Agenda Item D.4
Supplemental Council Member Presentation 1
April 2025

Recruitment at Different Levels of Spawning Abundance

Sacramento River Fall Chinook

Marc Gorelnik

Data Source

Pre-Season I Report, Table II-1

Harvest and abundance indices for adult Sacramento River fall Chinook (SRFC)

TABLE II-1. Harvest and abundance indices for adult Sacramento River fall Chinook (SRFC) in thousands of fish. (Page 1 of 2)

	SRFC Ocean Harvest South of Cape Falcon[a/]				River	Spawning Escapement			Sacramento	Exploitation
Year	Troll	Sport	Non-Ret[b/]	Total	Harvest	Natural	Hatchery	Total	Index (SI)[c/]	Rate (%)[d/]
1983	246.6	86.3	0.0	332.9	18.0	91.7	18.6	110.2	461.1	76
1984	266.2	87.0	0.0	353.1	25.9	120.2	38.7	159.0	538.1	70
1985	355.5	158.9	0.0	514.4	39.1	210.1	29.3	239.3	792.8	70
1986	619.0	137.5	0.0	756.4	39.2	218.3	21.8	240.1	1,035.7	77
1987	686.1	173.1	0.0	859.2	31.8	175.2	19.8	195.1	1,086.1	82
1988	1,163.2	188.3	0.0	1,351.5	37.1	200.7	26.8	227.5	1,616.1	86
1989	602.8	157.1	0.0	759.9	24.9	127.6	24.9	152.6	937.3	84
1990	507.3	150.4	0.0	657.8	17.2	83.3	21.7	105.1	780.0	87
1991	300.1	89.6	0.0	389.7	26.0 [e/]	92.8	26.0	118.9	534.6	78
1992	233.3	69.4	0.0	302.8	13.3 [e/]	59.9	21.7	81.5	397.6	79
1993	342.8	115.3	0.0	458.1	27.7 [e/]	112.8	24.6	137.4	623.2	78
1994	303.5	168.8	0.0	472.3	28.9 [e/]	135.0	30.6	165.6	666.7	75
1995	730.7	390.4	0.0	1,121.0	48.2	253.8	41.5	295.3	1,464.6	80
1996	426.8	157.0	0.0	583.8	49.2	269.1	32.5	301.6	934.7	68
1997	579.7	210.3	0.0	790.0	56.3	281.6	63.3	344.8	1,191.1	71
1998	292.3	114.0	0.0	406.3	69.8 [e/]	176.0	69.9	245.9	722.1	66
1999	289.1	76.2	0.0	365.3	68.9 [e/]	357.6	42.2	399.8	834.0	52
2000	421.8	152.8	0.0	574.6	59.5 [e/]	370.0	47.6	417.5	1,051.6	60
2001	284.4	93.4	0.0	377.9	97.4	539.4	57.4	596.8	1,072.0	44
2002	447.7	184.0	0.0	631.7	89.2 [e/]	684.2	85.6	769.9	1,490.8	48
2003	501.6	106.4	0.0	608.0	85.4	414.6	108.4	523.0	1,216.3	57
2004	621.8	212.6	0.0	834.5	46.8	206.2	80.7	286.9	1,168.2	75
2005	367.9	127.0	0.0	494.9	64.6	214.9	181.1	396.0	955.5	59
2006	149.9	107.7	0.0	257.7	44.9	196.5	78.5	275.0	577.6	52
2007	119.9	32.0	0.0	152.0	14.3 [e/]	70.1	21.3	91.4	257.7	65
2008	3.2	0.9	0.0	4.1	0.1 [e/]	47.3	18.0	65.4	69.6	6
2009	0.0	0.2	0.1	0.3	0.0 [e/]	24.9	15.9	40.9	41.1	1
2010	11.2	11.4	0.3	22.8	2.7 [e/]	91.1	33.2	124.3	149.8	17

24

TABLE II-1. Harvest and abundance indices for adult Sacramento River fall Chinook (SRFC) in thousands of fish. (Page 2 of 2)

