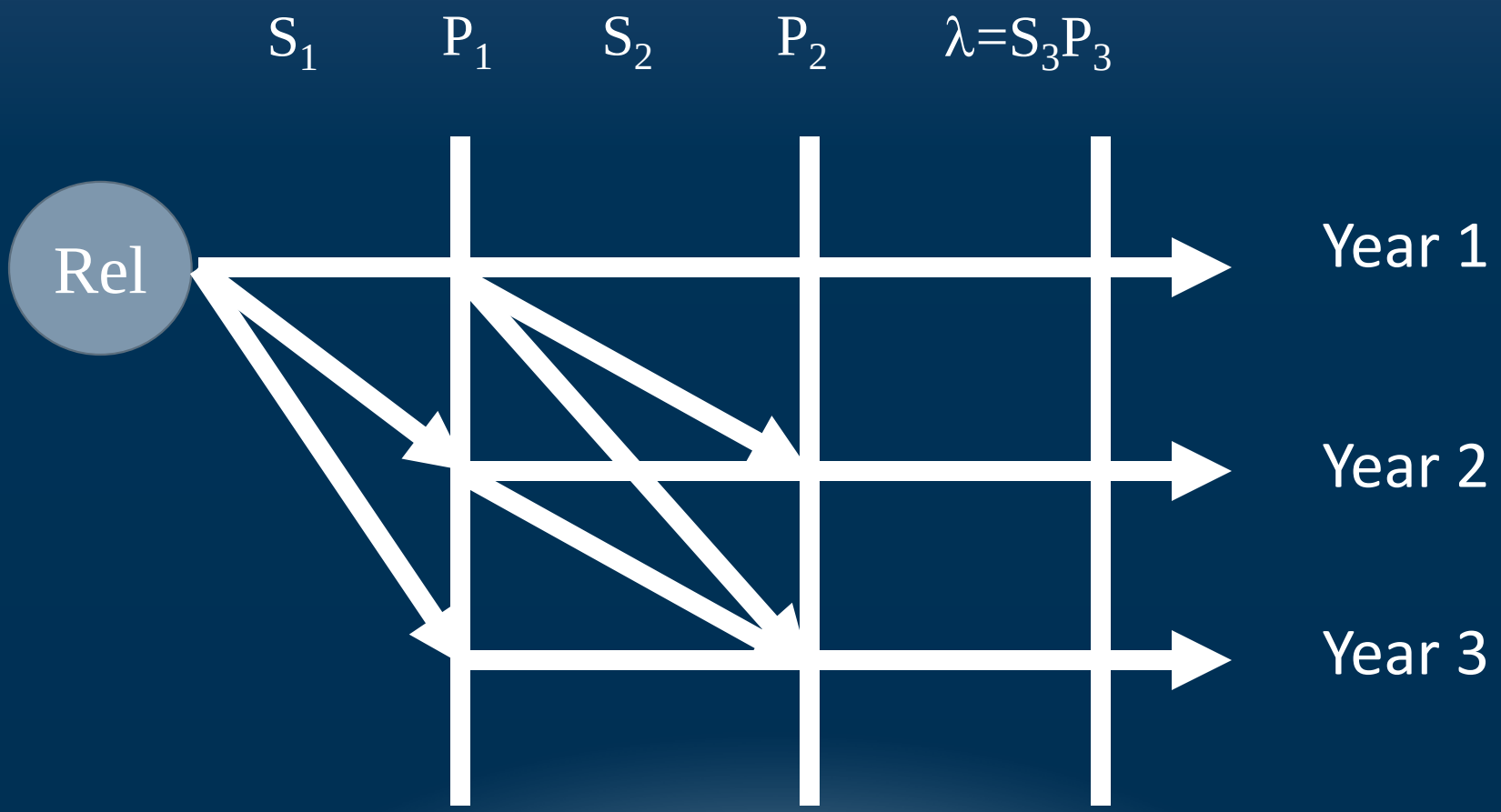
- Introduction: Cohort Survival
- Development of Analysis Model
- Case Study: Twisp River Steelhead, 2010 cohort
- Data and Software
- Results and Conclusions

