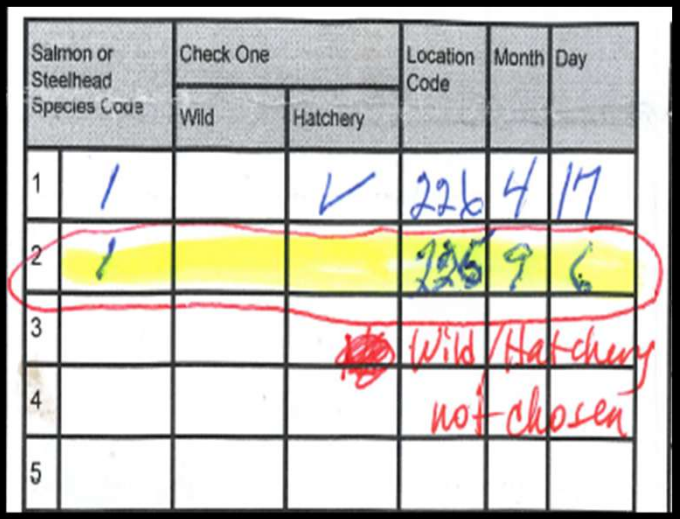
Update on mobile catch records and eCreel in Oregon

Michelle Jones, Biometrician

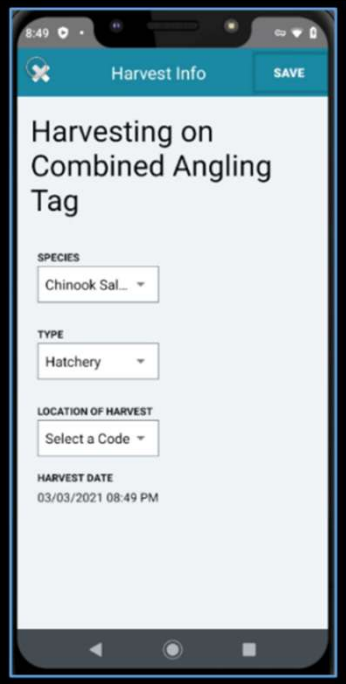
ODFW, Salem HQ

Michelle.k.jones@odfw.oregon.gov

In 2019, Oregon provided anglers with a choice to use a smart phone app instead of carrying paper licensing documents



	Salmon or Steelhead Species Code	Check One: Wild	Check One: Hatchery	Location Code	Month	Day
1	1		✓	226	4	17
2	1			125	9	6
3				Wild/Hatchery not chosen		
4						
5						



Licensing documents are for law enforcement

COMBINED ANGLING TAG LOCATION CODES

OCEAN HARVESTED FISH ONLY (FOR BAYS AND ESTUARIES USE RIVER SYSTEMS CODES)

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7	Siletz Bay
8	Depoe Bay
9	Newport
10	Waldport
11	Florence
12	Winchester Bay
13	Charleston
20	Sunset Bay
14	Bandon
15	Port Orford
16	Gold Beach
17	Brookings

COASTAL RIVER SYSTEMS

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98	Tillamook R.
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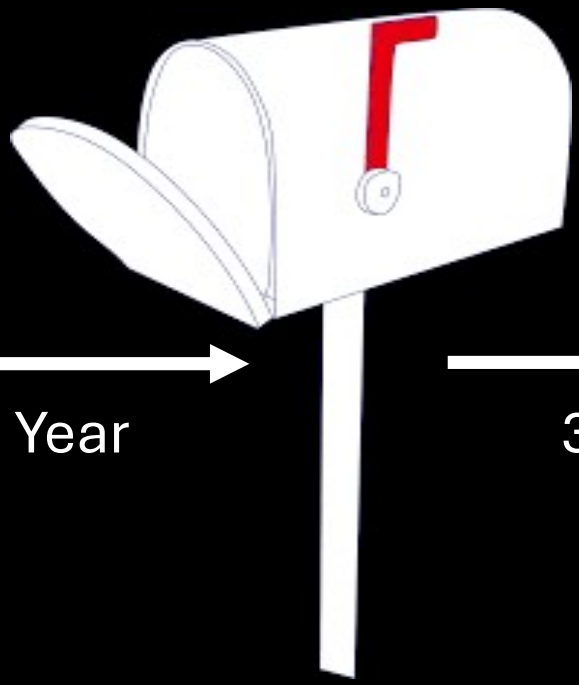
107	Little North Fk. (Wilson R.)
108	Winchuck R.
110	Yachats R.
111	Yaquina R. & Bay

All recreational anglers must report salmon and steelhead harvest on harvest cards

Prior to 2019...


STATE OF OREGON GAME COMMISSION
SALMON—STEELHEAD PUNCH CARD
Jan. 1, 1956—Dec. 31, 1956 867
FISHING LICENSE NO. 915
FOR INSTRUCTIONS SEE OTHER SIDE
KIND OF FISH Check One
Salmon
Steelhead
KIND OF FISH Check One
Salmon
Date
River

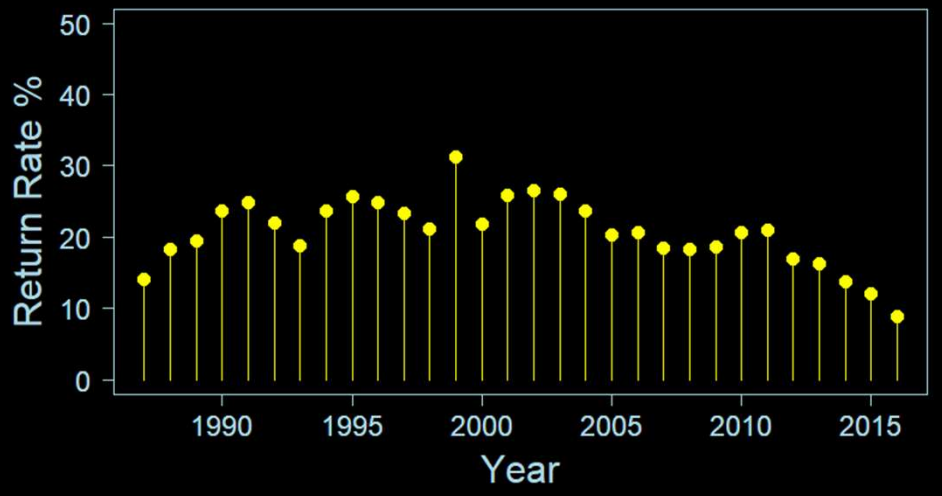
1 Year

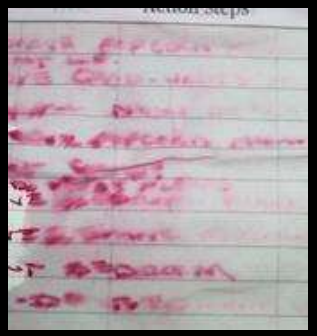


3 Years

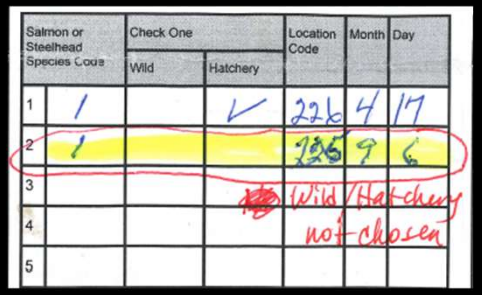
Paper harvest card data contains many sources of uncertainty

Low Returns





Legibility



Missing Information

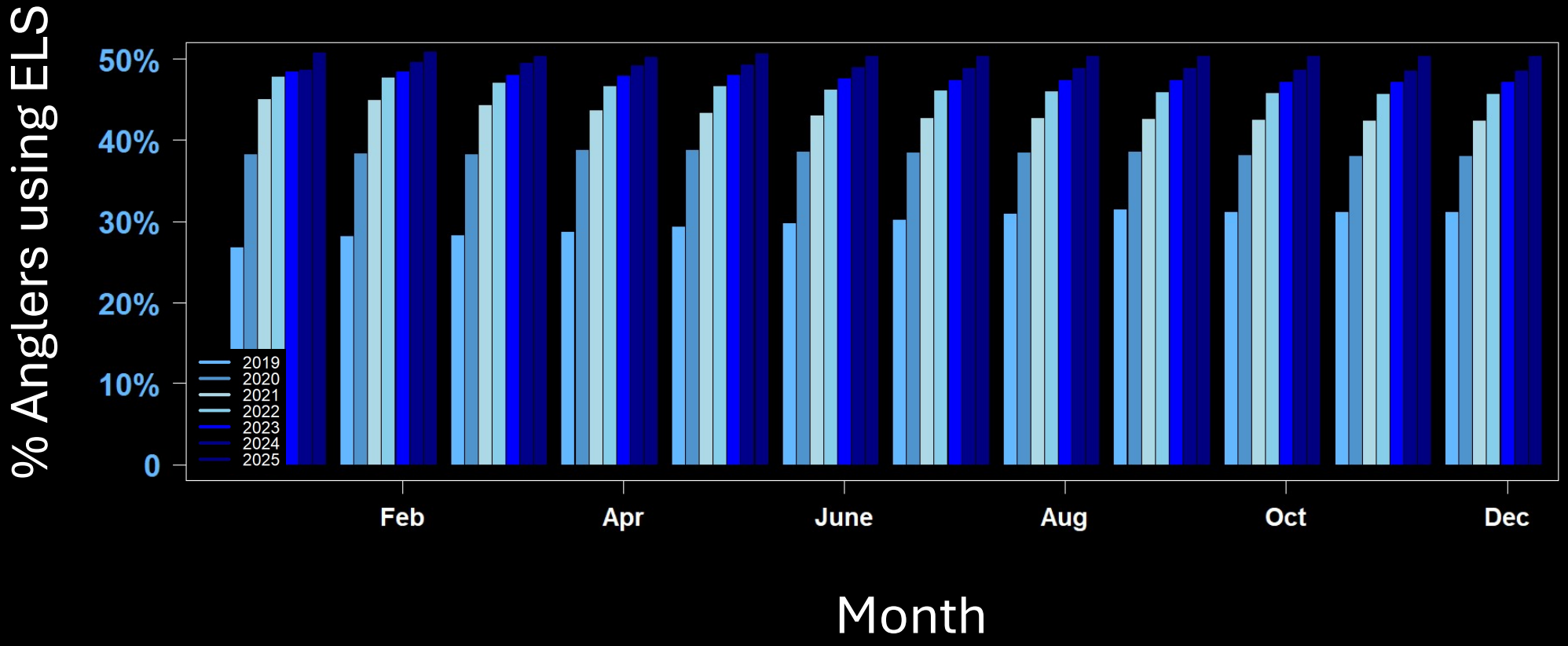
Electronic cards provided new data streams

