Fish IN
Fish OUT

SBSRTC

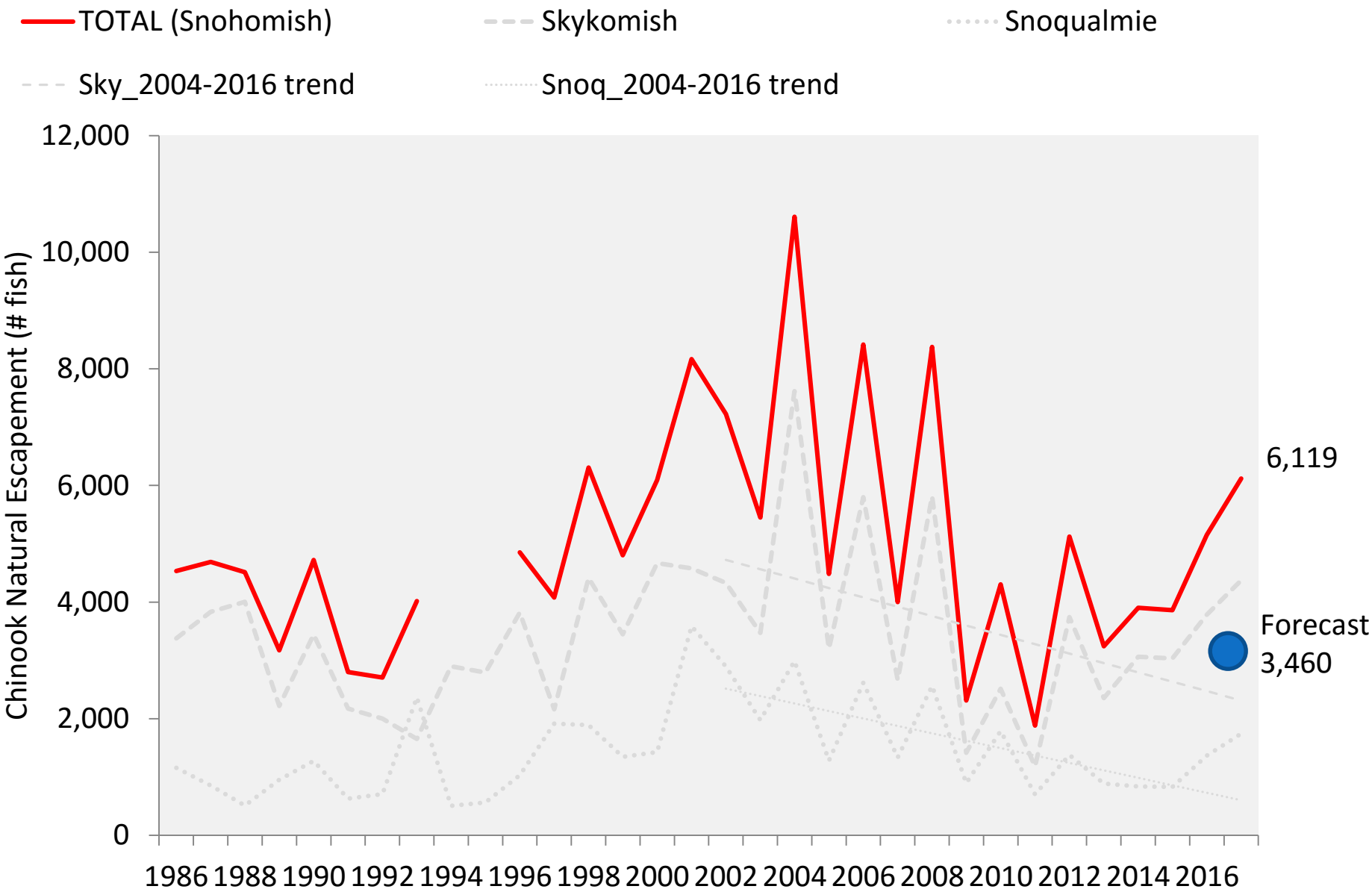
May 1, 2018

Colin Wahl

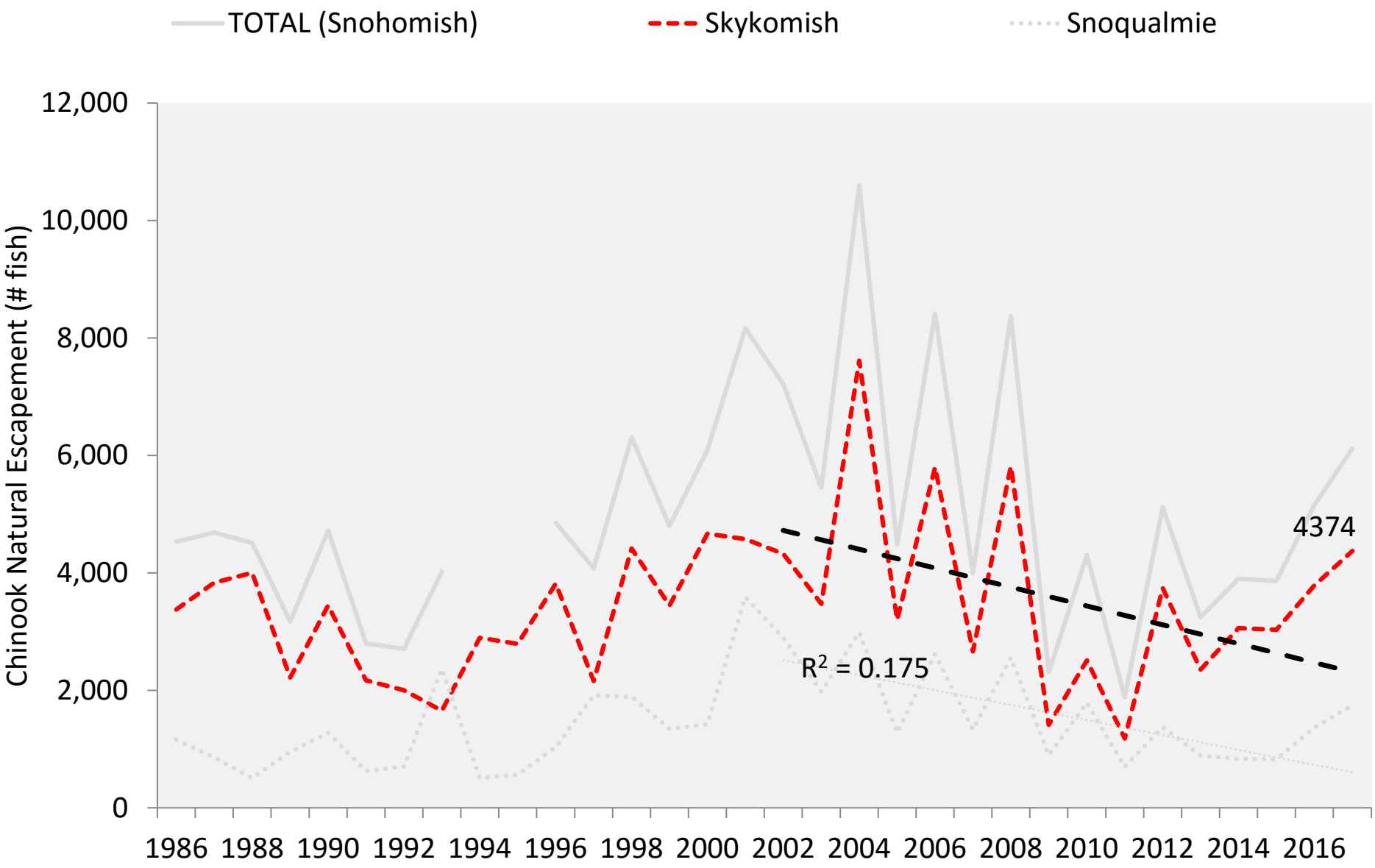
Tulalip Tribes

- Trends
- Trap numbers
- Productivity
- Ocean conditions/factors affecting trends
- 2018 forecast
- FRAM and 2018
- harvest management plan