DEVELOPMENT OF ANALYSIS MODEL: GENERALIZED LOWTHER-SKALSKI MODEL

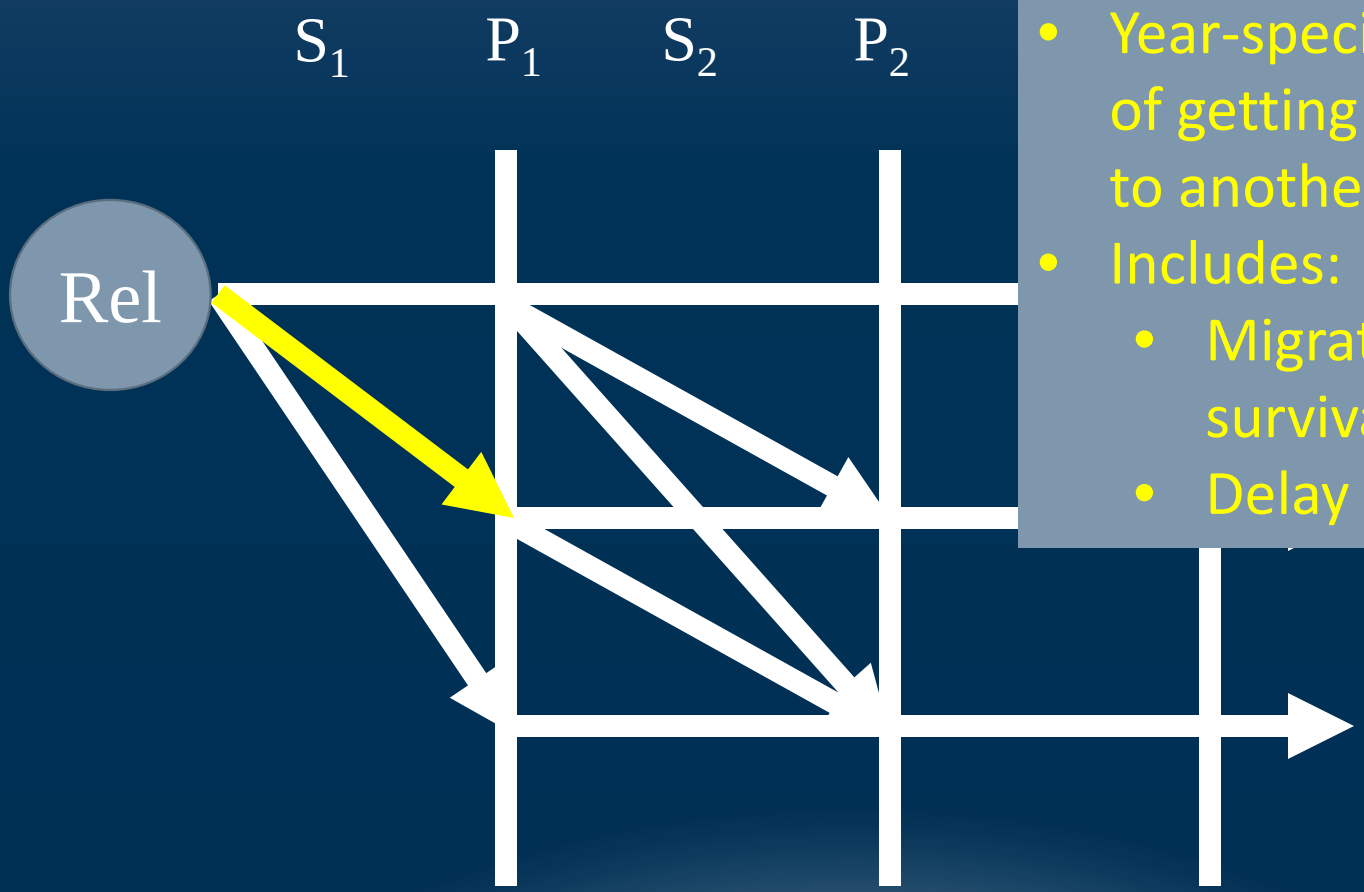
SIMPLE POPULATION: CJS MODEL



COMPLEX POPULATION: BRANCHING MODEL



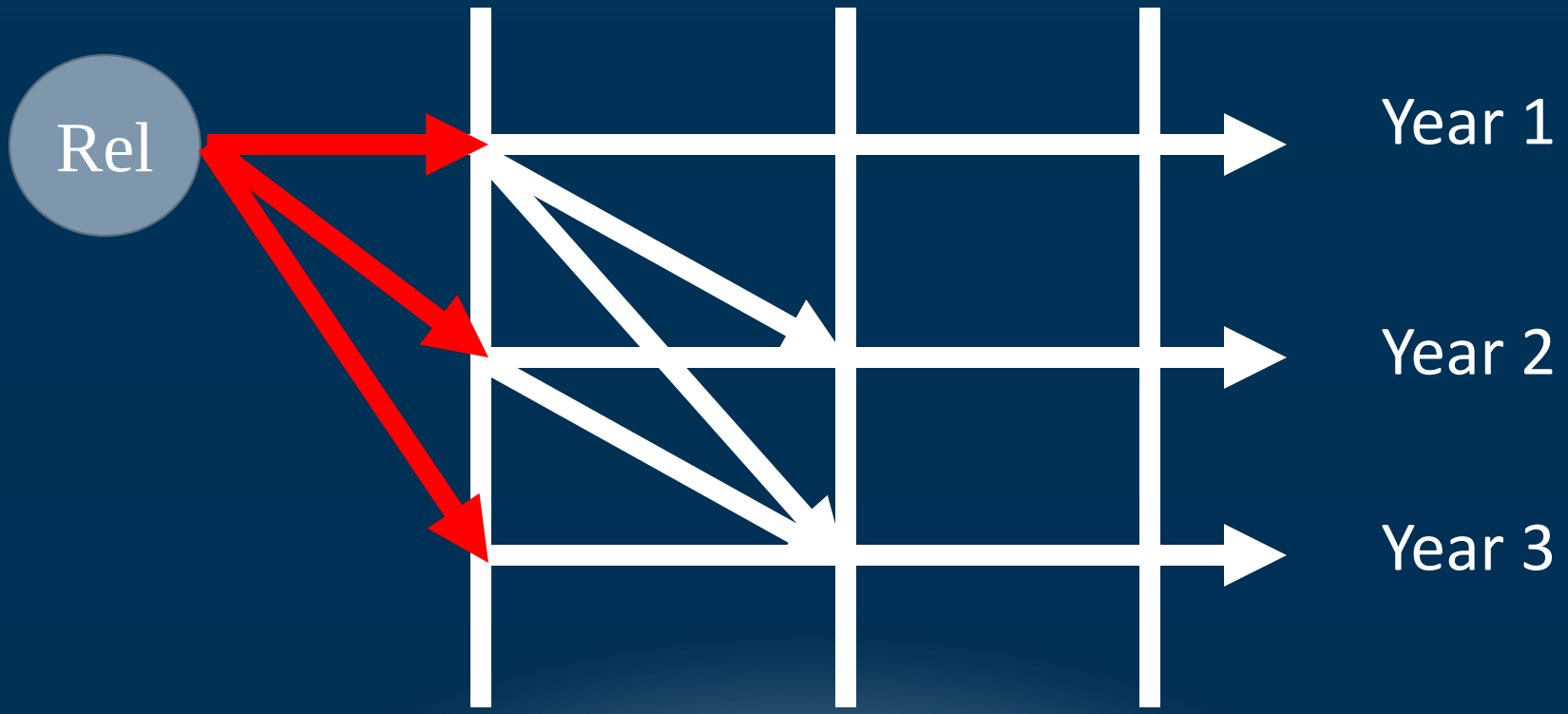