Immediate upload
Complete information

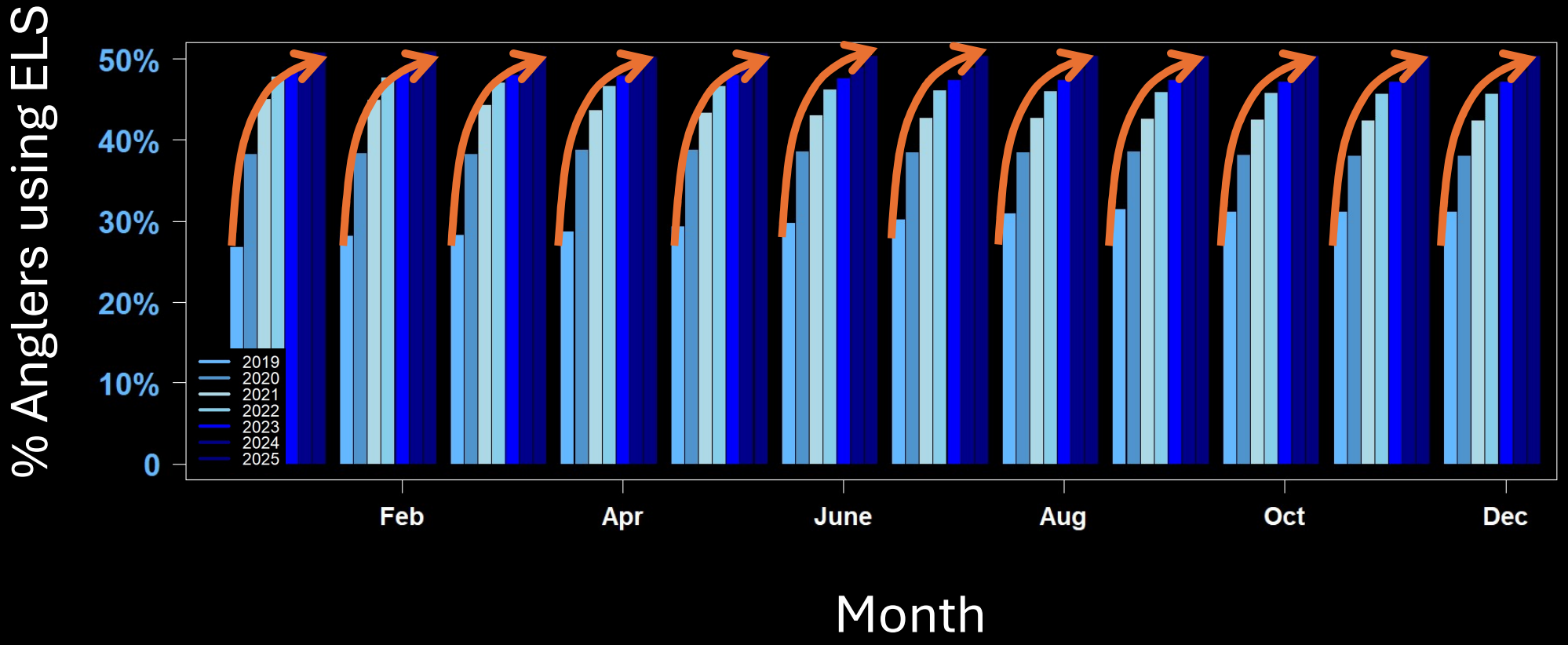

STATE OF OREGON GAME COMMISSION
SALMON–STEELHEAD PUNCH CARD
Jan. 1, 1956—Dec. 31, 1956
867
FISHING LICENSE NO. 965
FOR INSTRUCTIONS SEE OTHER SIDE
KIND OF FISH Check One
KIND OF FISH Check One