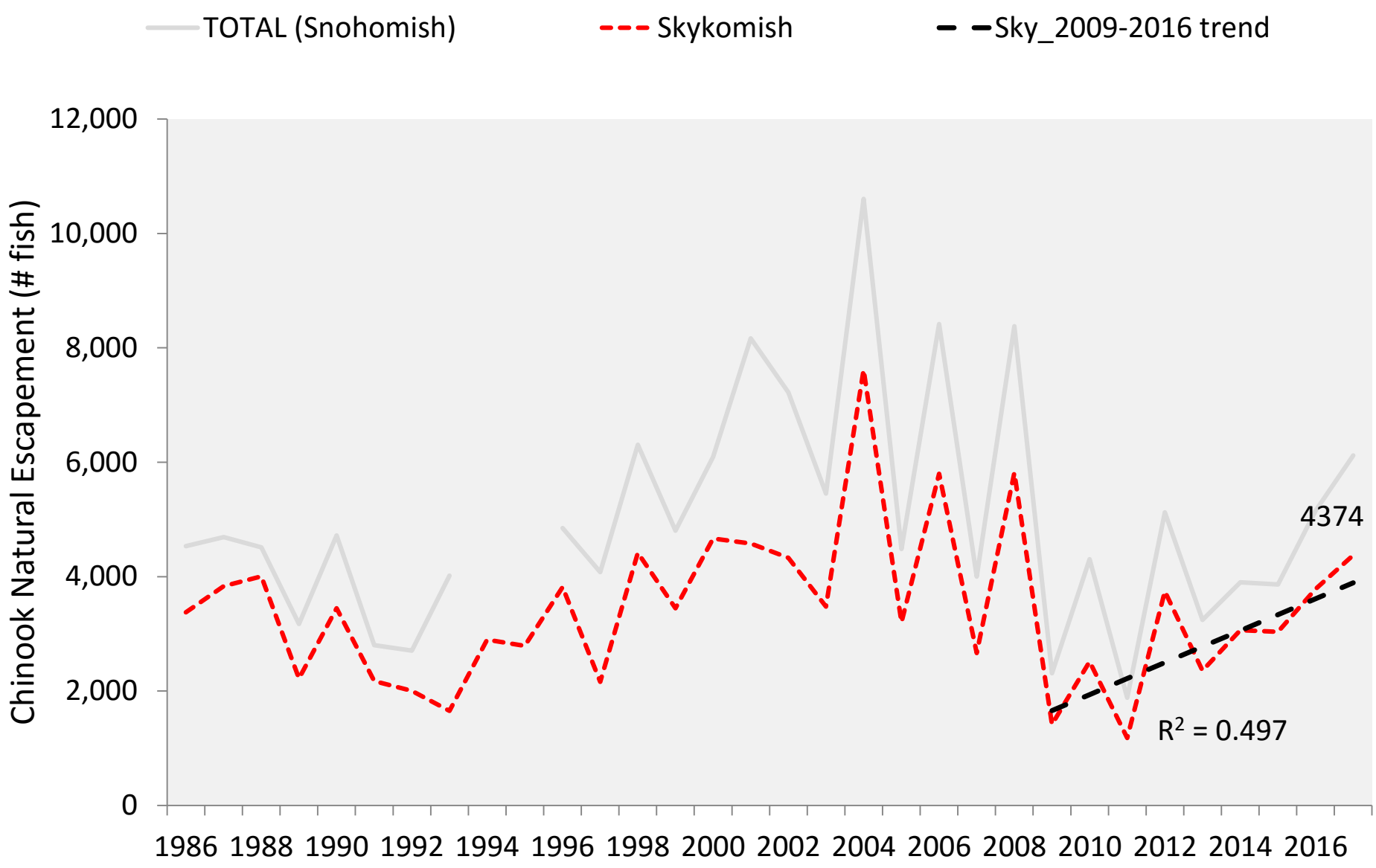
Snohomish Chinook



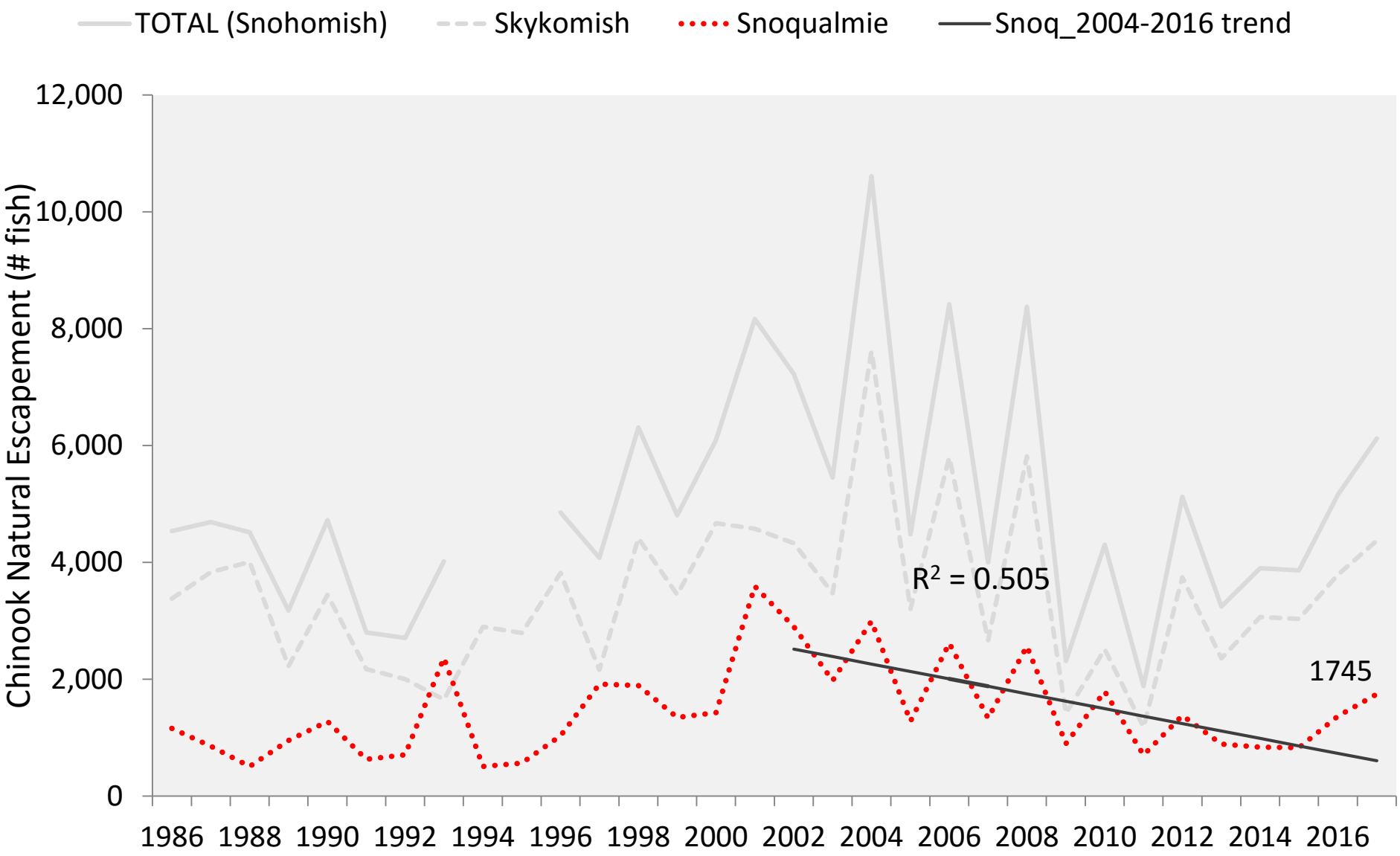
Skykomish Chinook



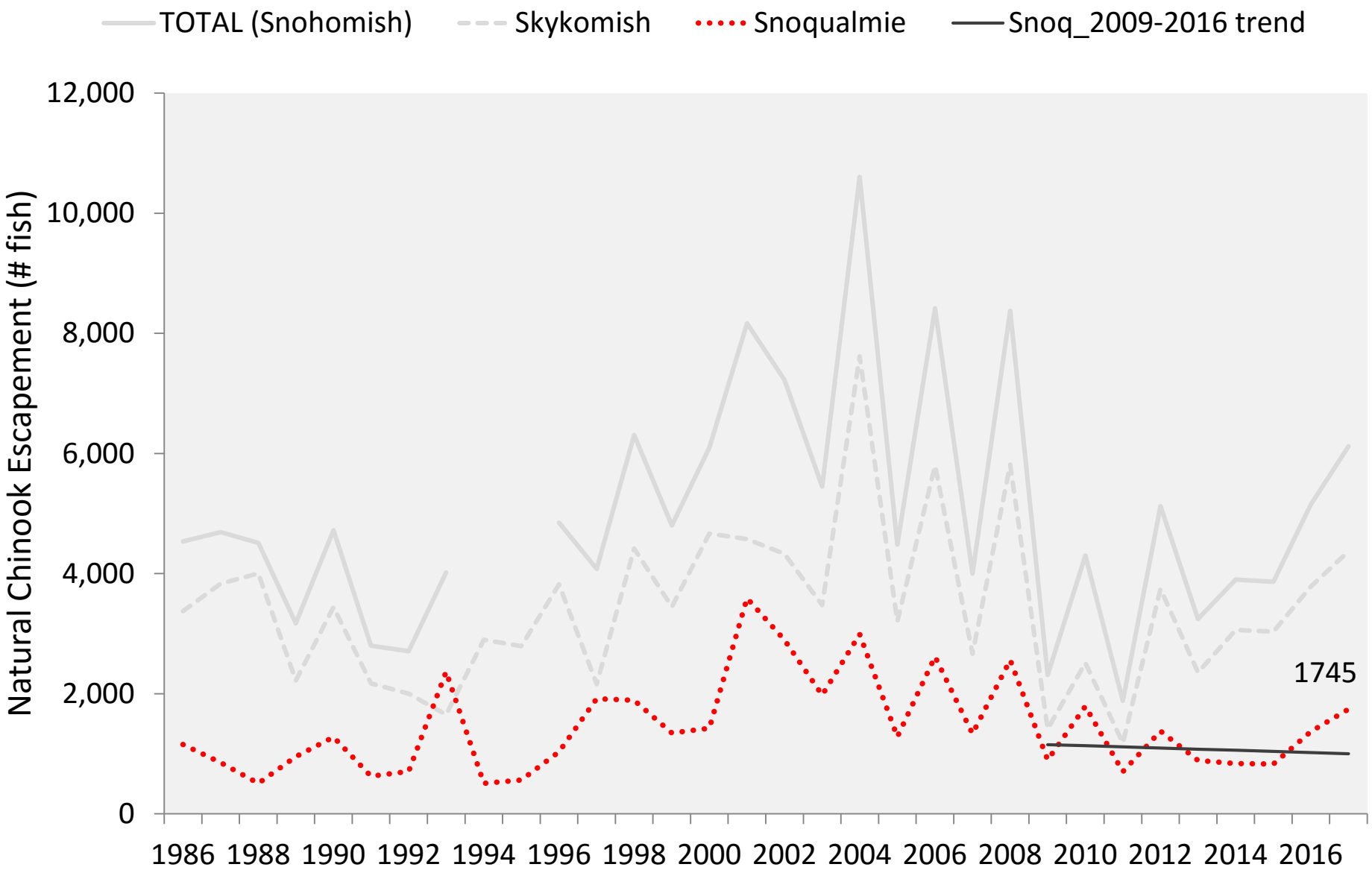
Skykomish Chinook (Since 2009)



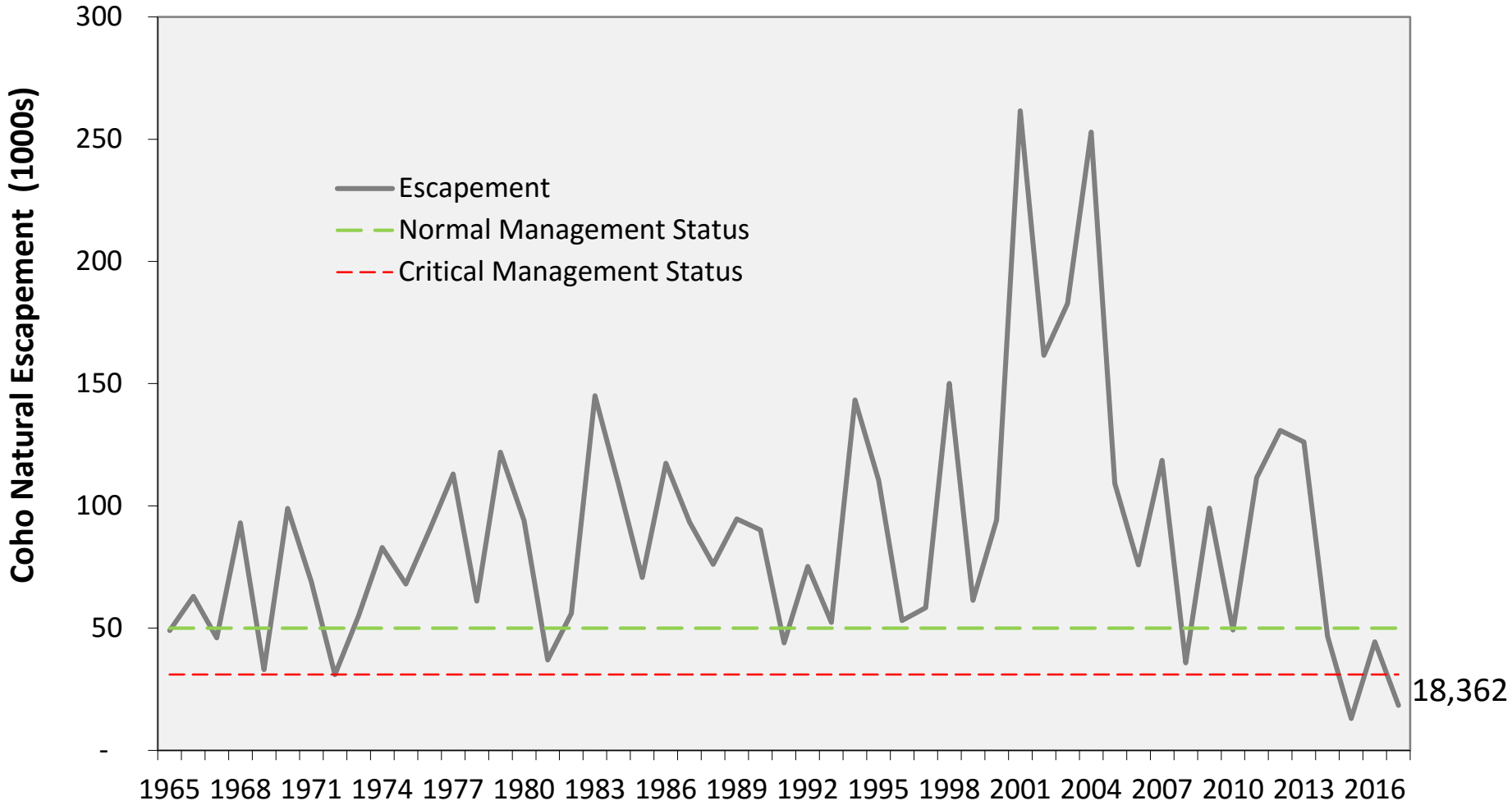
Snoqualmie


TOTAL (Snohomish)
Skykomish
Snoqualmie
Snoq_2004-2016 trend
Chinook Natural Escapement (# fish)
12,000
10,000
8,000
6,000
4,000
2,000
0
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
R² = 0.505
1745