COHORT BRANCHING MODEL



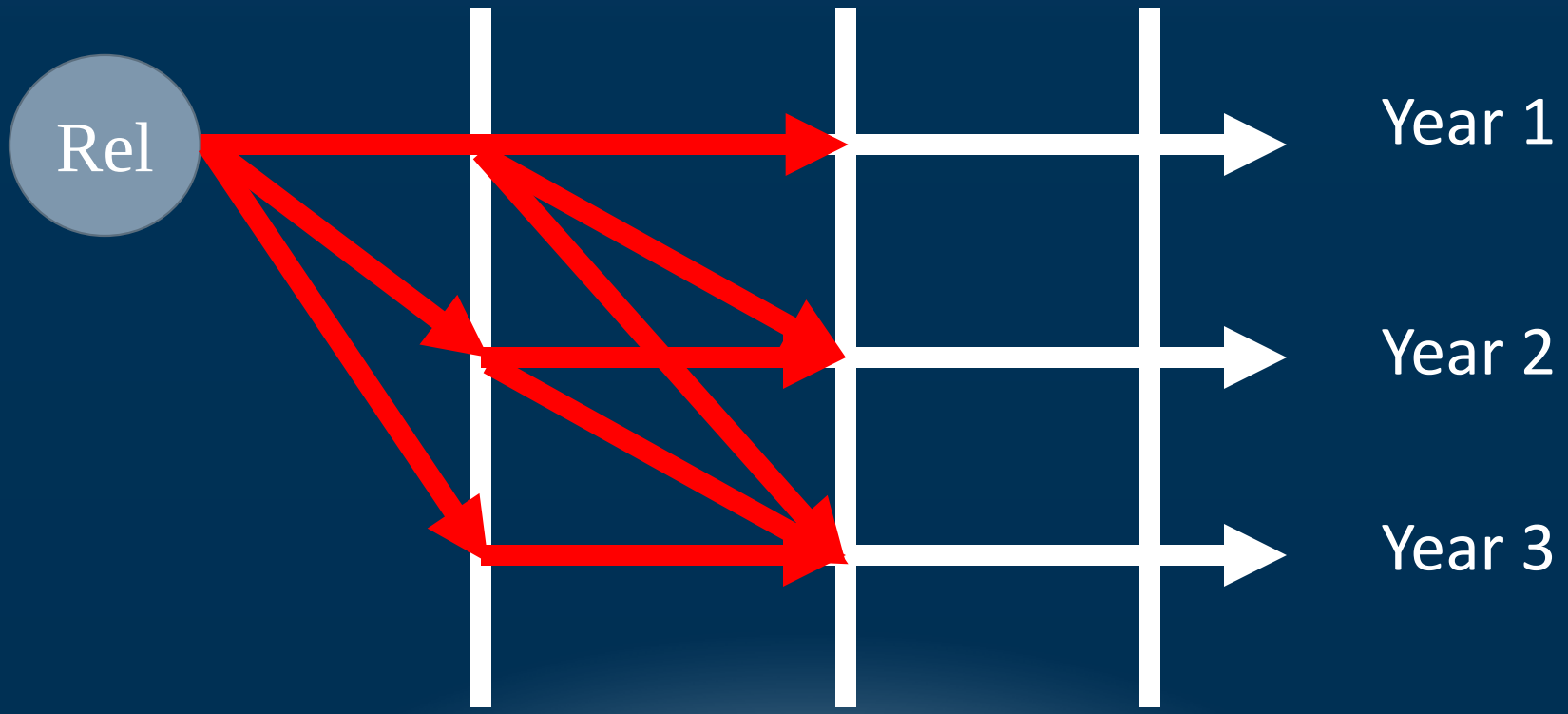
Model estimates transition probability

- Year-specific probability of getting from one site to another
- Includes:
  - Migration and survival
  - Delay and survival