Delayed
Missing information

ELS use has steadily increased across years

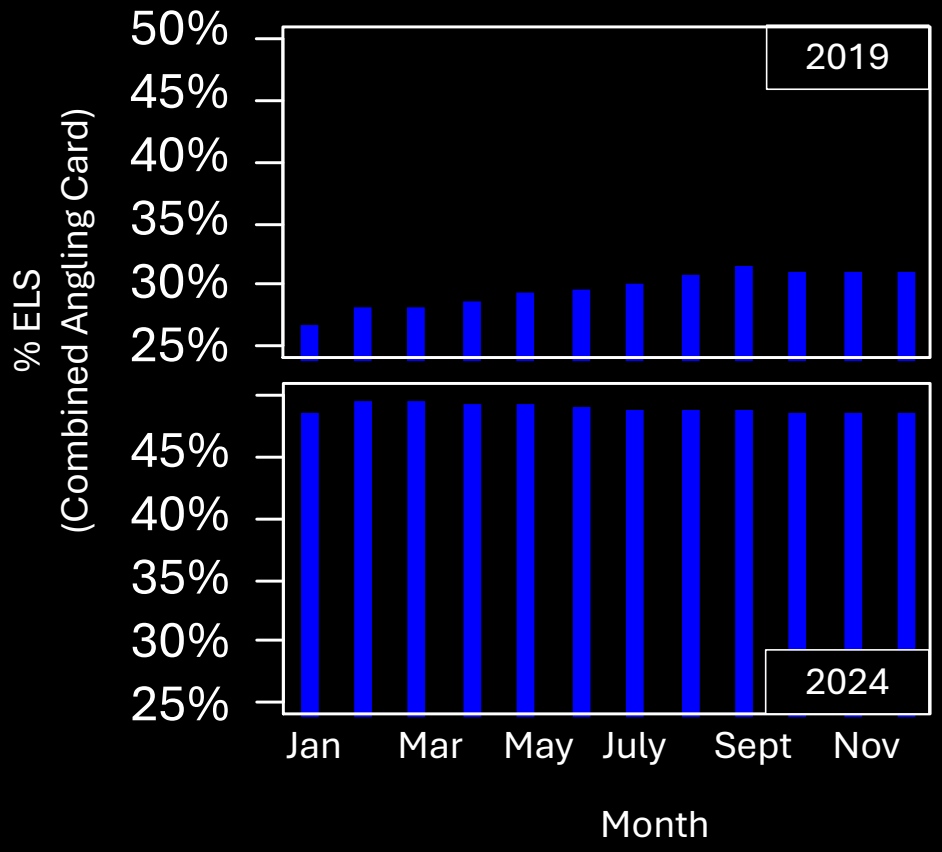


ELS use has steadily increased across years

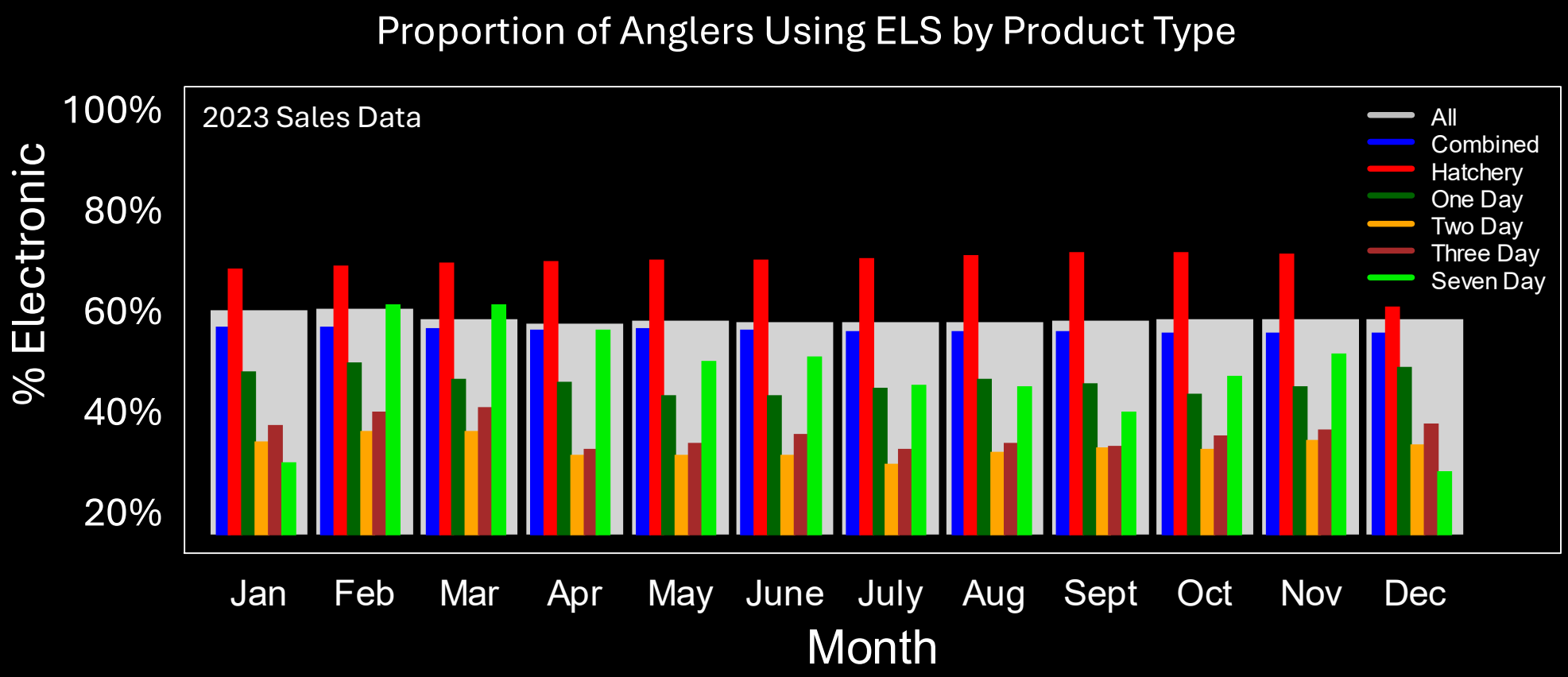


Within years, the proportion of anglers using ELS has stabilized

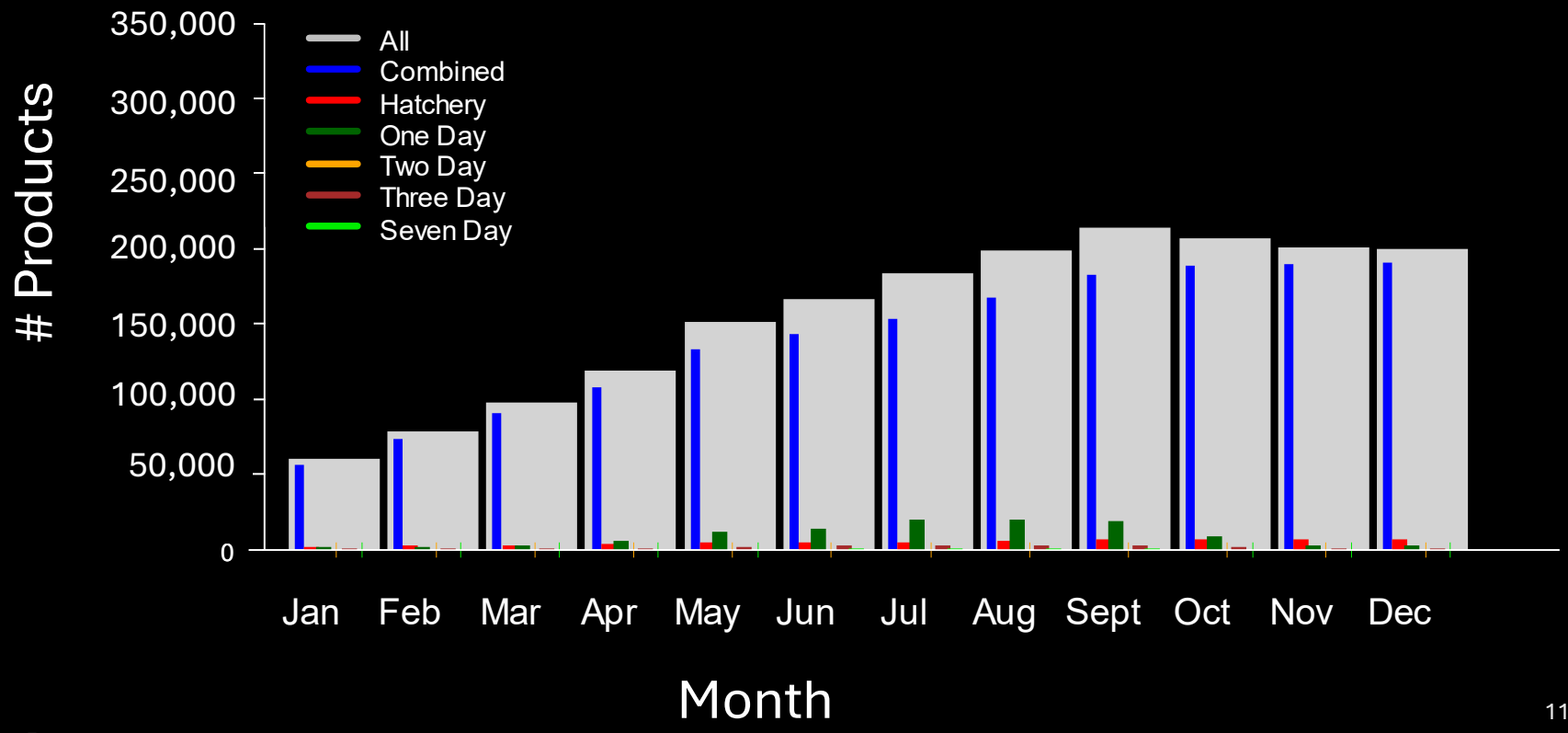
Initially, the proportion of anglers using ELS steadily increased throughout the year, while now it remains constant.



ELS use differs by licensing product



Total Valid Products by Month



2023 Sales Data

Stratified harvest expansion from sales data:

$$\widehat{H} = \sum_{l}^{L} \left[\sum_{m=1}^{m=12} \frac{N_{l,etag}}{p_{els}{}_{l,m}} \right]$$

Stratified by month and angling product

$\widehat{H}$: Estimated harvest

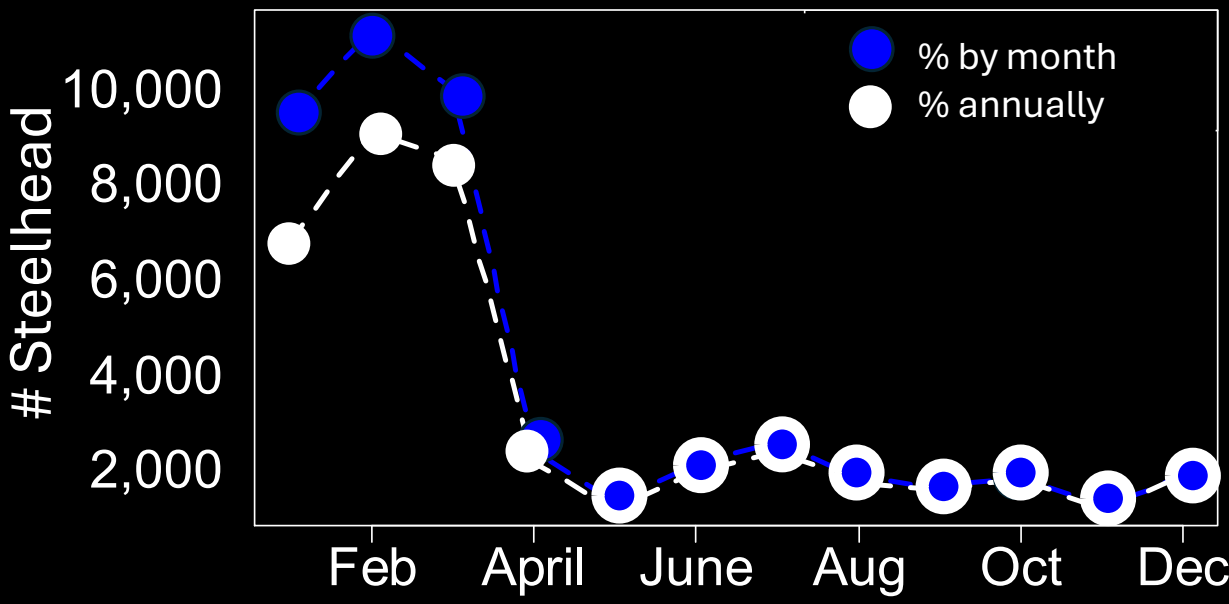
N_{etag}: Total harvest reported in the ELS system