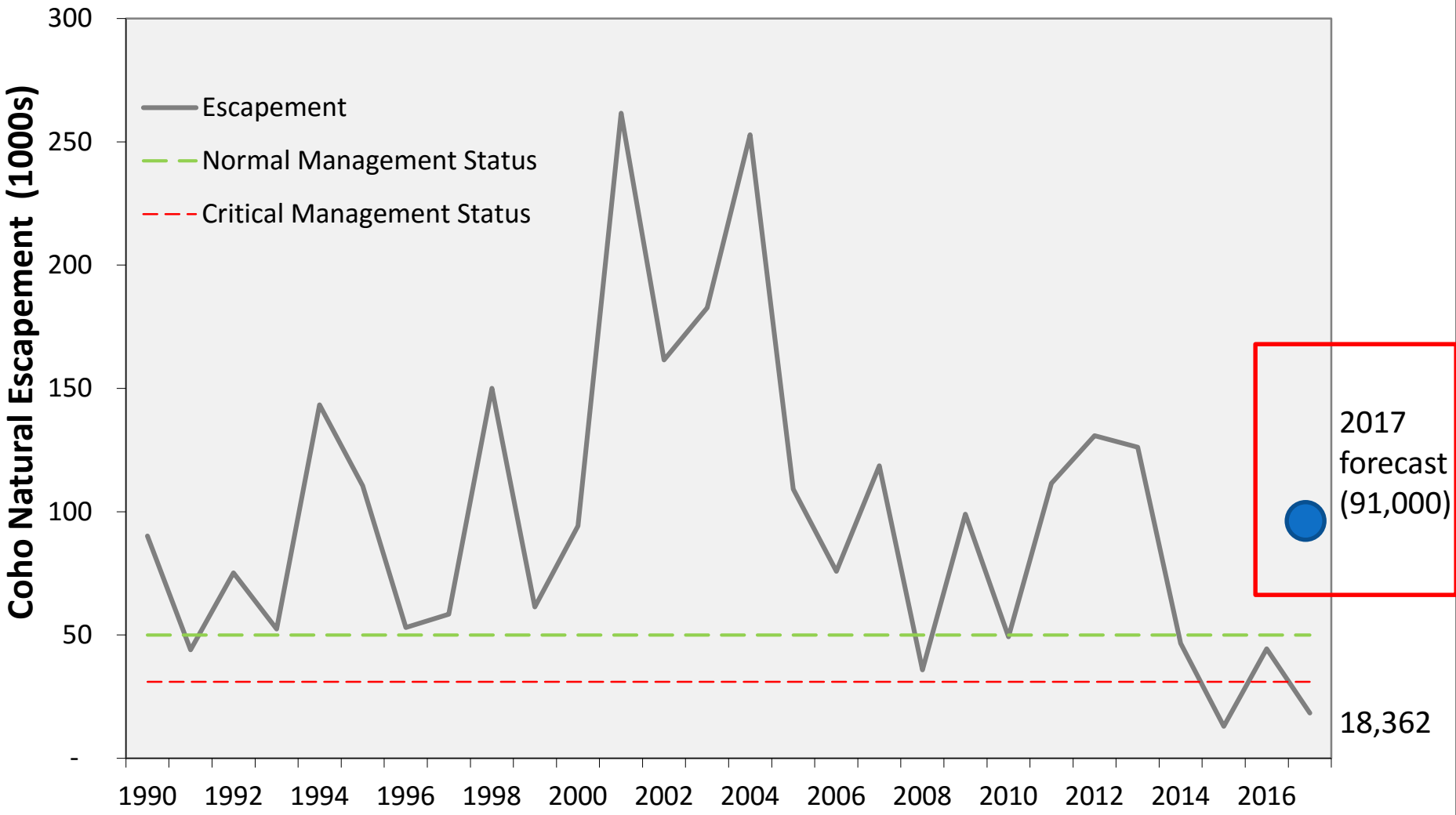
Snoqualmie Chinook



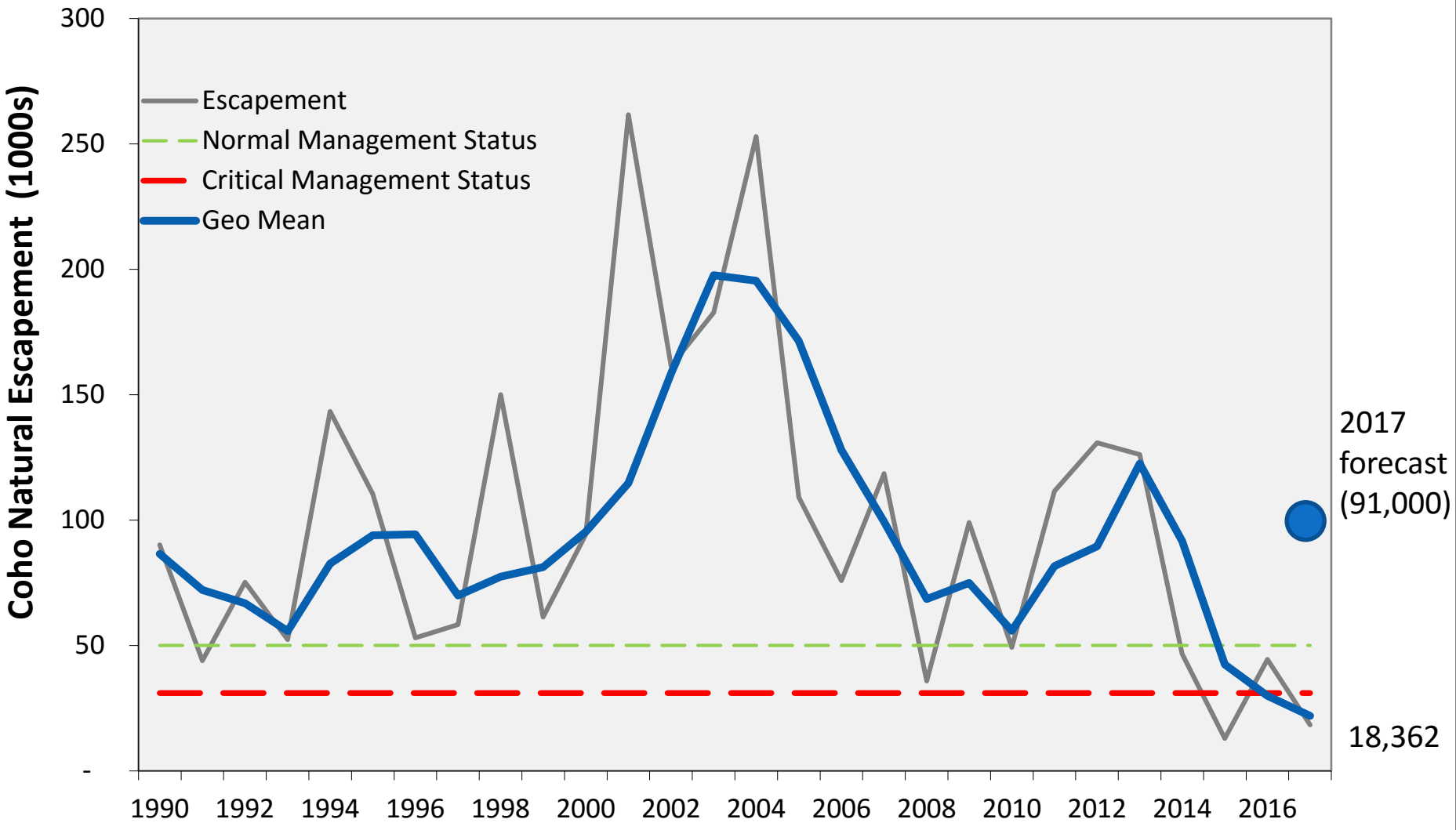
Coho (50 yr record)



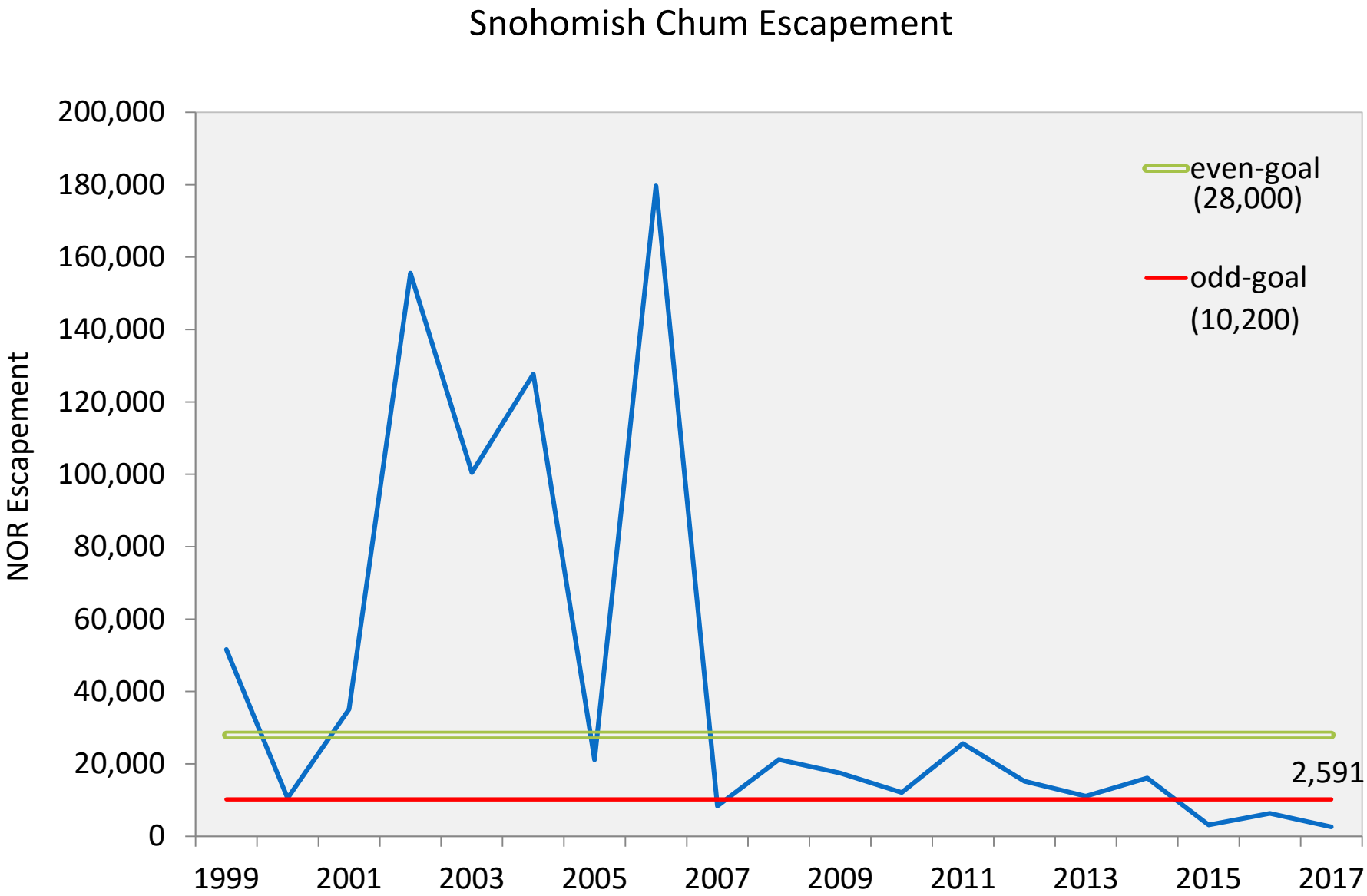
Coho (26 yr record)