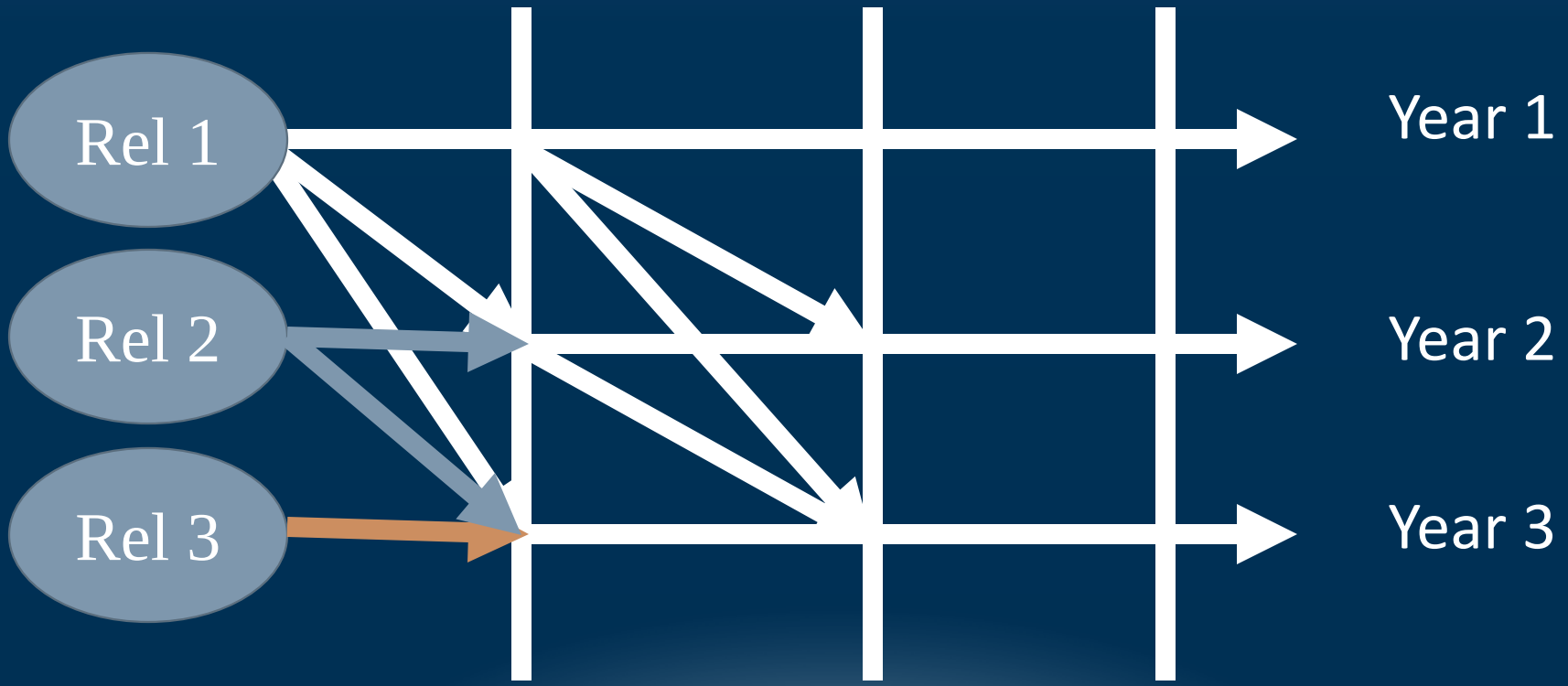
COHORT SURVIVAL TO SITE 1



COHORT SURVIVAL TO SITE 2



COHORT BRANCHING MODEL: ANNUAL RELEASES OVER AGE CLASSES



DETECTION SITES AND DATA

- Detection sites
  - Instream PIT-tag detectors (juvenile)
  - Juvenile Bypass Systems and other dam sites
  - Estuary Towed Array
  - Detection probabilities: not tiny

- Data
  - PIT-tag interrogation data
    - Detected where and when
    - Multiple observation years
    - DART query
  - Age data – identify the cohort

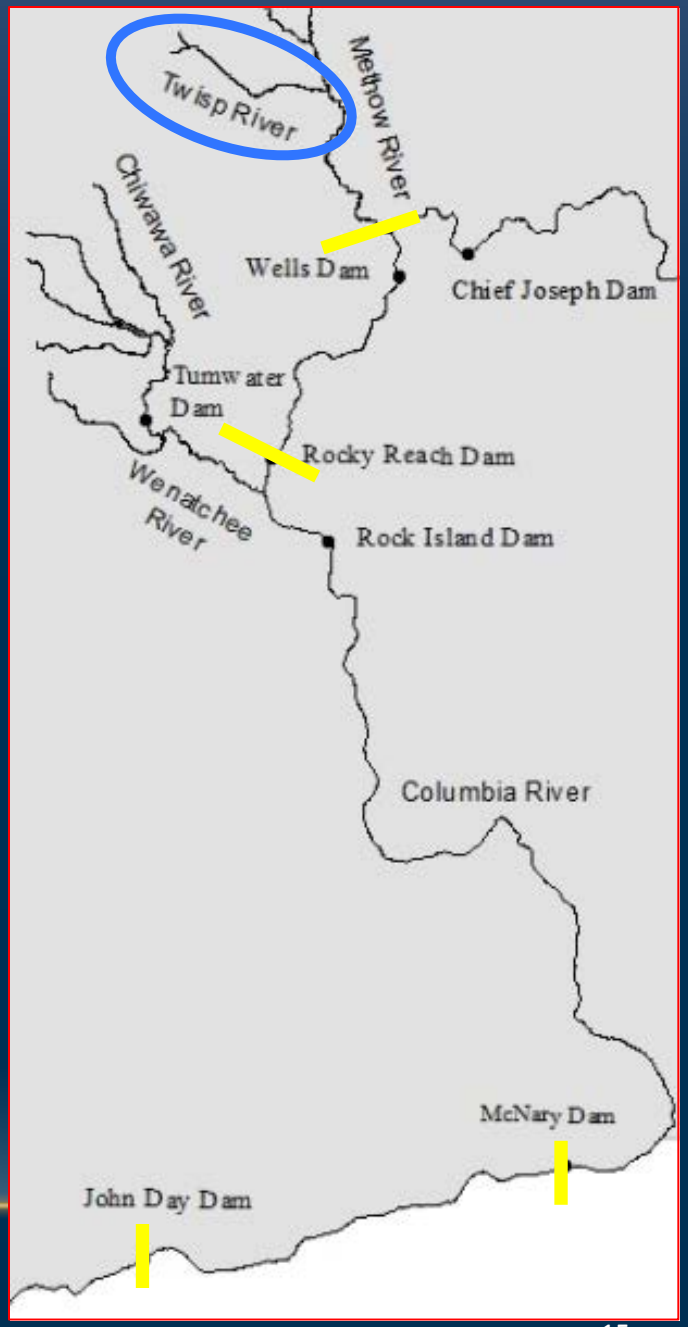
CASE STUDY: TWISP RIVER STEELHEAD

TWISP RIVER STEELHEAD

- 2010 – 2012 (July – October):
  - 5,422 juvenile *O. mykiss* tagged
- CSS Study
- Hatchery effectiveness monitoring for Douglas PUD