p_{els}: Proportion of all licensed anglers with an ELS license in month m

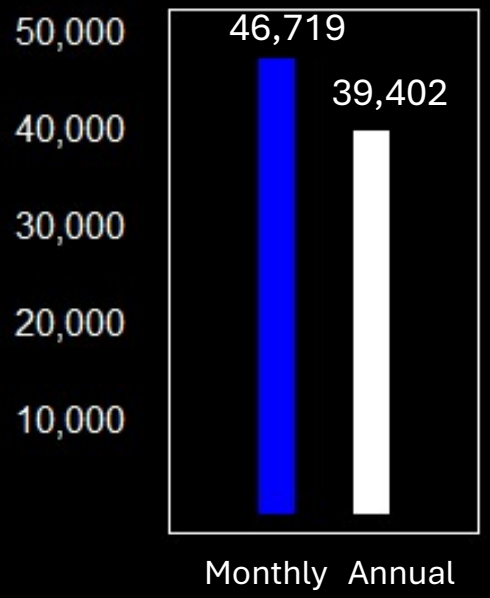
l: index for licensing product

L: Total number of licensing products

Stratifying by month prevents under-estimating winter and spring harvest



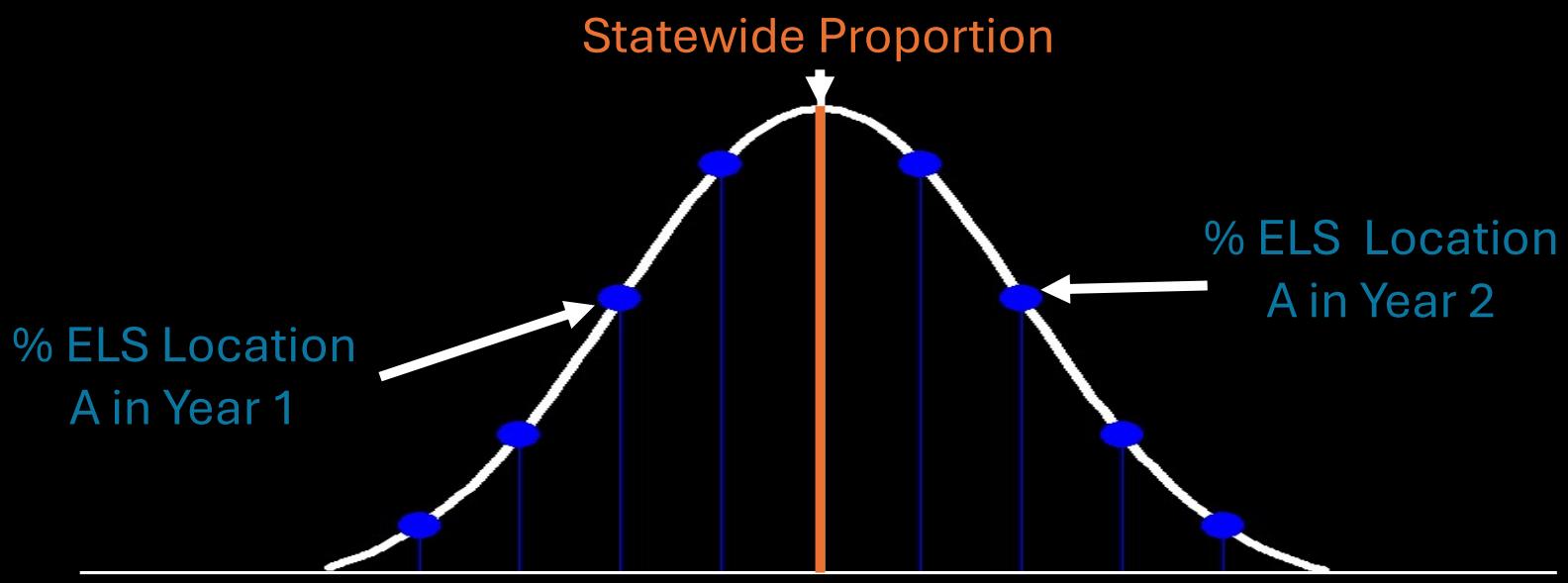
Annual Harvest Estimate



2019 data

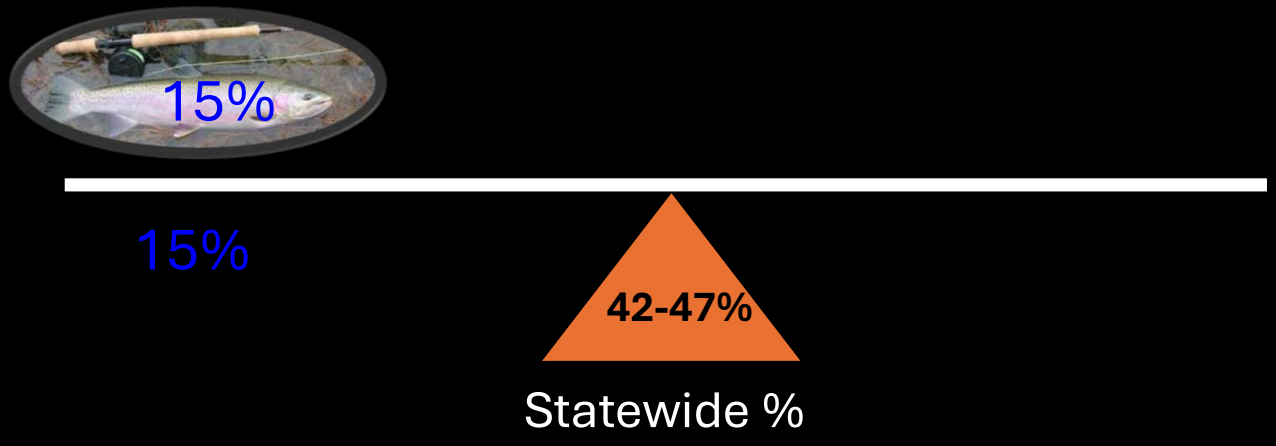
Sales Data Assumption

Anglers at specific locations are random draws from a single distribution



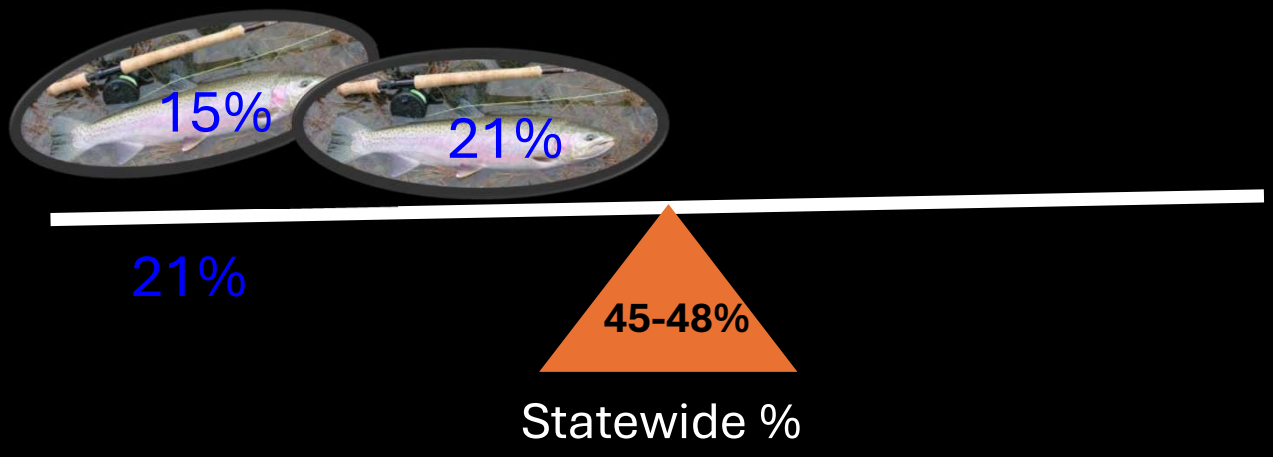
ELS Adoption in Rogue Steelhead Fishery

In 2021/2022 creel surveys found ~ 15% of Rogue River Steelhead anglers used ELS



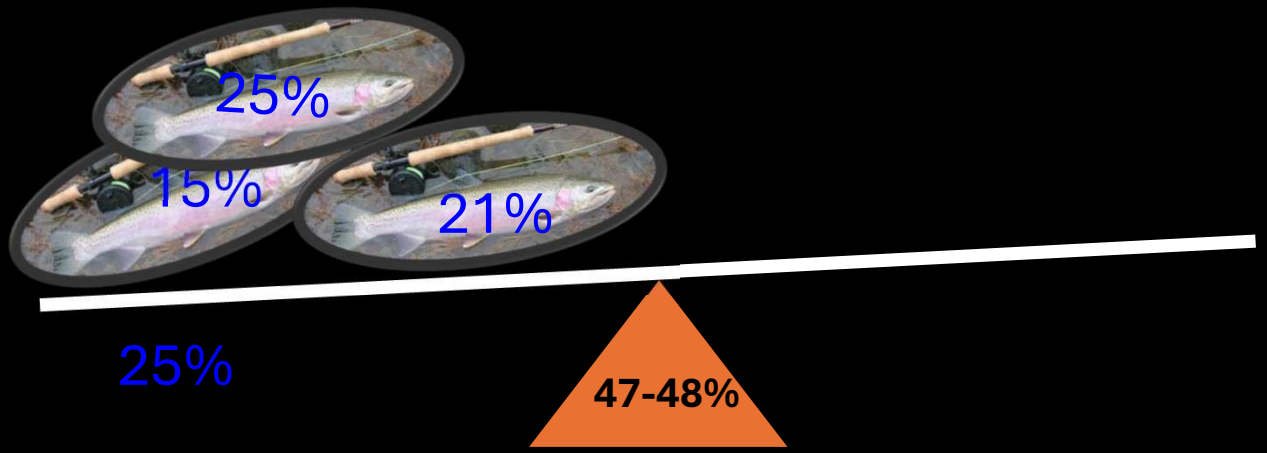
ELS Adoption in Rogue Steelhead Fishery

In 2022/2023 creel surveys found ~21% of Rogue River Steelhead anglers used ELS



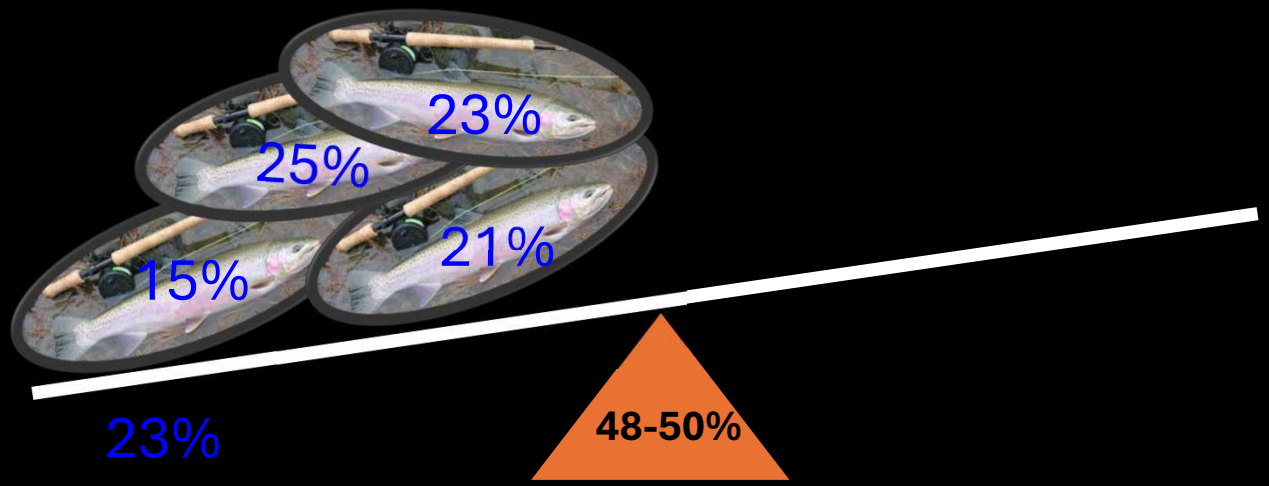
ELS Adoption in Rogue Steelhead Fishery

In 2023/2024 creel surveys found ~25% of Rogue River Steelhead anglers used ELS



ELS Adoption in Rogue Steelhead Fishery

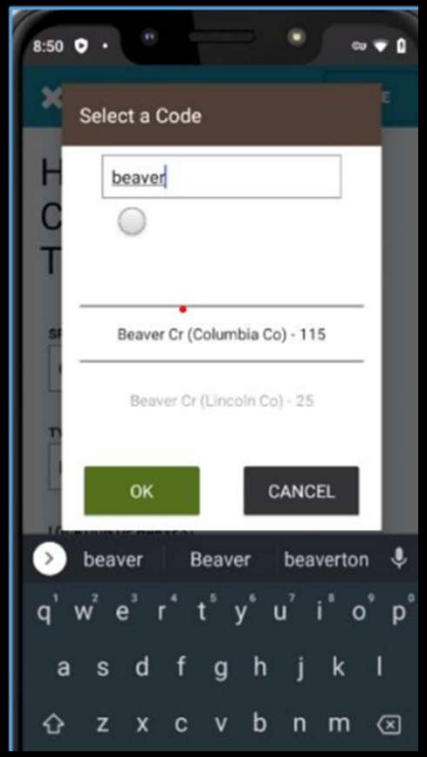
In 2024/2025 creel surveys found ~ 23% of Rogue River Steelhead anglers used ELS



Statewide %

Relying on sales data is nuanced and subject to many sources of bias and uncertainty

- Multiple product types
- Misreporting (location, species, etc.)
- No geographic resolution



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eCreel

Sample the fish, **not** the angler

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FEATURE ARTICLE

Paradigm Shift: Applying Capture–Recapture Techniques to Electronic Licensing System Data to Estimate Chinook Salmon Harvest

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Michelle K. Jones
Oregon Department of Fish and Wildlife, 4034 Fairview Industrial Drive Southeast, Salem, Oregon 97302, USA

Abstract

Implementing creel surveys that produce robust and unbiased estimates of harvest can be complicated, expensive, and labor intensive. Additionally, field personnel often face safety risks associated with traversing roads and highways, occasionally under inclement travel conditions. Here, we develop an alternative method to estimate recreational fish harvest using a hybrid creel that employs capture–recapture techniques in conjunction with data collected from the Oregon Department of Fish and Wildlife's electronic licensing system. We evaluated the method by comparing