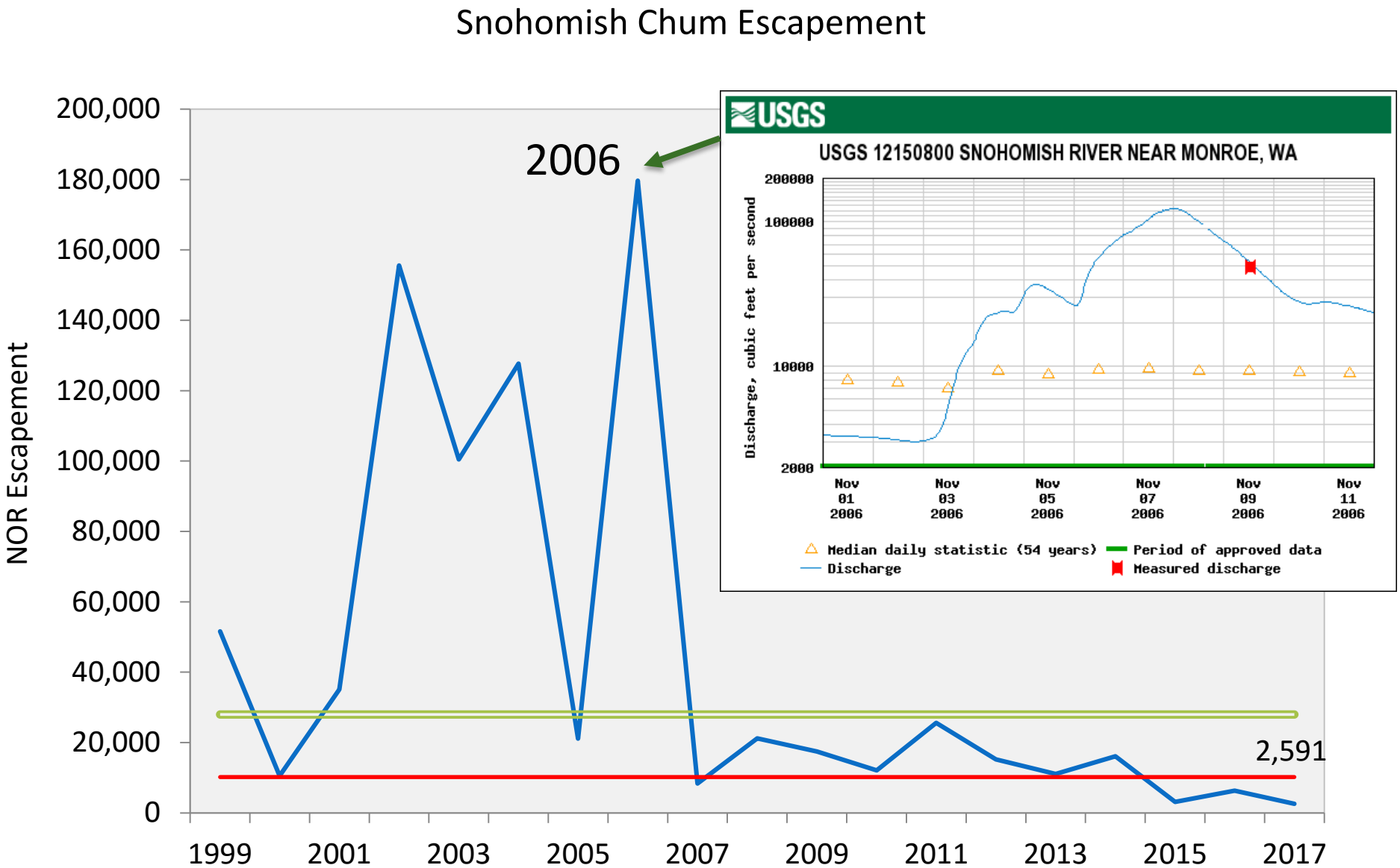
Coho in critical status



Chum

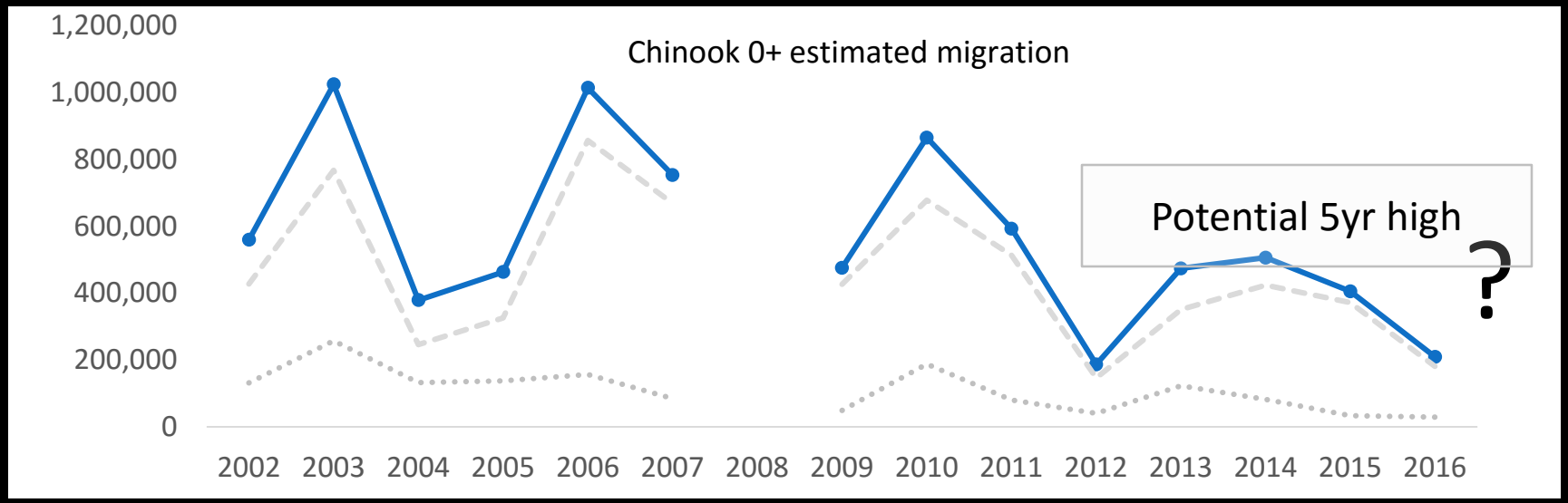

Snohomish Chum Escapement
NOR Escapement
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
1999
2001
2003
2005
2007
2009
2011
2013
2015
2017
even-goal (28,000)
odd-goal (10,200)
2,591