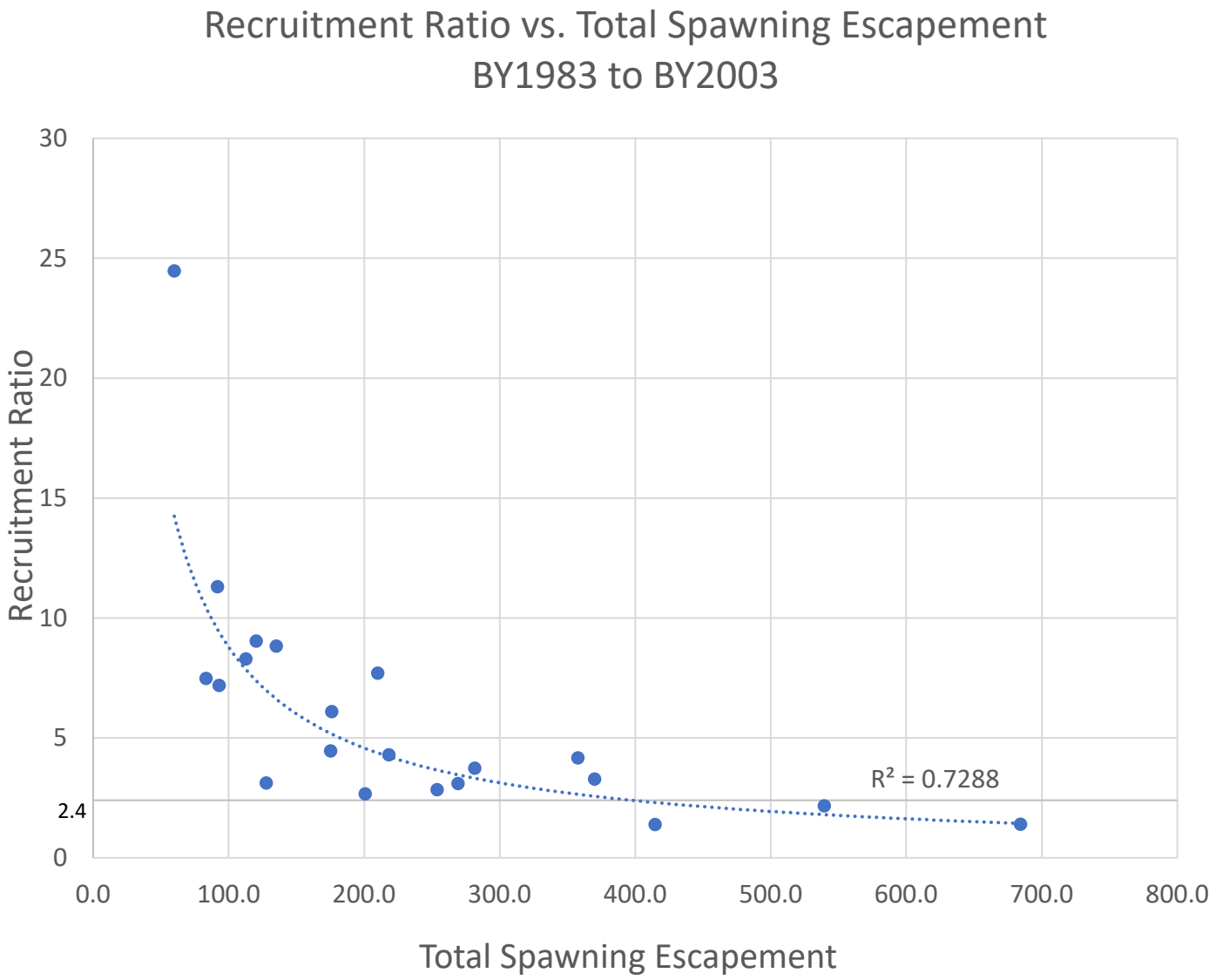
	SRFC Ocean Harvest South of Cape Falcon[a/]				River	Spawning Escapement			Sacramento	Exploitation
Year	Troll	Sport	Non-Ret[b/]	Total	Harvest	Natural	Hatchery	Total	Index (SI)[c/]	Rate (%)[d/]
2011	46.7	22.8	0.0	69.5	18.2 [e/]	77.9	41.5	119.3	207.0	42
2012	183.1	93.4	0.3	276.7	65.8 [e/]	166.2	119.2	285.4	627.9	55
2013	290.7	114.3	0.0	404.9	57.5 [e/]	305.6	101.2	406.8	869.3	53
2014	240.6	62.4	0.0	303.0	35.7 [e/]	168.7	43.8	212.5	551.2	61
2015	100.1	24.5	0.0	124.6	16.9 [e/]	74.5	39.0	113.5	254.9	55
2016	62.9	28.9	0.0	91.8	23.9 [e/]	56.3	33.4	89.7	205.3	56
2017	38.7	31.9	0.0	70.7	22.1 [e/]	17.9	26.5	44.3	137.1	68
2018	53.7	45.0	0.0	98.6	16.3 [e/]	71.7	33.8	105.5	220.4	52
2019	248.6	74.4	0.0	323.0	20.3 [e/]	121.6	42.1	163.8	507.1	68
2020	154.8	44.6	0.0	199.5	14.9 [e/]	100.2	37.9	138.1	352.5	61
2021	165.7	41.7	0.0	207.4	10.8 [e/]	72.8	32.8	105.6	323.8	67
2022	135.9	50.2	0.0	186.0	4.9 [e/]	32.7	29.2	61.9	252.7	76
2023	3.8	1.8	0.0	5.6	0.0 [e/]	105.8	28.0	133.8	139.4	4
2024[f/]	3.4	0.3	0.0	3.7	0.0 [e/]	72.4	26.8	99.3	103.0	4