harvest estimates between the new approach (e-creel) and estimates from a traditional roving creel conducted on four of Oregon's coastal Chinook Salmon *Oncorhynchus tshawytscha* populations in 2019. Our results indicated that Chinook Salmon harvest estimates derived from our hybrid creel approach were more precise than estimates using traditional creel methods. Both methods generated statistically equivalent estimates of Chinook Salmon recreational harvest, differing by only 3.4%. Estimated mean harvest was 1,264 Chinook Salmon based on the e-creel approach versus 1,258 based on the traditional creel approach. On average, the e-creel estimates reduced the SE by 41% relative to traditional creel estimates. Post hoc assessment of spending associated with creel projects in 2019 suggested that a total savings of US$74,525 in personnel and operational cost, corresponding to an average 15% budget reduction per investigation, could be realized by transitioning from a traditional creel design to an e-creel design.

Time Step 1 – Anglers report their catch

Recorded in ELS (marked)

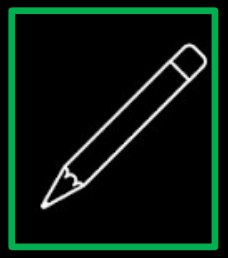
X1

These fish are our “M”

or

Recorded on Paper (unmarked)

X0



Time Step 2 – Creelers look for harvested fish

Seen in creel

X_1

or

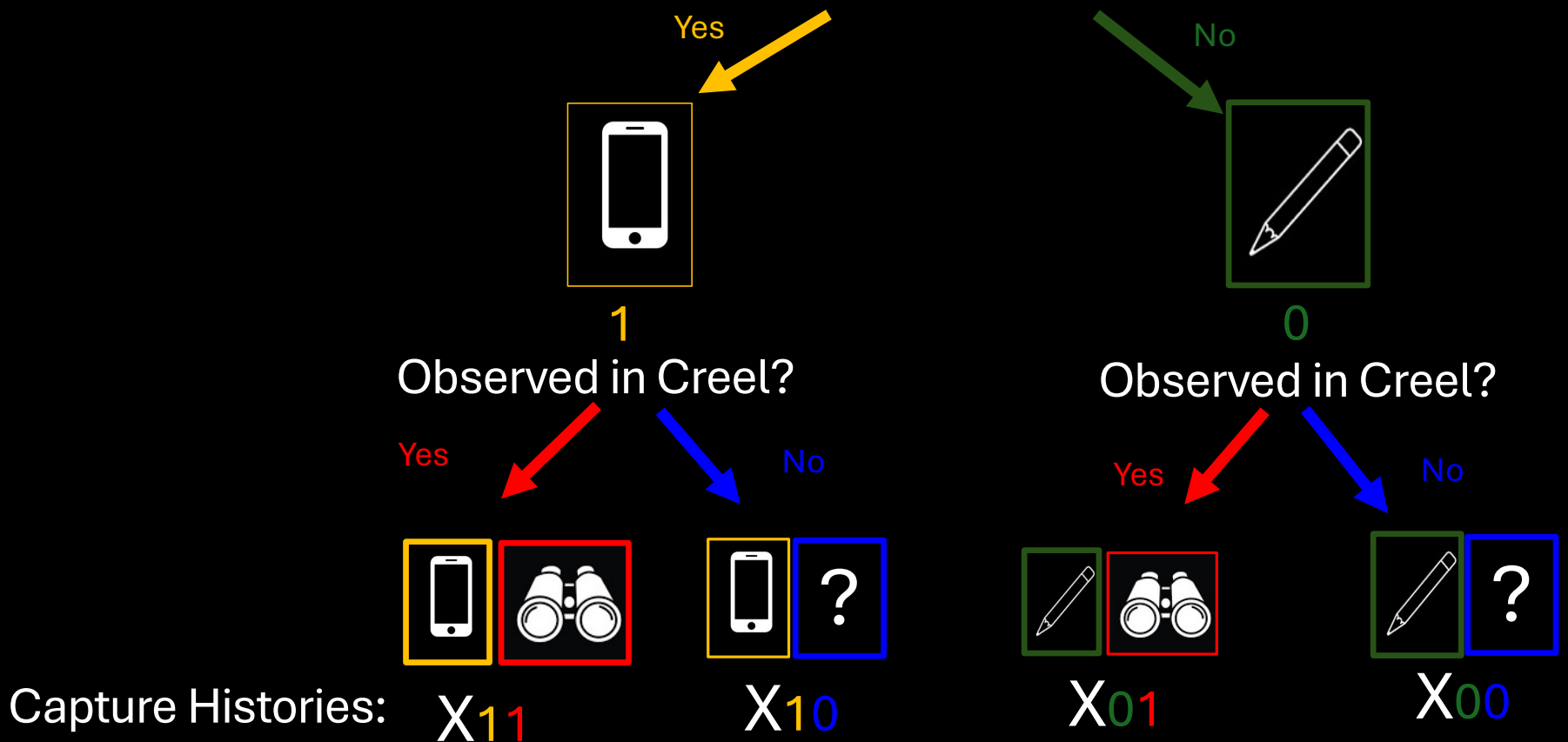
Not seen in creel

X_0

?

These fish are our total captures, “c”

Recorded in ELS



A less presuming alternative - eCreel

Large Sample

$$\widehat{H} = \frac{MC}{R}$$

Small Sample

$$\widehat{H} = \frac{(M+1)(C+1)}{R+1} - 1$$

$\widehat{H}$*:* Estimated harvest

M: Total number of fish entered by anglers into the ELS system

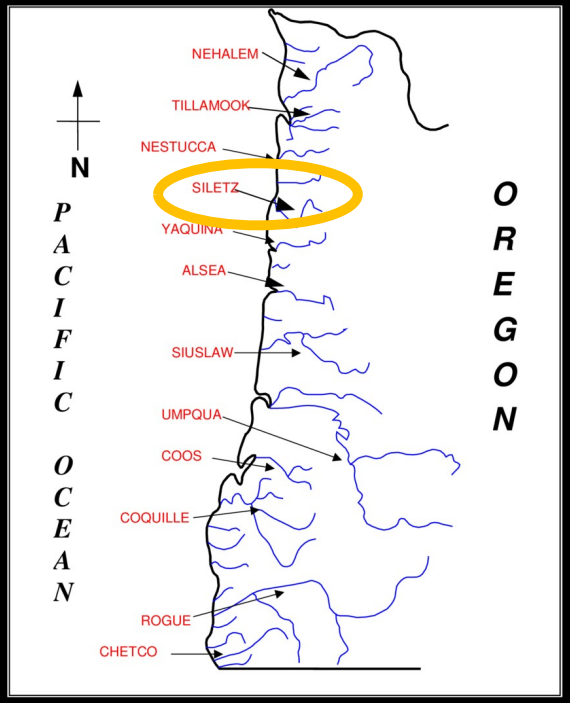
C: Total fish observed by surveyors (including paper-tagged fish)

R: Total fish observed by surveyors that were also tagged electronically

Fall Coastal Chinook Fisheries

Location	Year	eCreel -Estimate (SD)	ELS Expansion*	|% △ |
Salmon River*	2019	1,001 (144)	798*	25%
	2020	903 (903)	921*	2%
	2021	1,084 (79)	852*	27%
	2022	794 (62)	747*	6%
	2023	1,231 (133)	960*	28%
	2024	1,870 (112)	1,381*	35%
Siletz River*	2019	1,776 (176)	2,096	15%
	2020	1,826 (94)	2,414	24%
	2021	1,745 (85)	2,036	14%
	2022	2,406 (123)	2,727	12%
	2023	3,142 (100)	3,868	18%
	2024	4,744 (142)	4,276	11%

The ELS expansions presented here are not a direct match with the exact dates of each eCreel and are for general inference only.