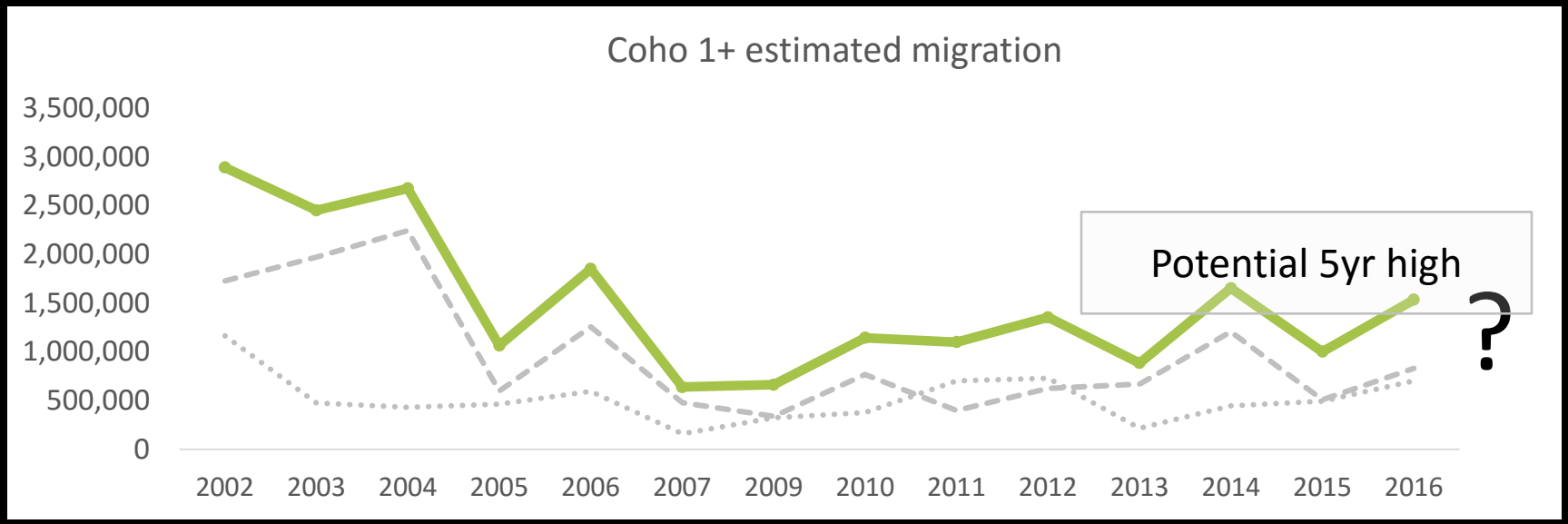
4th highest peak flow on record



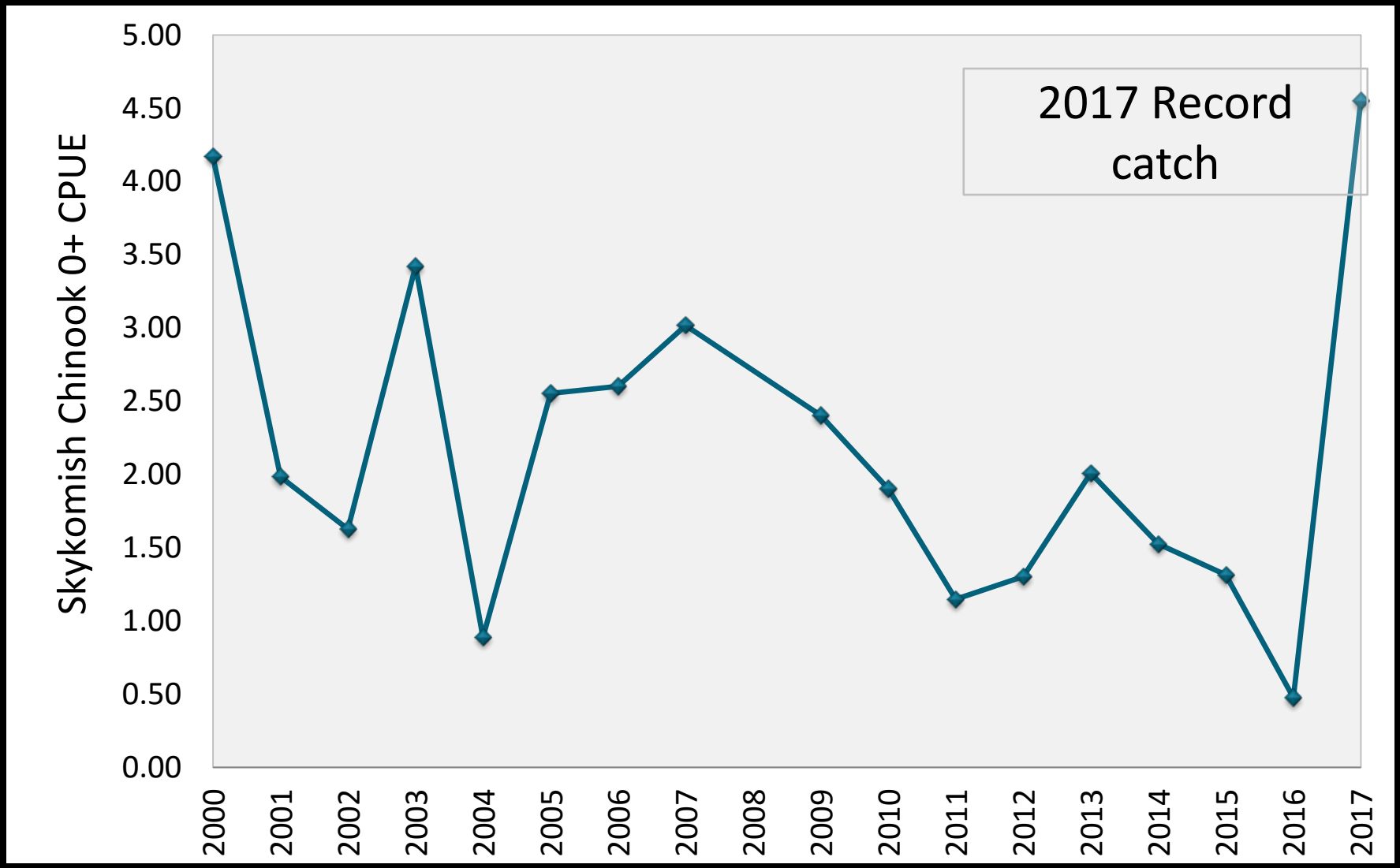
Screw Trap

2017 Anecdotes were GOOD

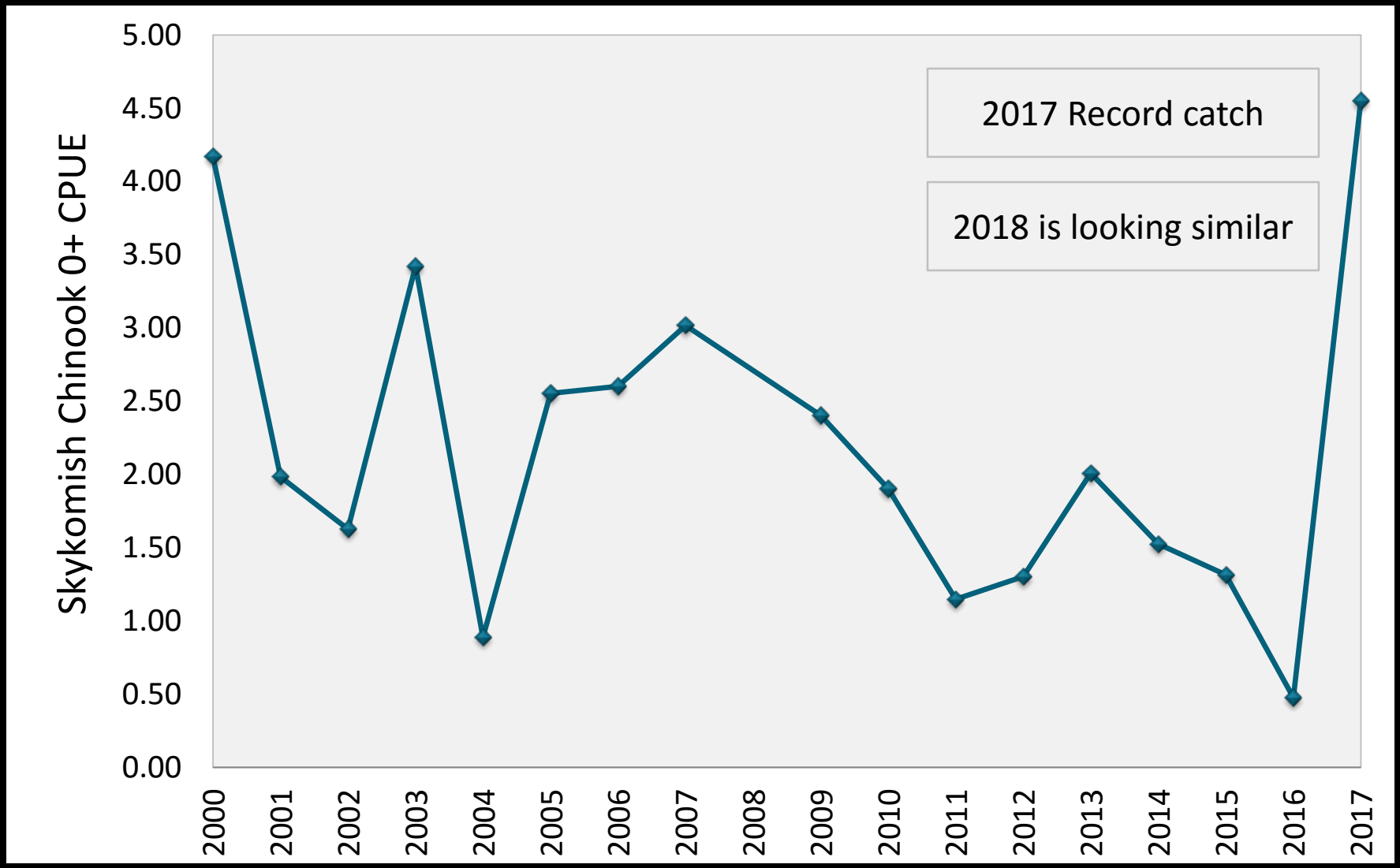




2017 Chinook (CPUE)

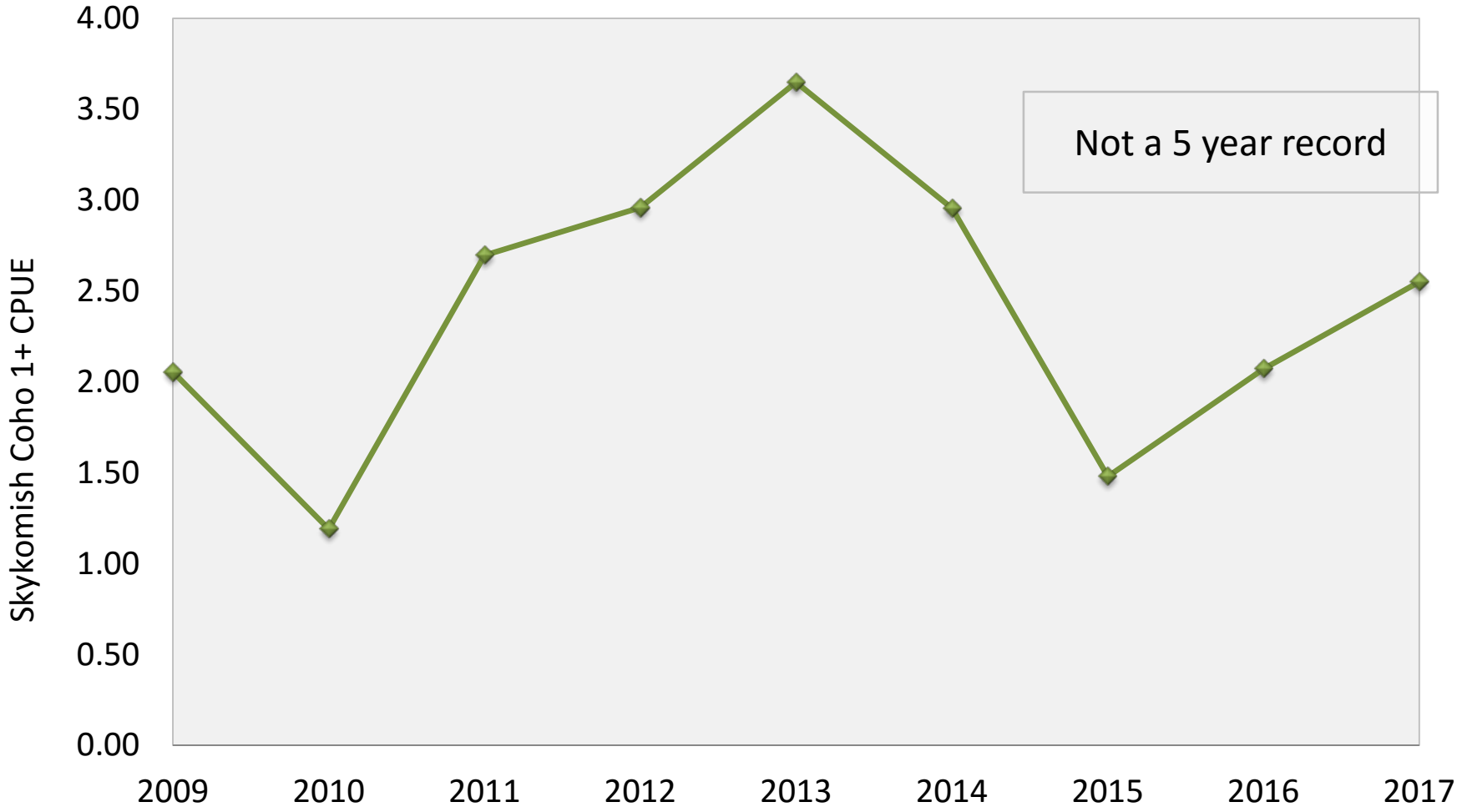


2017 Coho (CPUE)



2017 Coho (CPUE)

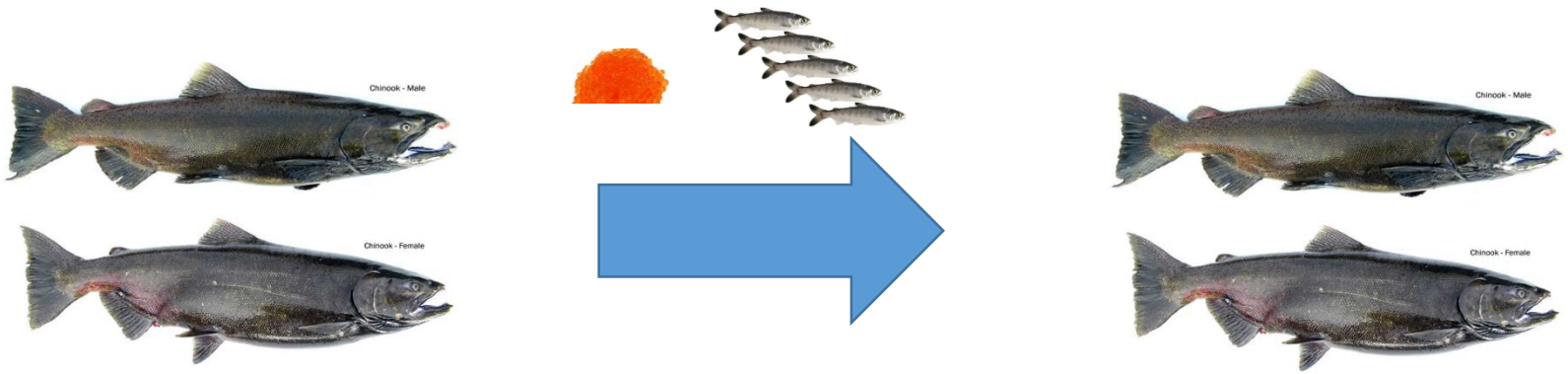
2009 – 2017 Coho



Productivity

Salmon are a naturally productive species

What is Productivity?