Ecological Productivity Changed Beginning With Brood Year 2004

	1983-2006	2007 to 2023	Change
Sacramento Index (Avg)	922.8K	303.9K	-67%
Ocean Harvest (Avg)	593.9K	149.5K	-75%
Spawning Escapement (Avg)	282.7K	135.4K	-52%
Ocean Exploitation Rate (Avg)	65%	42%	-35%

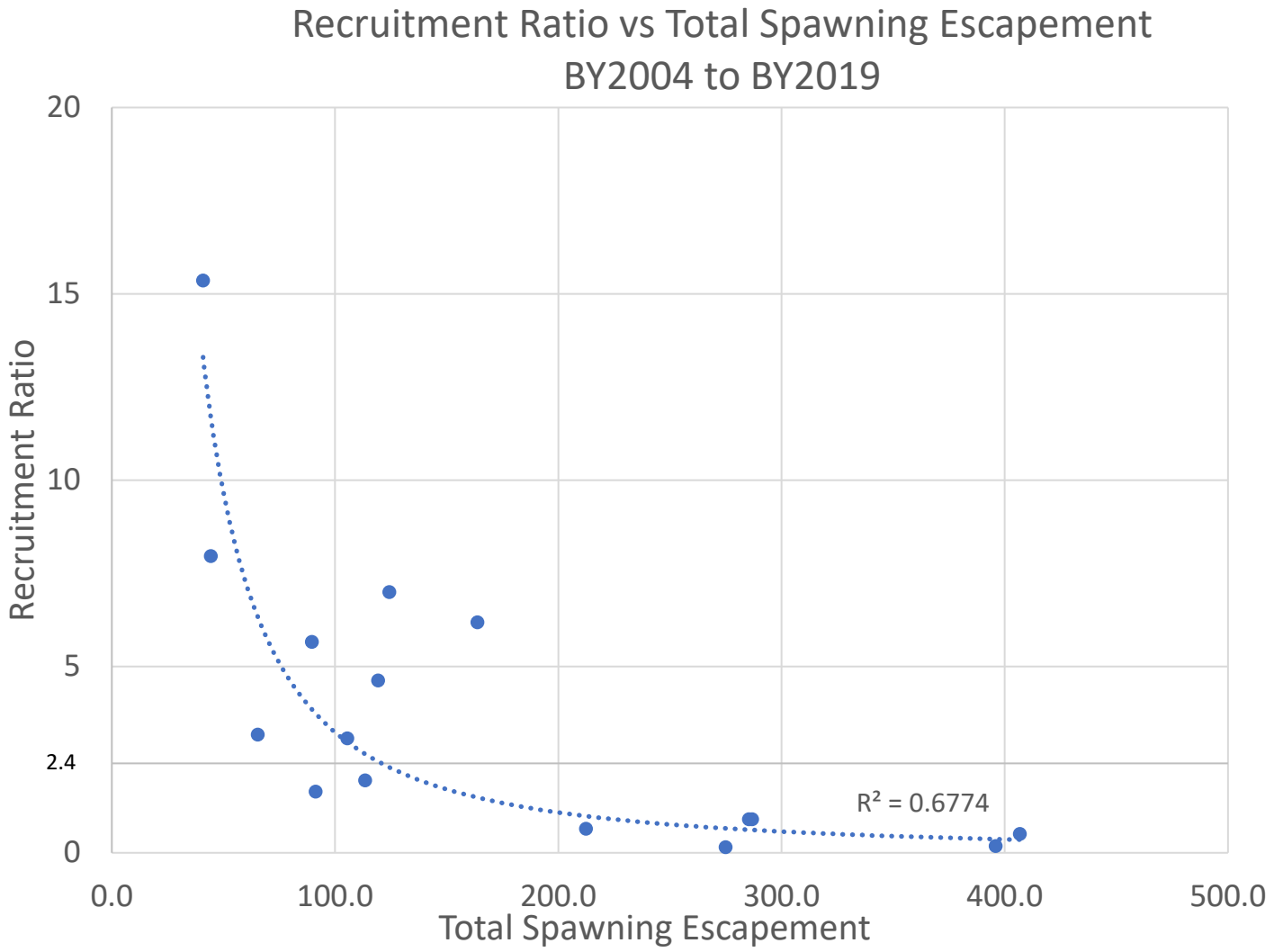
Healthy Spawner Recruit Relationship Through BY2003

- Recruitment Ratio = (SI_{y+3}/$Spawn_y$)
- A 58% exploitation rate needs a recruitment ratio of 2.4 or better for even or growing abundance
- Highly productive recruitment below ~200K escapement
- Productive recruitment to ~400K
- Expected inverse relationship