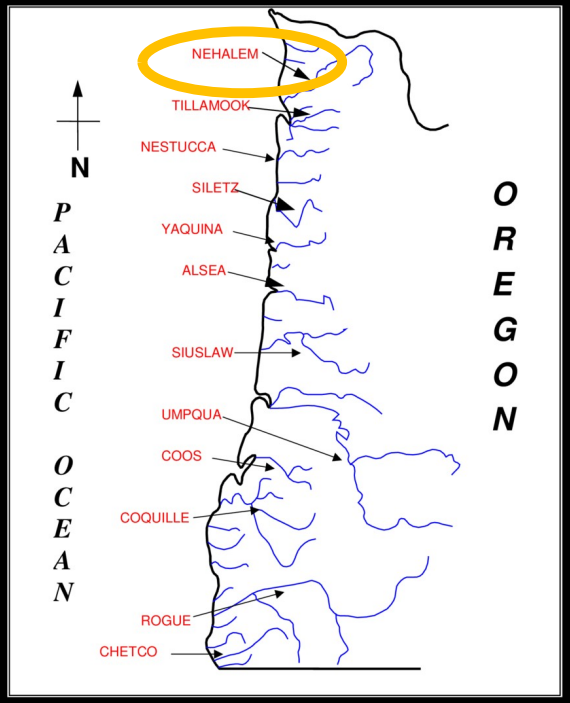


Provided by Coastal Chinook Research and Monitoring Program – contact Brian Riggers

Fall Coastal Chinook Fisheries

Location	Year	eCreel Estimate (SD)	ELS Expansion	|%△|
Nehalem River*	2019	1,527 (133)	1,499*	2%
	2021	1,858 (122)	2,598*	28%
	2022	1,983 (108)	2,555*	22%
	2023	2,408 (120)	2,921*	17%
	2024	2,575 (103)	2,798*	8%
Elk River	2019	565 (67)	518	9%
	2020	489 (37)	447	9%
	2021	493 (37)	495	1%>
	2022	632 (42)	354	78%
	2023	452 (33)	412	9%
	2024	348 (21)	284	22%

The ELS expansions presented here are not a direct match with the exact dates of each eCreel and are for general inference only.

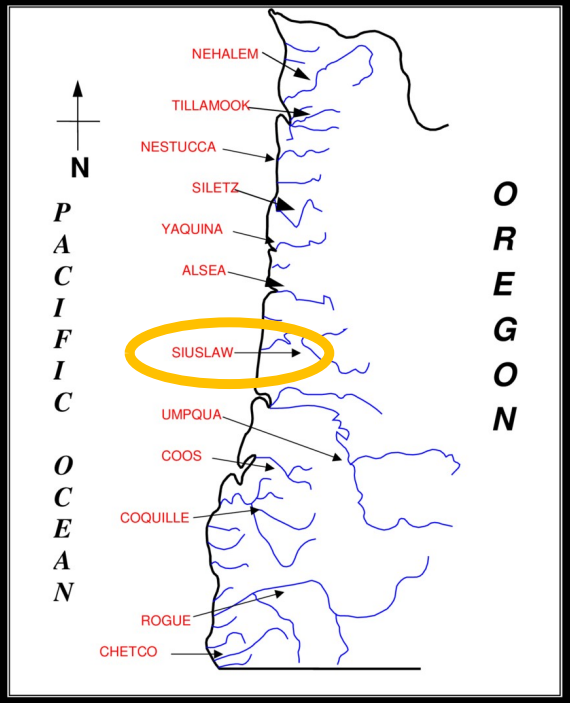


Provided by Coastal Chinook Research and Monitoring Program – contact Brian Riggers

Fall Coastal Chinook Fisheries

Location	Year	eCreel Estimate (SD)	ELS Expansion	|% △ |
Siuslaw River	2020	1,314 (55)	1,248	5%
	2021	1,591 (80)	1,691	6%
	2023	2,070 (77)	2,434	15%
	2024	1,838 (55)	2,277	19%
Sixes	2020	503 (86)	423	19%
	2021	277 (33)	234	18%
	2022	215 (14)	210	2%
	2023	269 (29)	356	24%
	2024	211 (19)	149	41%

The ELS expansions presented here are not a direct match with the exact dates of each eCreel and are for general inference only.

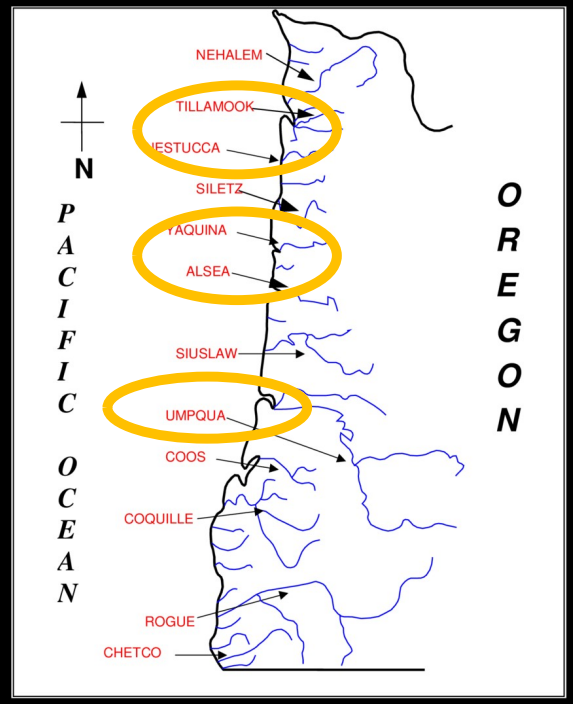


Provided by Coastal Chinook Research and Monitoring Program – contact Brian Riggers

Fall Coastal Chinook Fisheries

Location8%	Year	eCreel Estimate (SD)	ELS Expansion	|△%|
Umpqua River	2022	2,392 (87)	2,962	20%
	2023	1,922 (61)	2,484	23%
	2024	2,063 (82)	2,071	<1%
	2025	664 (Wild) 148 (Hatchery)	604 (Wild) 136 (Hatchery)	<1% 9%
Tillamook River	2022	356 (52)	330	8%
Nestucca River	2023	1,176 (51)	2,598	55%
	2024	2,206 (110)	2,072	6%
Yaquina River	2023	519 (78)	432	20%
	2024	553 (50)	502	10%
Alsea River	2023	2,365 (180)	3,189	26%
	2024	2,662 (133)	3,352	21%

The ELS expansions presented here are not a direct match with the exact dates of each eCreel and are for general inference only.

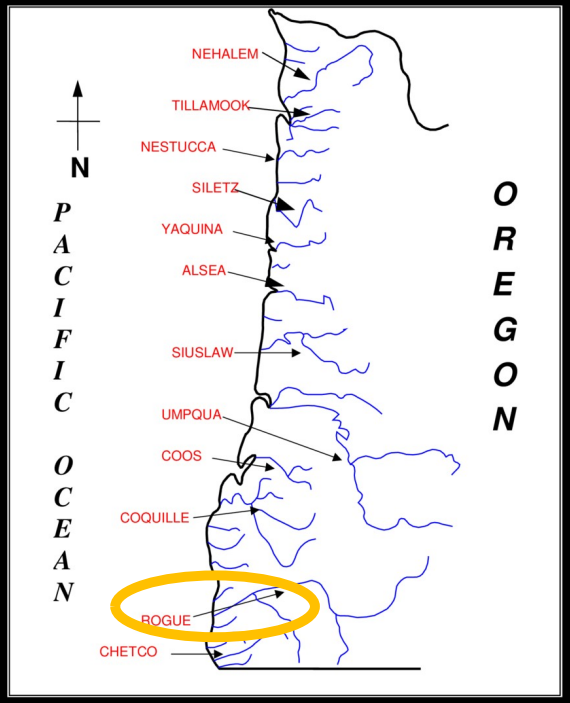


Provided by Coastal Chinook Research and Monitoring Program – contact Brian Riggers