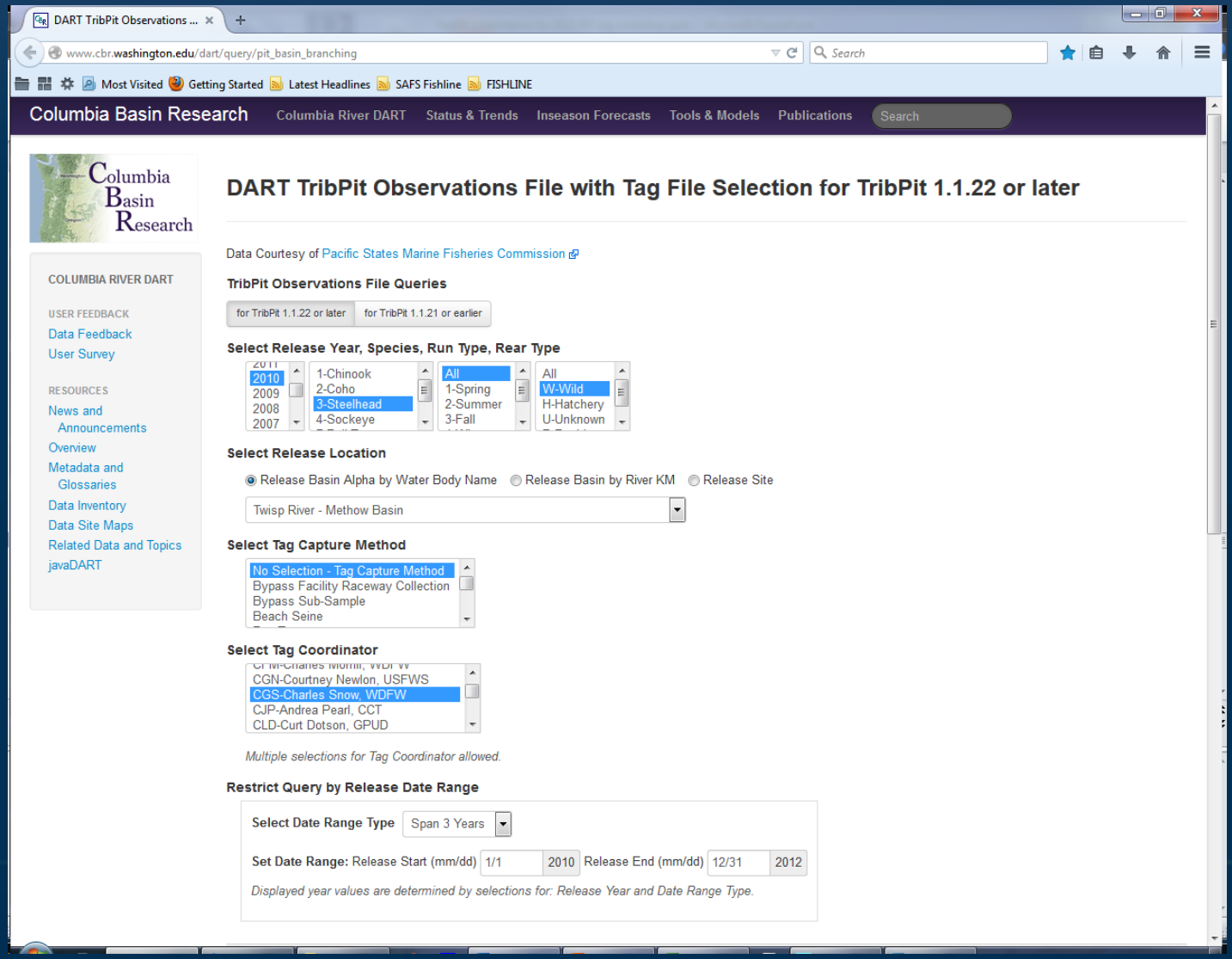
TWISP RIVER STEELHEAD

- Brood Year: 2010
- Tagging: Hook and line, electroshock, rotary screw trap
  - 2010: 211
  - 2011: 759
  - 2012: 514
- Age data
  - Scale samples (WDFW)
  - < 90 mm: subyearlings (fall) or yearlings (July)
- Detection Sites
  - LMR = Lower Methow River – couldn't use
  - Rocky Reach, McNary, John Day



DART DATA QUERY:

WWW.CBR.WASHINGTON.EDU/DART/QUERY/PIT_BASIN_BRANCHING



TAGGING AND OBSERVATION DATA

21	#RelGrpSt	RelGrpEndDate	TagID	SpRRT	RelVTime	Lgth	BrdYear	TagFile	MigrYear	TagDate	CoordID	RelSite	RiverKM	CaptureM	SessionM	ObsDateLast	ObsSite	ObsMonit	ObsStage
22																			
23	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/9/2009 13:00	167	NA	CGS09190.	2009	7/9/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/17/2010 0:35	TWR	Lower In-S	J
24	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	162	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/23/2009 23:48	TWR	Lower In-S	J
25	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	162	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/20/2010 13:31	RRJ	DSM Bypa	J
26	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	162	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/28/2010 7:22	MCJ	RIVER-1 E	J
27	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	163	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/22/2010 23:37	RRJ	DSM Bypa	J
28	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	137	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48.371360)RELLONG(120.170230)				
29	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	135	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/23/2010 16:58	RRJ	DSM Bypa	J
30	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	133	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48.369870)RELLONG(120.143630)				
31	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/16/2010 21:51	TWR	Lower In-S	J
32	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	4/21/2010 19:56	RRJ	DSM Bypa	J
33	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	7/26/2011 10:28	BO1	VERTICAL	A
34	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/4/2011 19:00	MC1	COUNTIN(	A
35	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/12/2011 12:15	PRA	Left [East]	A
36	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/15/2011 9:14	RIA	Right Ladd	A
37	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/16/2011 16:51	RRF	WEIR 6	A
38	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/20/2011 11:22	WEA	Left Ladde	A
39	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	179	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	10/14/2011 5:56	LMR	Upstream	A
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42	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/10/2009 13:00	123	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48.373740)RELLONG(120.202300)				
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44	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/14/2009 13:00	119	NA	CGS09195.	2009	7/14/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/4/2009 15:15	TWR	Lower In-S	J
45	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/24/2009 13:00	157	NA	CGS09205.	2009	7/24/2009	CGS	TWISPR	843.066.01	HOOK	RELLAT(48.377820)RELLONG(120.236520)				
46	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	158	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48	8/20/2009 23:31	TWR	Lower In-S	J
47	1/1/2009	12/31/2012	3D9.1C2C(	32W	7/7/2009 13:00	153	NA	CGS09188.	2009	7/7/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48.369870)RELLONG(120.143630)				
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51	1/1/2009	12/31/2012	3D9.1C2D(	32W	7/24/2009 13:00	165	NA	CGS09205.	2009	7/24/2009	CGS	TWISPR	843.066.01	HOOK	RELLAT(48.377820)RELLONG(120.236520)				
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53	1/1/2009	12/31/2012	3D9.1C2D(	32W	7/10/2009 13:00	135	NA	CGS09191.	2009	7/10/2009	CGS	TWISPR	843.066.0(	HOOK	RELLAT(48.371360)RELLONG(120.170230)				
54	1/1/2009	12/31/2012	3D9.1C2D(	32W	7/24/2009 13:00	112	NA	CGS09205.	2009	7/24/2009	CGS	TWISPR	843.066.01	HOOK	RELLAT(48.380050)RELLONG(120.243110)				
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PROGRAM TRIBPIT