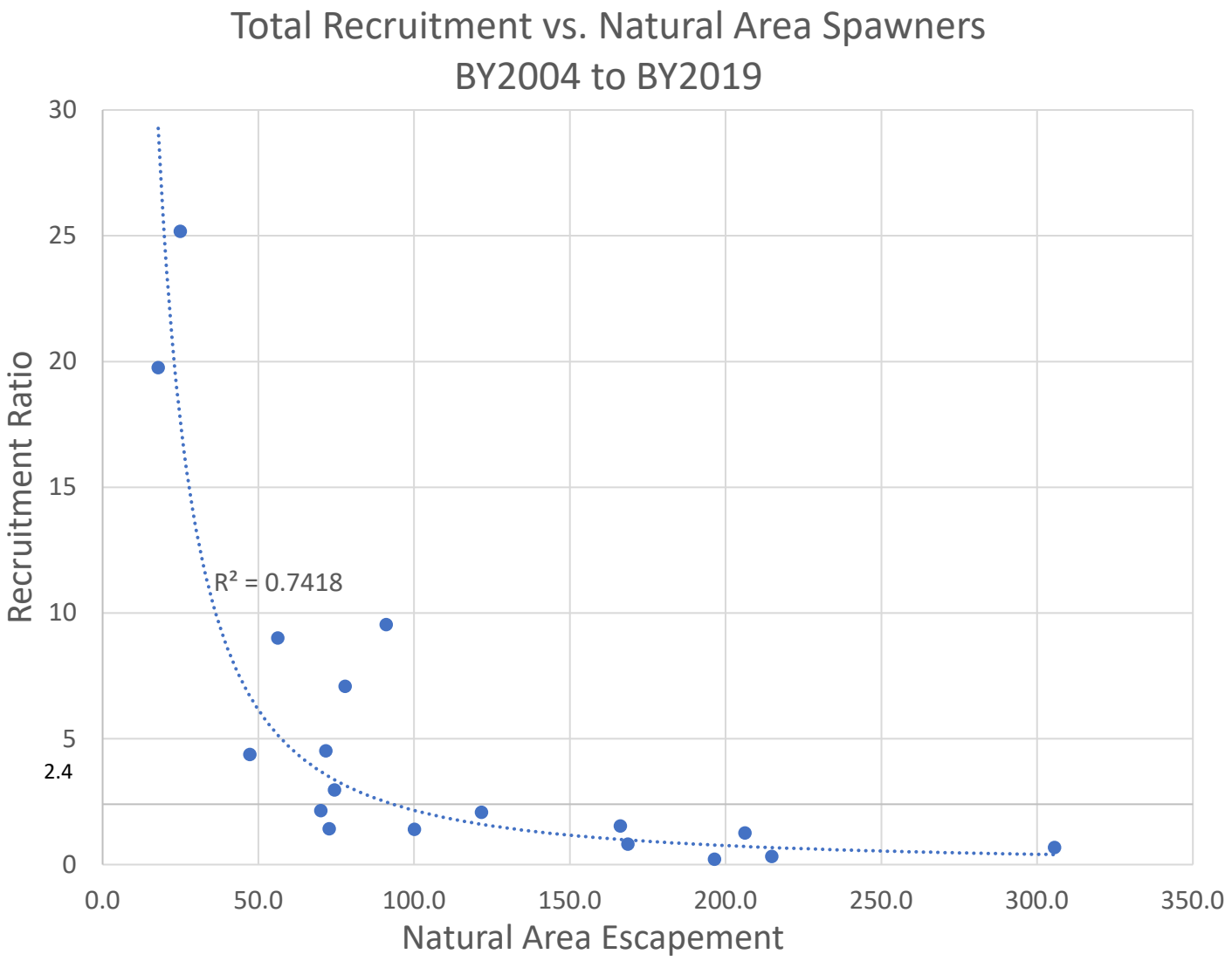
Spawner/Recruit Relationship Deteriorated Beginning With BY2004

- Highly productive recruitment below ~75K escapement (was 200K)
- Productive recruitment to ~120K (was 400K)
- Escapement >250K falls below a ratio of 1 resulting in recruitment lower than the number of spawners even in the absence of fishing



A Look at Natural Area Escapement

- If escapement to the natural areas becomes a management metric, it is useful to consider how it relates to recruitment
- Natural escapement >100K falls below recruitment ratio of 2.4
- Natural escapement >165K falls below a ratio of 1 resulting in recruitment lower than the number of spawners even in the absence of fishing



BY1983 to BY2003 Witnessed Substantially Higher Spawner/Recruit Relationships Than Today

- Productivity and carrying capacity in the ecosystem that supports SRFC may have declined substantially since the establishment of the current spawner escapement target of 122,000 to 180,000
- If productivity has changed, hasn't the system's maximum sustainable yield changed?
- If the MSY has changed, what does that suggest for a revised escapement target?

Considerations

- What is the benefit to increasing escapement to the point of depressing recruitment ratios below 2.4?
- At what point does increased escapement have less value to the nation than forgone river and ocean fishing opportunities?
- What is the likelihood that river productivity will return to pre-BY2004 levels?
  - Dewatering fall Chinook redds
  - Excessive water temperatures
  - Absence of flows calculated to facilitate successful outmigration of natural and hatchery production
  - If river productivity returns, are current escapement requirements adequate?

Recommendations

- Ask SRWG to develop two different escapement recommendations with likely adult production results:
  - One based on the current condition of the ecosystem, taking into full account the data beginning with brood year 2004, for the purpose of management
  - One based on the potential productivity of the ecosystem, at least as it relates to data predating brood year 2004, for the purpose of commenting on water operations
- Provide a forum for the public to consider and respond to the SRWG recommendations
- Council should consider costs and benefits of changing escapement