South Coast Fall Chinook Fisheries

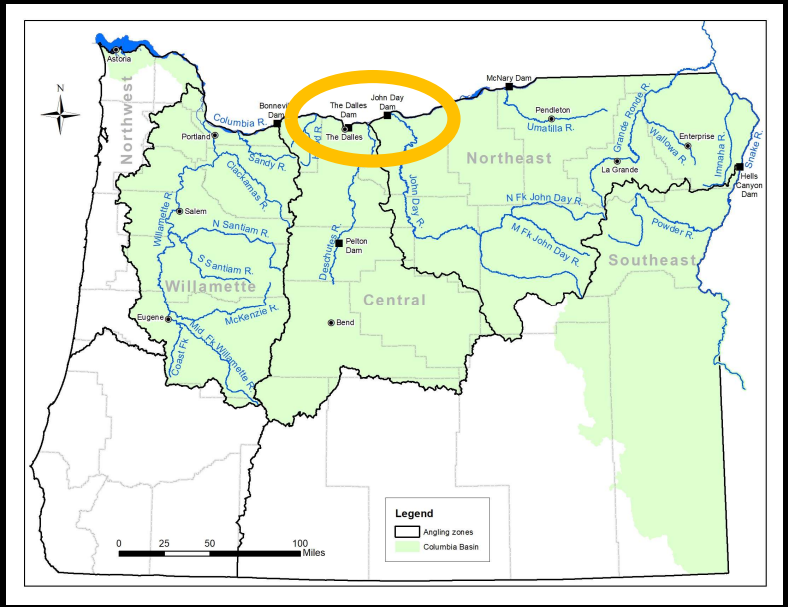
Location	Type	Year	eCreel	Creel	|△%|
Rogue Bay	Hatchery	2023	160	172	7%
		2024	320	287	11%
		2025	88	107	18%
	Wild	2023	3,814	3,647	4%
		2024	4,976	4,409	12%
		2025	2,830	2,512	12%

Data provided by Laura Green and other district staff.



Zone 6 Columbia River

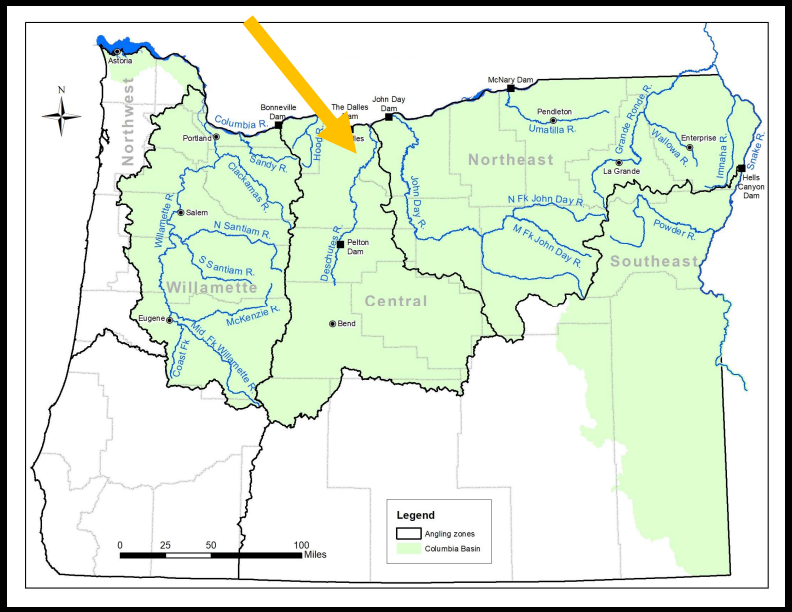
Species	Year	eCreel	Roving Creel	|%△|
Spring Chinook	2023	2,022	1,038	94%
Spring Chinook	2024	1,375	1,440	4%
Summer Chinook	2023	189	54	200%
Fall Chinook	2023	12,035	15,848	30%
Fall Coho	2023	2,987	2,445	22%
Summer Sockeye	2023	63	50	26%



Creel estimates and data provided by Andrea Carpenter

Deschutes River

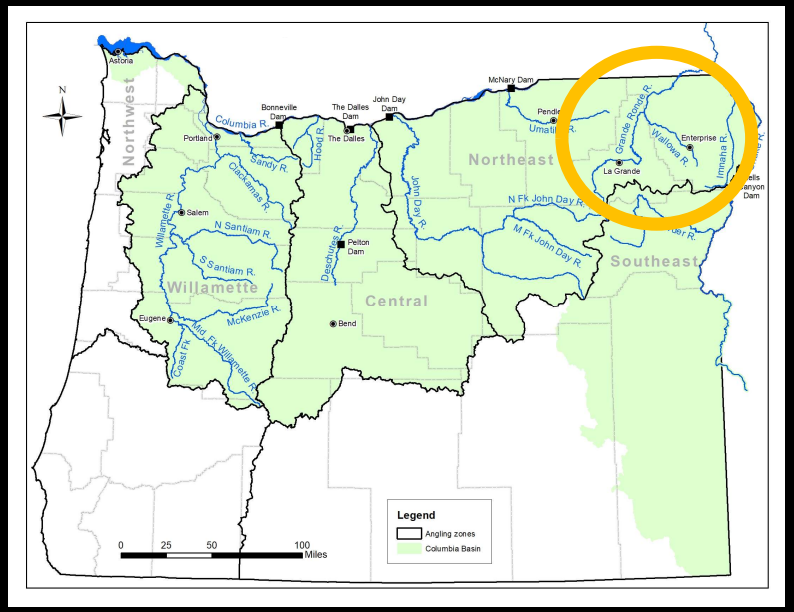
Species	Year	eCreel	ELS Expansion	|% △|
Chinook – Wild	2023	1,293	1,091	18%
	2024	1,012	773	31%
Chinook – Hatchery	2023	49	60	23%
	2024	76	57	33%
Coho – Wild	2023	136	95	43%
	2024	176	148	18%
Coho - Hatchery	2023	26	26	0
	2024	93	70	33%
Steelhead - Hatchery	2023	791	976	19%
	2024	1,590	1,809	12%



Creel estimates and data provided by Lindsay Powel and Jason Seals

East Region Steelhead Fisheries

Location	Species	Year	eCreel	ELS	|%△|
Imnaha	Steelhead	2021	87 (35)	57 (13)	52%
		2022	48 (22)	29 (12)	65%
		2023	90 (13)	94 (24)	4%
		2024	80 (9.6)	88 (39)	9%
Lower Grande Ronde	Steelhead	2021	144 (27)	64 (18)	125%
		2022	162 (30)	109 (23)	32%
		2023	350 (44)	195 (38)	44%
		2024	202 (32)	171 (44)	18%
Wallowa	Steelhead	2021	784 (159)	508 (65)	54%
		2022	623 (120)	321 (57)	94%
		2023	840 (16)	722 (71)	16%
		2024	1037 (167)	620 (81)	67%



- Discrepancies may be linked to differences in overlap between fishery & reporting codes

Gibson, P.P, Felhaus, J.W., & M.J., Greiner. 2024 Evaluation of eCreel methods for monitoring steelhead harvest in the Gande Ronde and Imnaha basins. Oregon Department of Fish and Wildlife East Region Research.

How do we advance the method to work for fisheries without reporting requirements?

Released targeted fish

Sensitive non-target species

Warmwater species

Option 1: Create ratios with marked fish

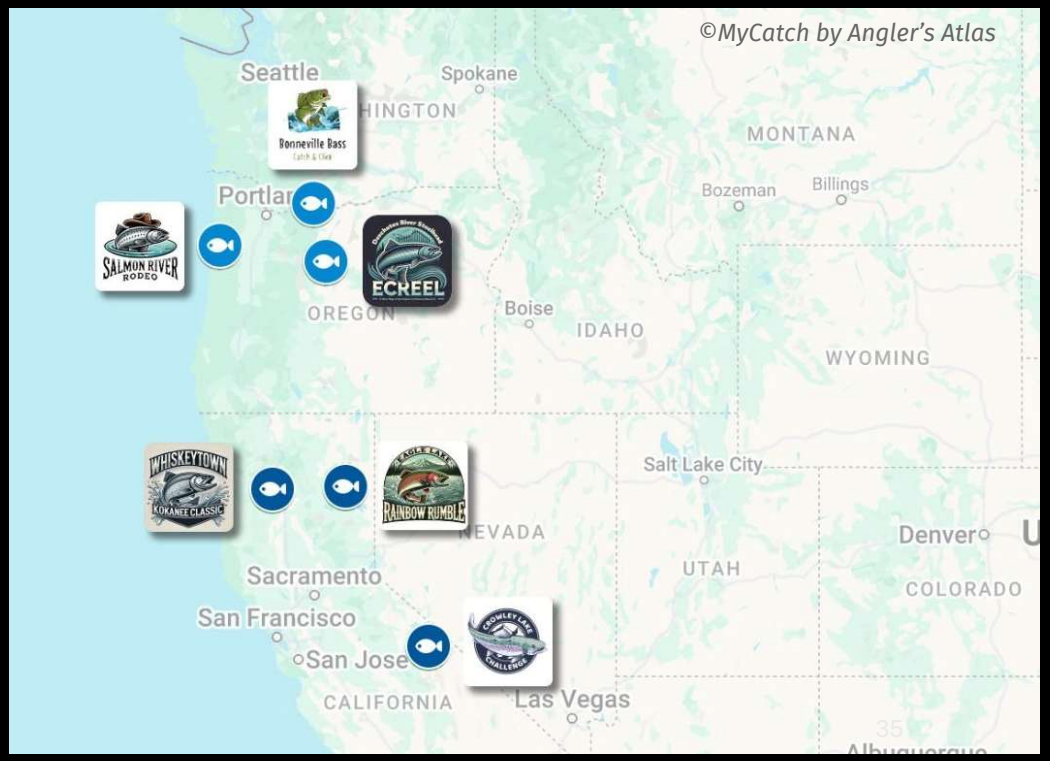
		E-creel		
Run year	Harvest estimate (full ELS data set)	SD of harvest estimate	Wild catch per harvest	Estimated wild catch
Imnaha (loc. 144)				
2021	143	59.7	1.364	195
2022	80	37.5	2.667	213
2023	131	19.6	1.353	177
2024	174	23.6	0.815	142
Lower Grande Ronde (loc. 231-233)				
2021	199	38.4	4.222	840
2022	198	36.7	2.387	473
2023	473	60.1	1.719	813
2024	312	52.9	3.854	1202
Wallowa (loc. 234-235)				
2021	925	184.6	0.471	436
2022	788	155.2	0.608	479
2023	1036	94.9	0.451	467
2024	1402	220.0	0.500	701

Gibson, P.P, Felhaus, J.W., & M.J., Greiner. 2024 Evaluation of eCreel methods for monitoring steelhead harvest in the Gande Ronde and Imnaha basins. Oregon Department of Fish and Wildlife East Region Research.