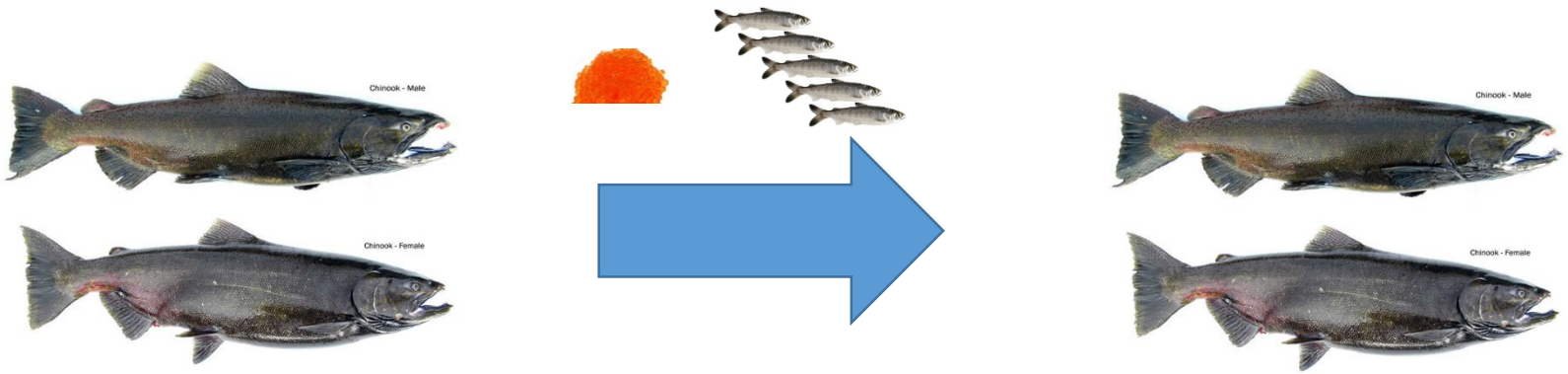


Number of spawners

Number of progeny to reach adulthood

$$\frac{2}{2} = 1$$

Productivity = 1 (replacement)