WWW.CBR.WASHINGTON.EDU/ANALYSIS

TRIBPIT

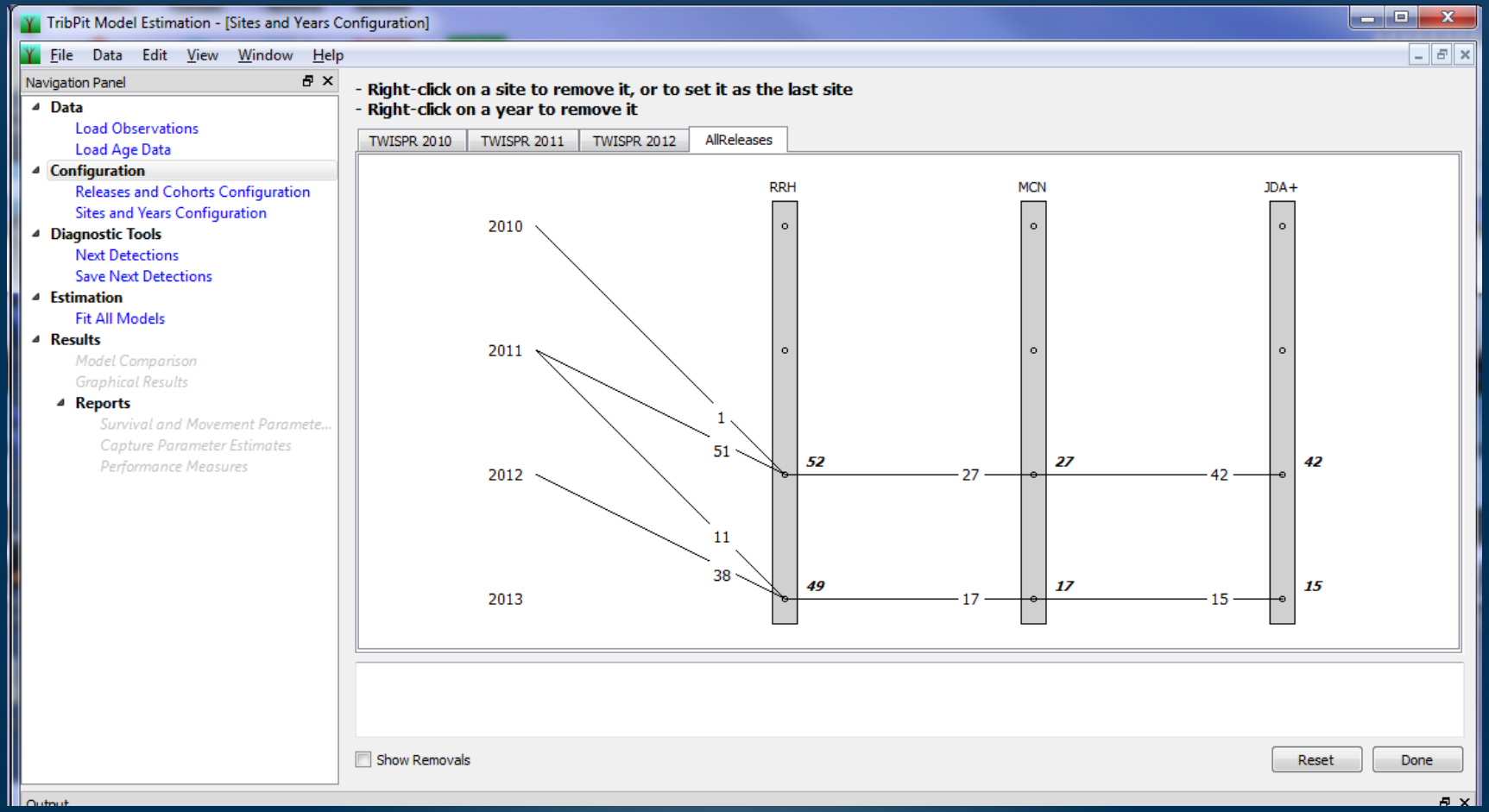
Analysis of PIT-tag detections in tributaries