Option 2: Create incentivized platforms for voluntary reporting

Fishery-specific events set as pilot case-studies across 6 locations in Oregon & California

- Bonneville Pool
- Crowly Lake
- Deschutes River
- Eagle Lake
- Salmon River
- Whiskey Town Lake

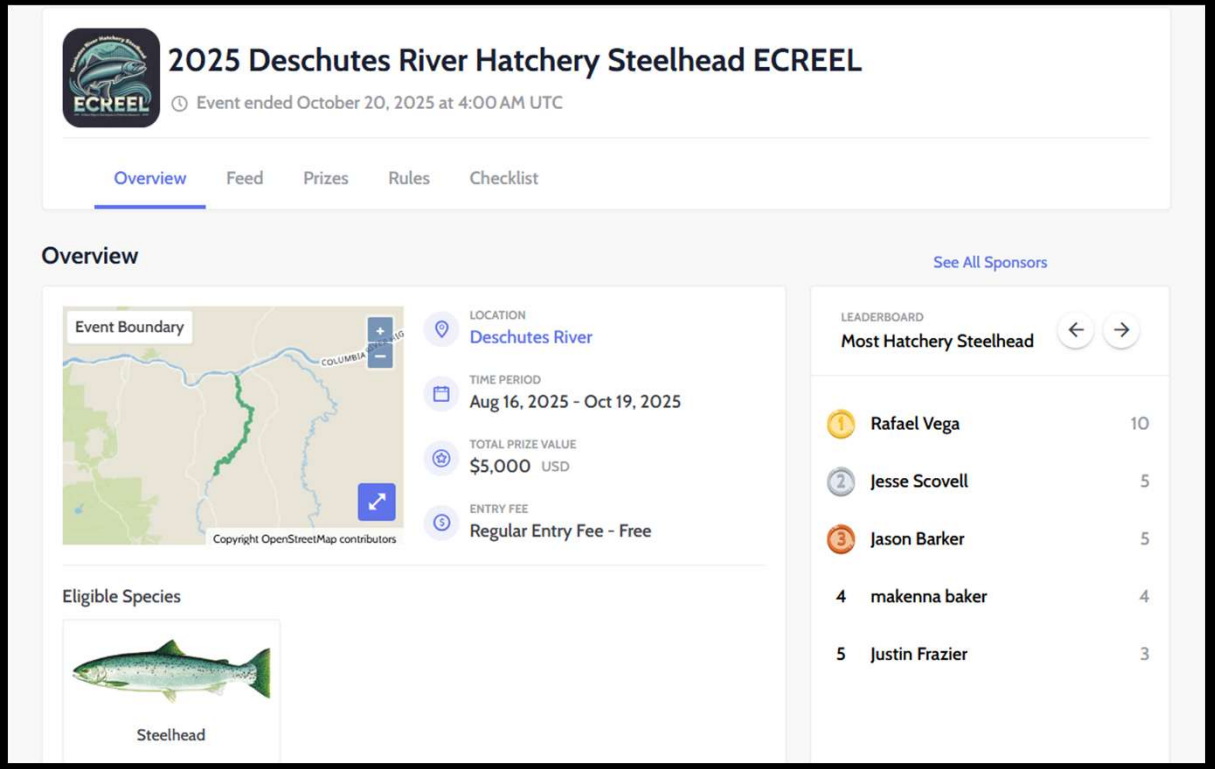


Partners

- *MyCatch by Angler's Atlas*
- *National Fish and Wildlife Foundation*
- *Oregon Department of Fish and Wildlife*
- *California Department of Fish and Wildlife*
- *Many local angling organizations and retailers*

General Design

- Create a virtual event
- Design a prize structure
- Recruit anglers
- Angler creates marks
- Surveyors provide recaptures



Angler Recruitment

- Anglers come for the prizes.
- The prizes structure encourages complete data.

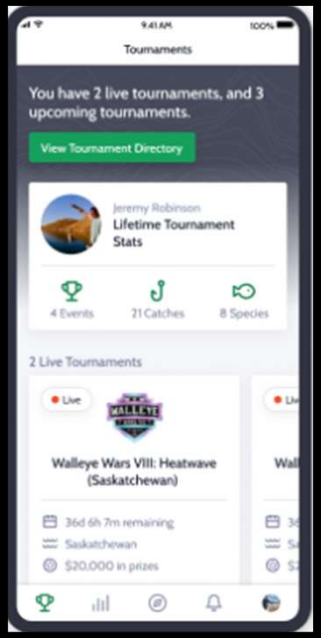
Anglers report fish (m) that surveyors can find through interviews (R)

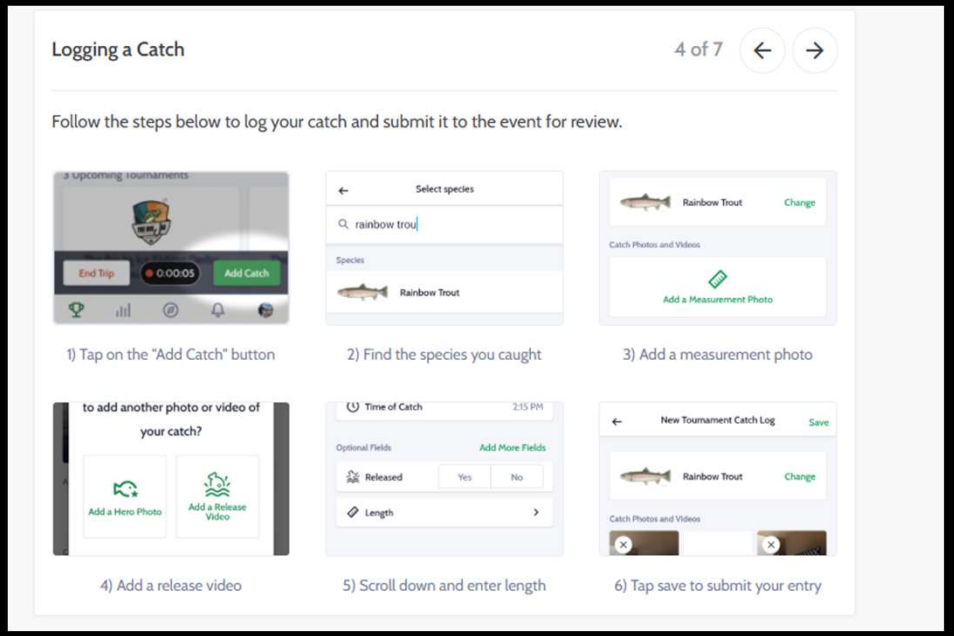
Key statistical point:

- Agency staff don't know who is participating in the event

Why do we care?

- The particular fish observed with on-the-ground surveys are randomized, and this ensures full mixing of tagged and untagged catch





2024 Preliminary Estimates

Location	Species	eCreel		Creel		|%△|
		Estimate	Error	Estimate	Error	(from Creel)
Crowly Lake	Brown Trout	1,857	371	1,255	3,440	47%
	Rainbow Trout	2,173	235	1,982	6,209	10%
	Cutthroat Trout	3,052	995	409	2,767	646%
	Sacramento Perch	8,357	1,866	15,852	47,788	47%
Bonneville*	Smallmouth Bass*	11,684*	-	14,996*	-	28%
Eagle Lake	Rainbow Trout	742	128	900	494	17%
Salmon River	Chinook	1,534	514	1,708	115	10%
Whiskeytown	Kokanee	1,643	235	1,552	721	6%

* Estimate for the 2025 program. Only one recapture during the 2024 program so no estimate was generated.

2024 Estimates and Data

Location	Species	eCreel		Raw Recoveries		% △
		Estimate	Error	Captures (marking rate)	Recaptures (Recapture Rate)	(from creel)
Crowly Lake	Brown Trout	1,857	371	72 (4%)	15 (21%)	47%
	Rainbow Trout	2,173	235	53 (2.5%)	31 (58%)	10%
	Cutthroat Trout	3,052	995	28 (<1%)	2 (7%)	646%
	Sacramento Perch	8,357	1,866	26 (<1%)	9 (35%)	47%
Bonneville*	Smallmouth Bass*	11,684*	-	2,099 (18%)	146 (6%)	28%
Eagle Lake	Rainbow Trout	742	128	63 (8%)	18 (29%)	17%
Salmon River	Chinook	1,534	514	29 (20%)	5 (17%)	10%
Whiskeytown	Kokanee	1,643	235	254 (15%)	32 (13%)	6%

* Estimate for the 2025 program. Only one recapture during the 2024 program so no estimate was generated.

New Sources of Bias

- Surveyors may cause participation rates to increase, which in turn positively biases the recapture rates (i.e., fish observed are more likely to be marked because they were observed).

Moving Forward

- Repeat pilot studies in 2025 (currently ongoing)
- Increase angler recruitment and engagement
- Restrict when people can enter fish

Questions

Extra Slides