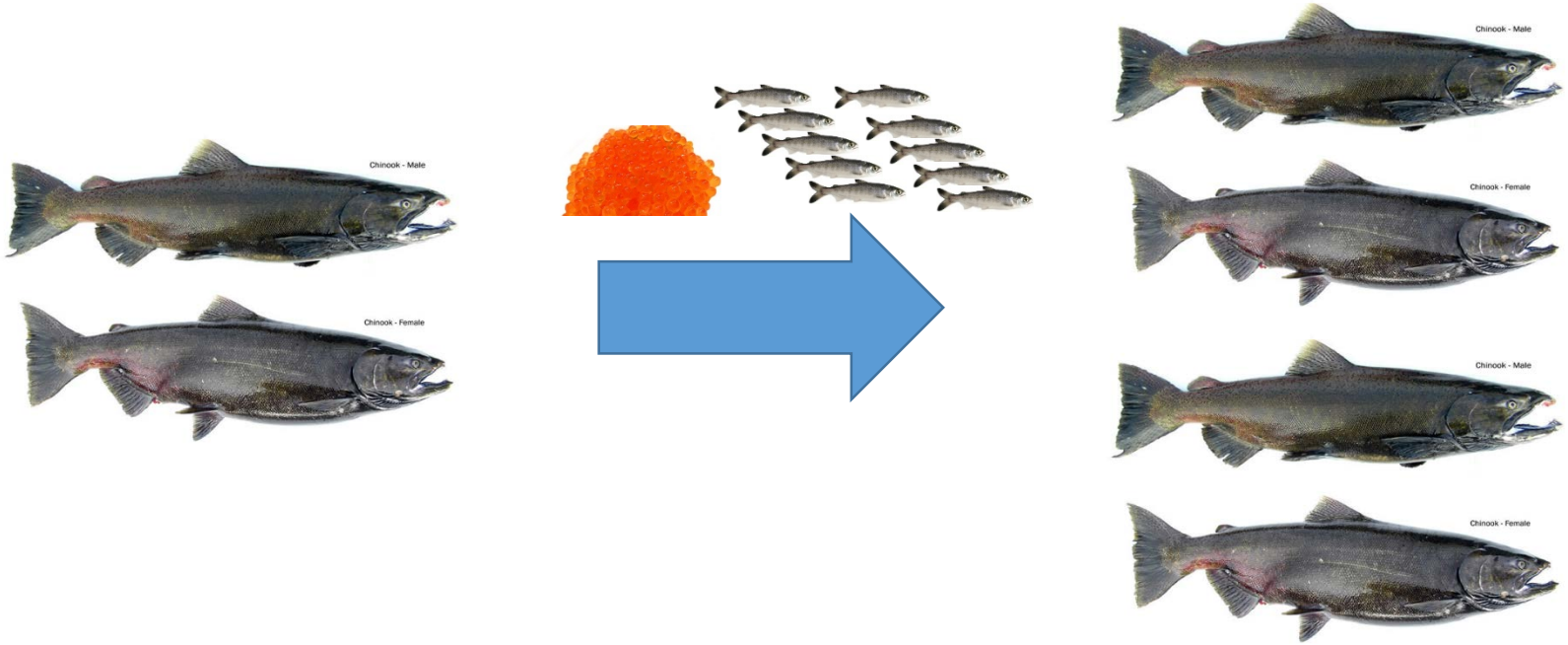


Number of spawners

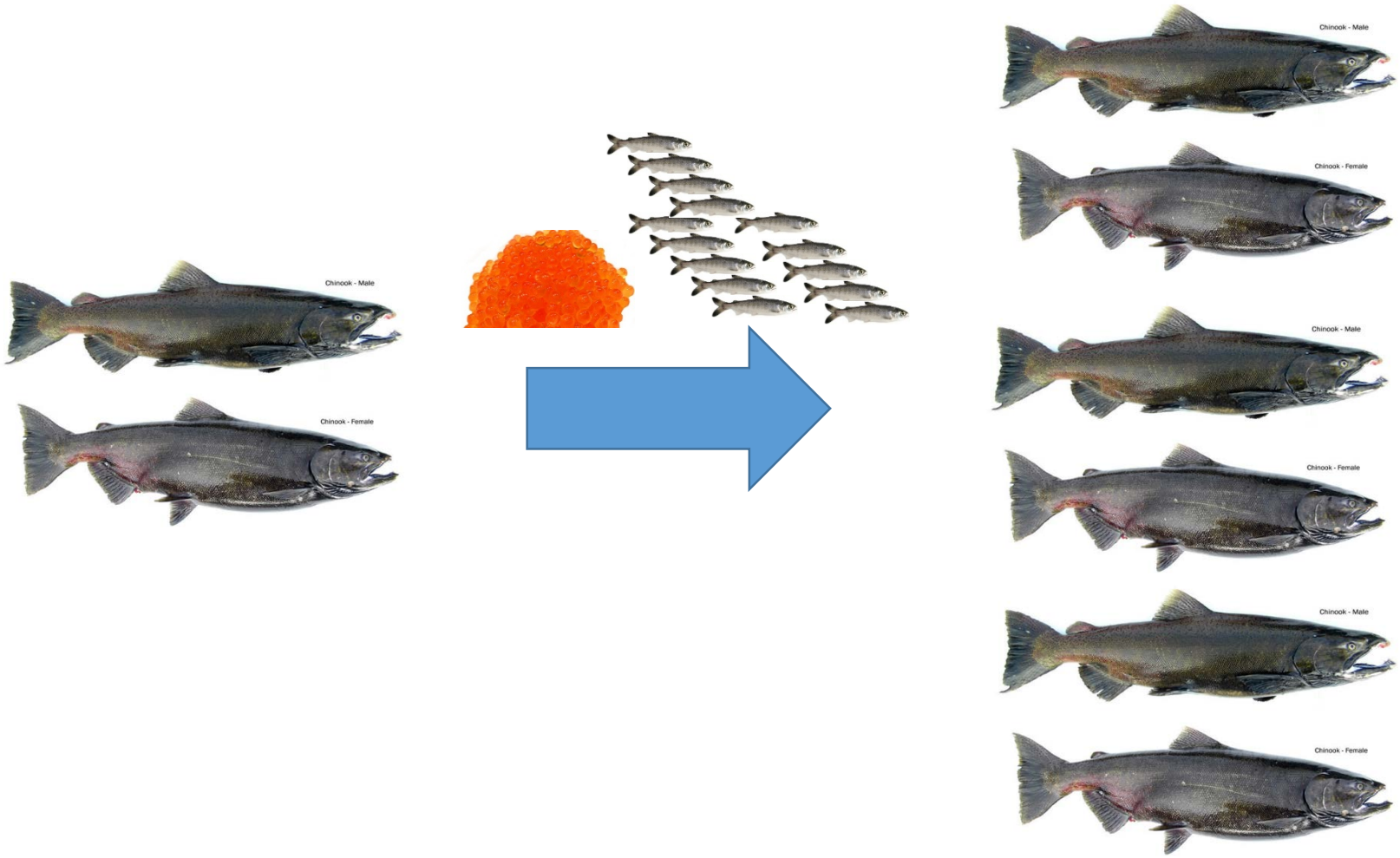
Number of progeny to reach adulthood

$$\frac{2}{2} = 1$$

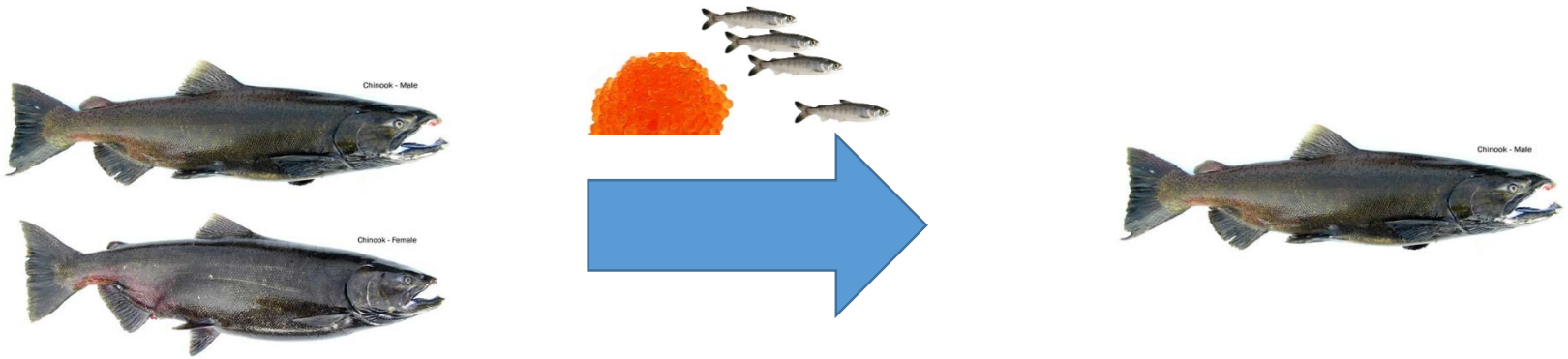
Productivity = 2



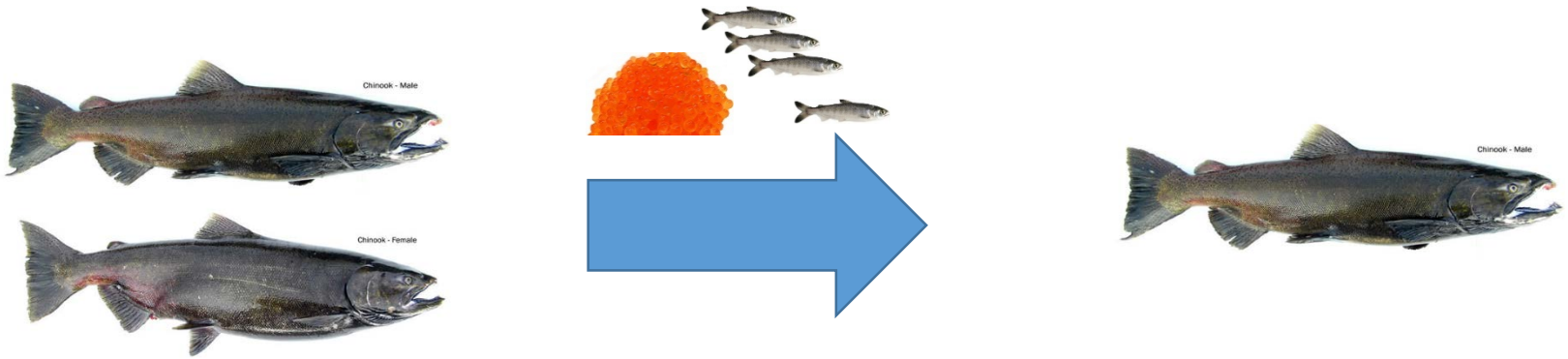
Productivity = 3 (high productivity)



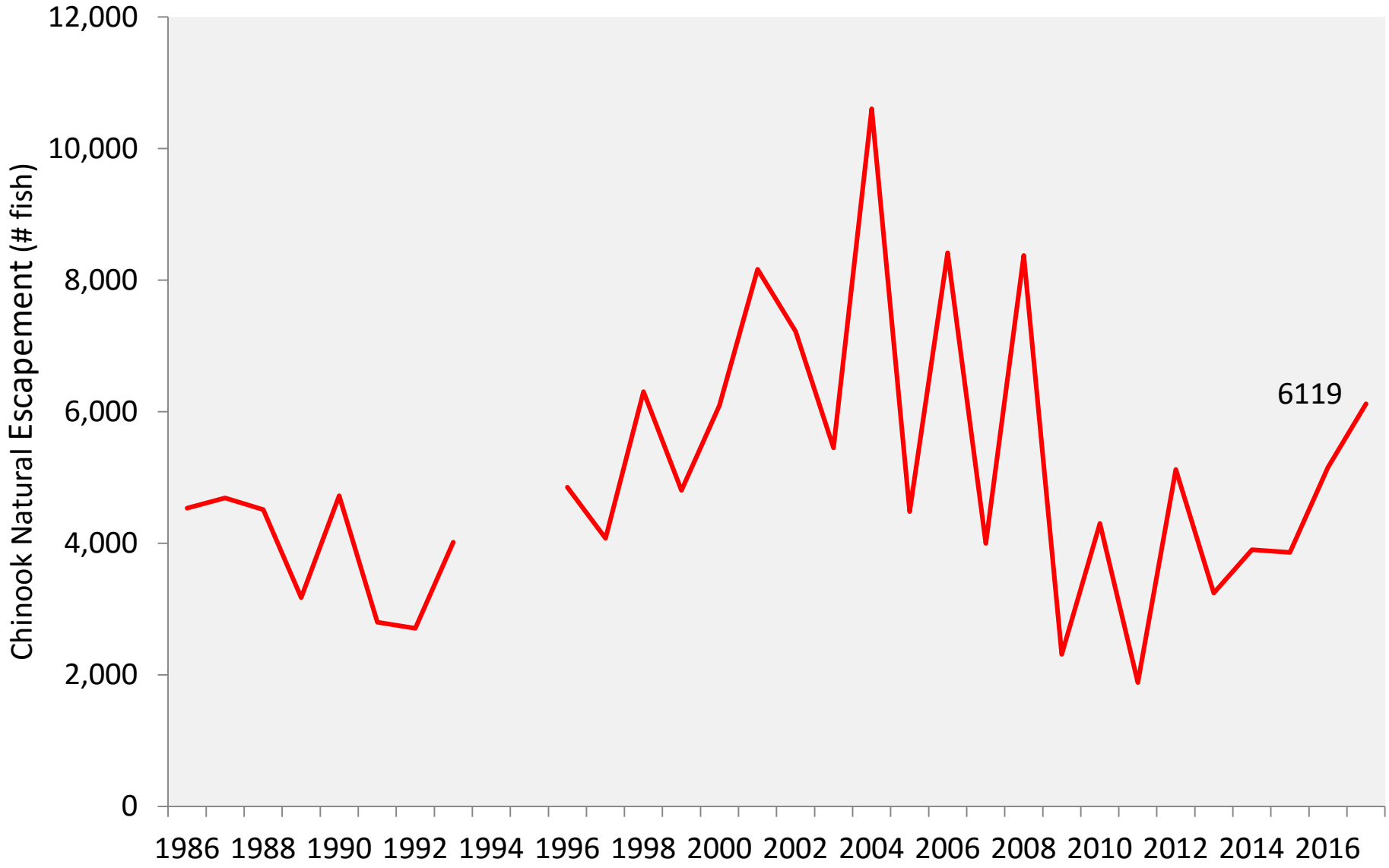
Productivity = 0.5 (Low productivity)