Version 1

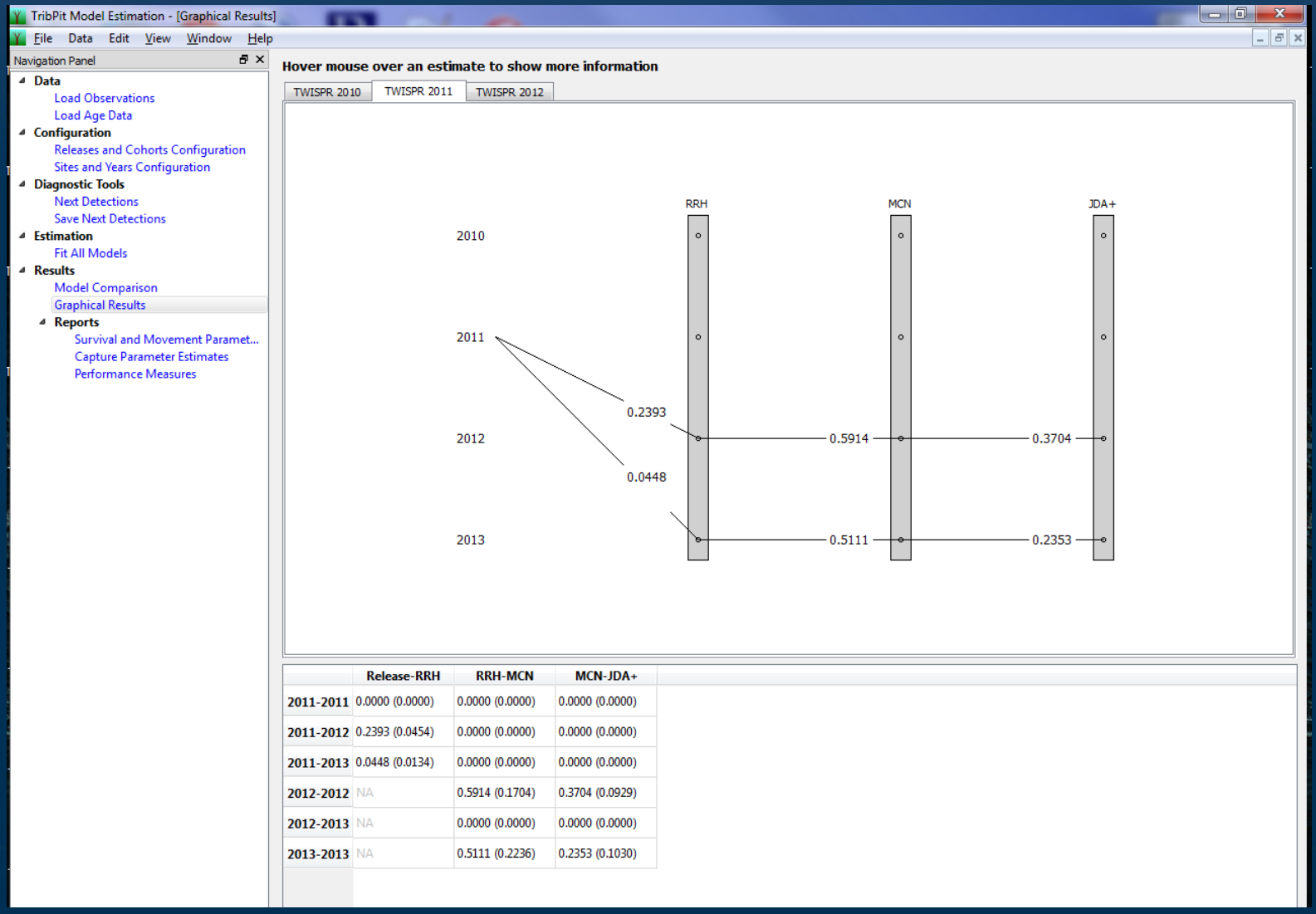
Jim Lady and Peter Westhagen
John R. Skalski, Project Manager
University of Washington
School of Aquatic & Fishery Sciences

Funding provided by the Bonneville Power Administration

SITES AND YEARS CONFIGURATION

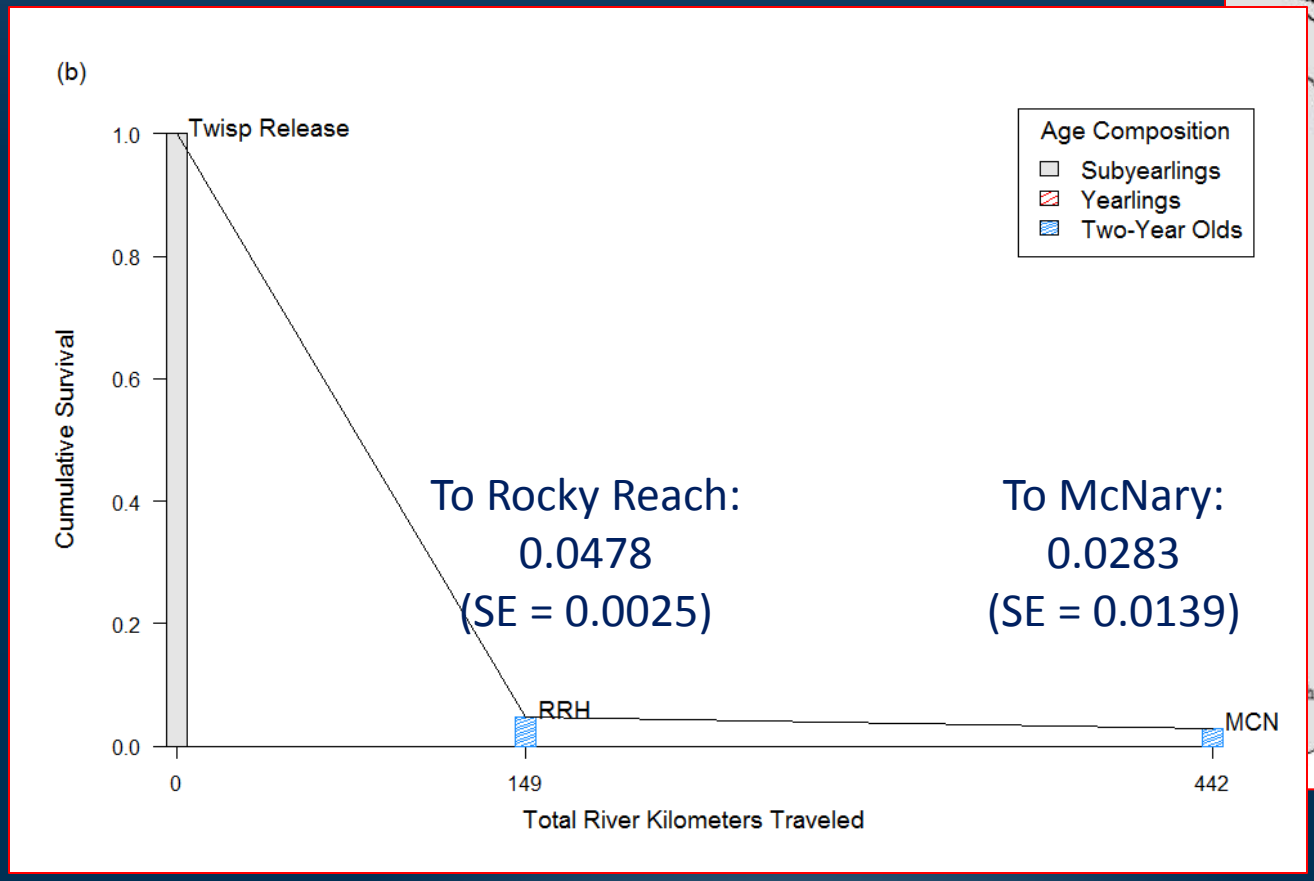


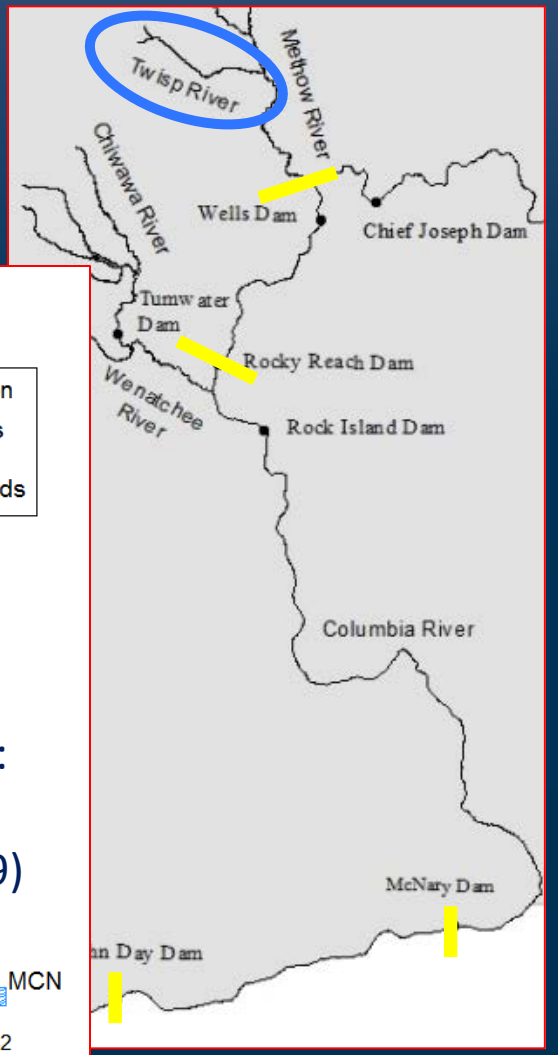
RESULTS: TRANSITION PROBABILITIES



	Release-RRH	RRH-MCN	MCN-JDA+
2011-2011	0.0000 (0.0000)	0.0000 (0.0000)	0.0000 (0.0000)
2011-2012	0.2393 (0.0454)	0.0000 (0.0000)	0.0000 (0.0000)
2011-2013	0.0448 (0.0134)	0.0000 (0.0000)	0.0000 (0.0000)
2012-2012	NA	0.5914 (0.1704)	0.3704 (0.0929)
2012-2013	NA	0.0000 (0.0000)	0.0000 (0.0000)
2013-2013	NA	0.5111 (0.2236)	0.2353 (0.1030)

TWISP STEELHEAD: COHORT SURVIVAL





DATA REQUIREMENTS

- PIT-tag subyearlings
- Age the fish – all the fish you want to use to estimate cohort survival
- Sample size
  - Sample size of subyearlings is key
  - Large enough to represent every migration year for cohort
  - Tributary Survival SampleSize (Columbia Basin Research)

CONCLUSIONS

- Cohort survival is the probability of a subyearling surviving to a downstream location
  - Proportions of fish outmigrating each year
  - Survival for each age class
  - Performance metric from Bi-Op
- What we learn from cohort survival and TribPit
  - Survival to the hydrosystem
  - Where are fish overwintering
  - Age structure of migrants
- Applications
  - Steelhead juvenile outmigration
  - Fall Chinook salmon
  - Spring Chinook salmon (non-natal rearing areas)
- Software: www.cbr.washington.edu/analysis

THANKS

- Software:
  - Jim Lady and Susannah Iltis, Columbia Basin Research, University of Washington
- Consultation:
  - Andrew Murdoch, Todd Miller – WDFW
  - Tim Copeland, Brett Bowersox, Nick Davids – IDFG
  - Scott Favrot – ODFW
  - Jody White – QCI
  - Joe Zendt – Yakama Nation
  - Rick Orme – Nez Perce Tribe
  - Josh Murauskas – Anchor QEA
  - Pat Connolly – USGS
- Funding: Bonneville Power Administration