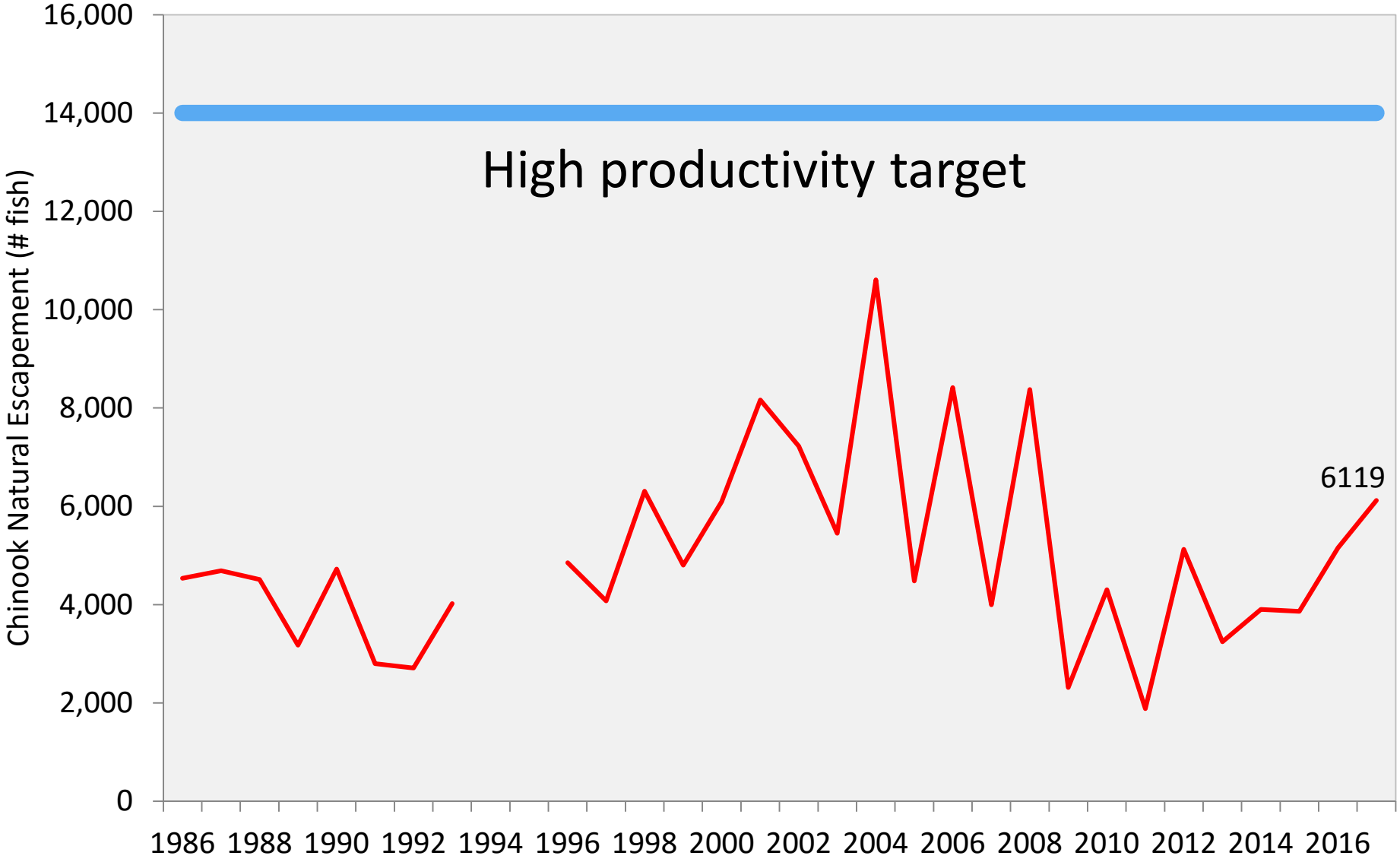
Productivity defines our recovery goals



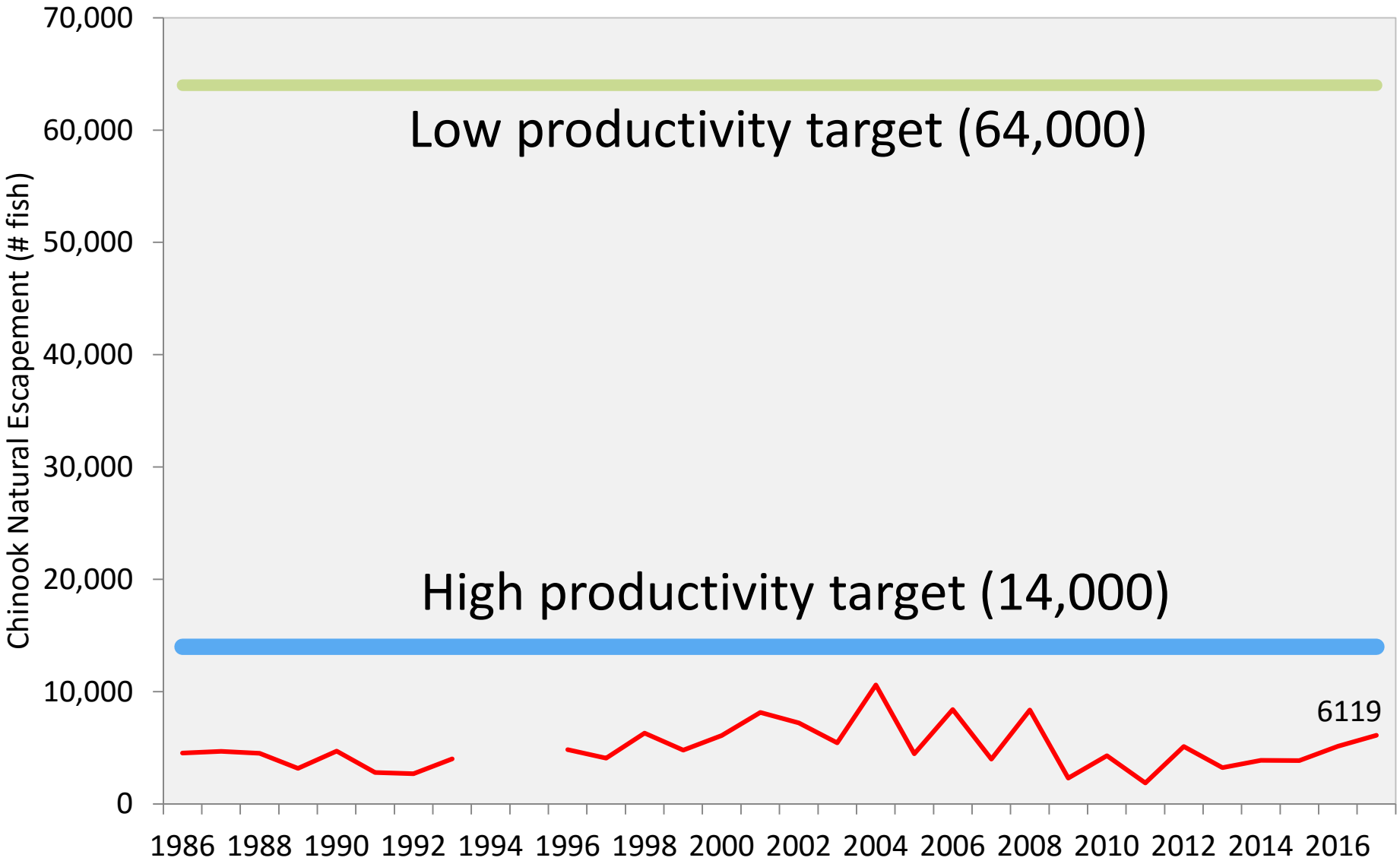
Productivity goals



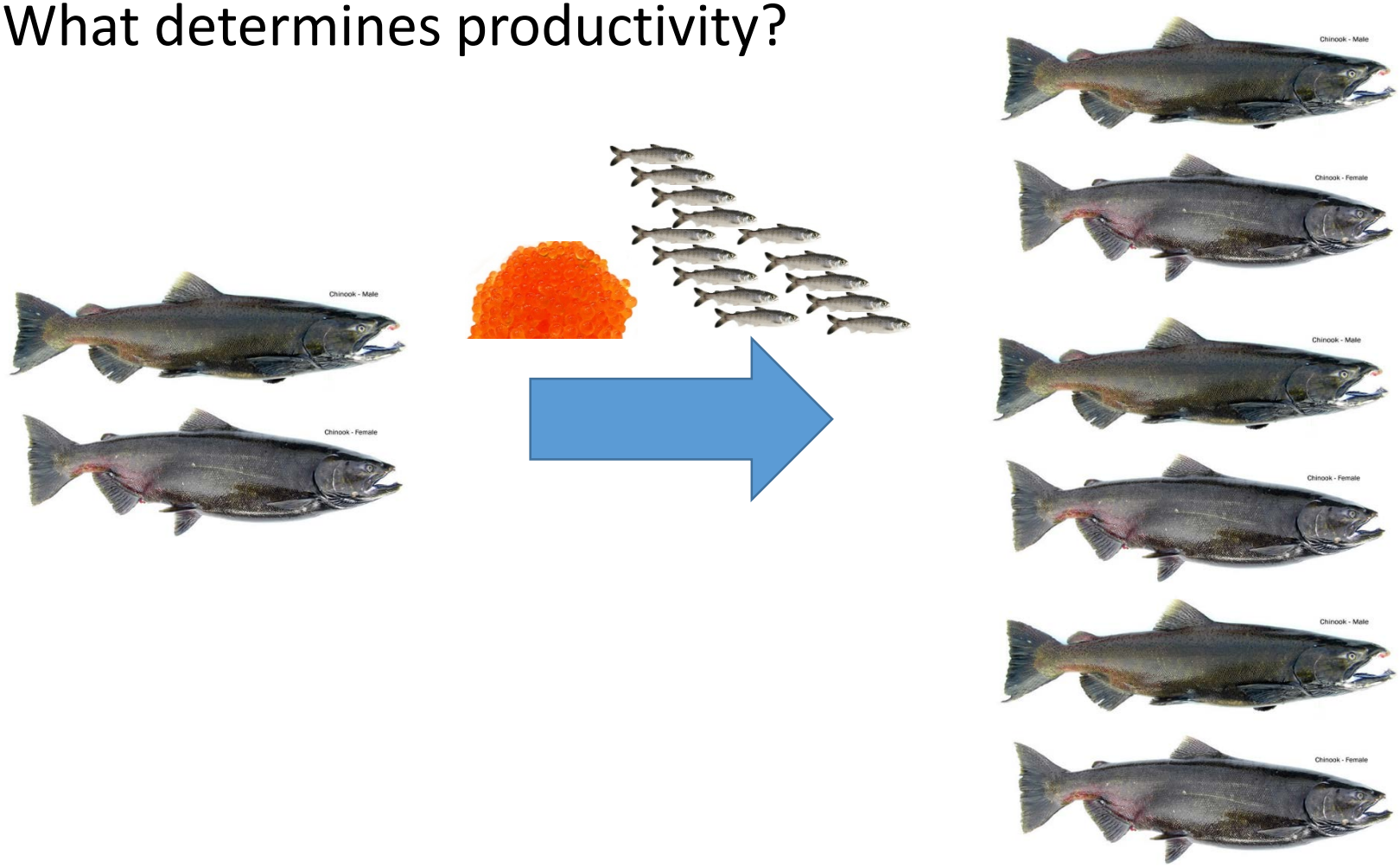
Recovery Goals



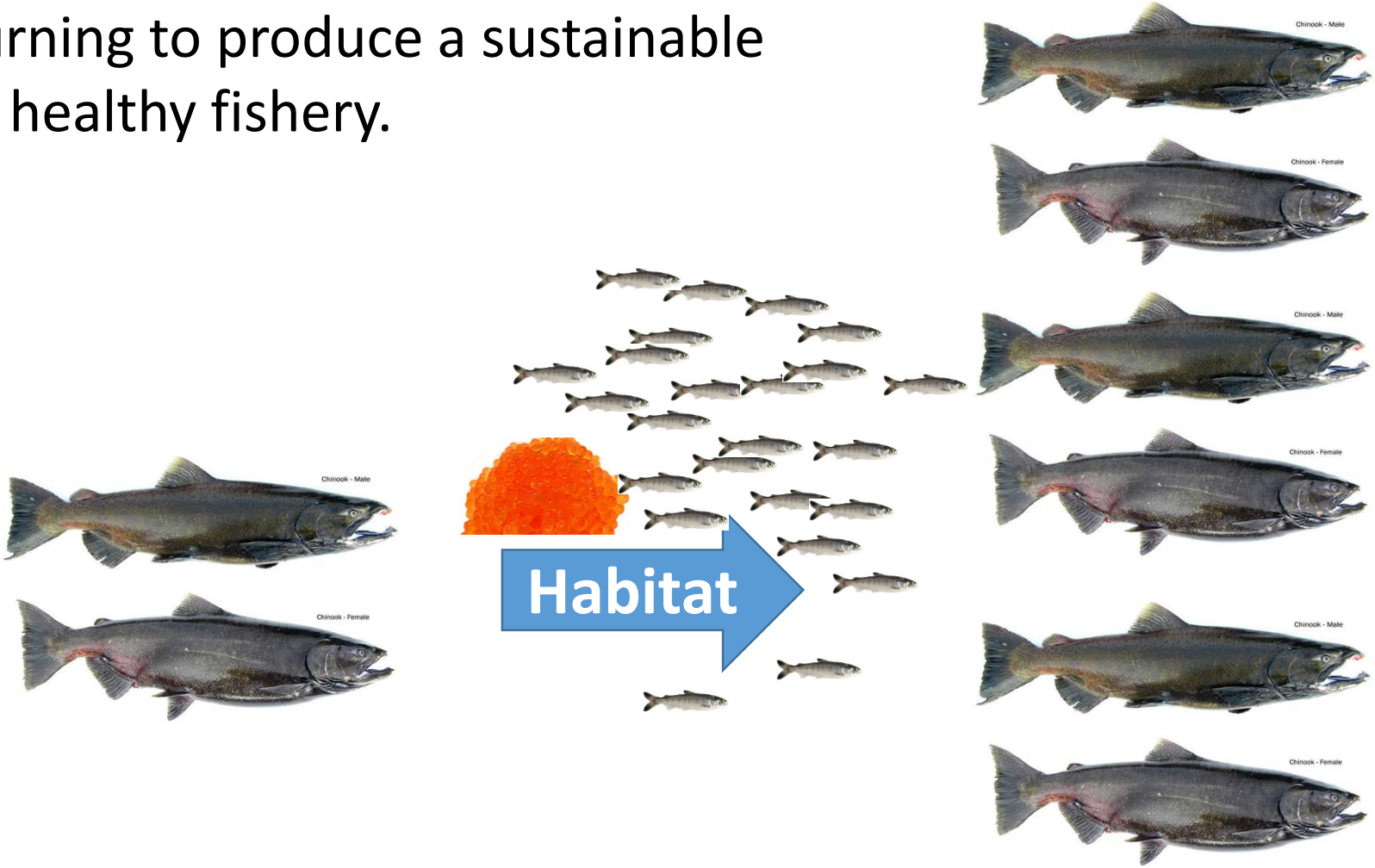
Recovery Goals



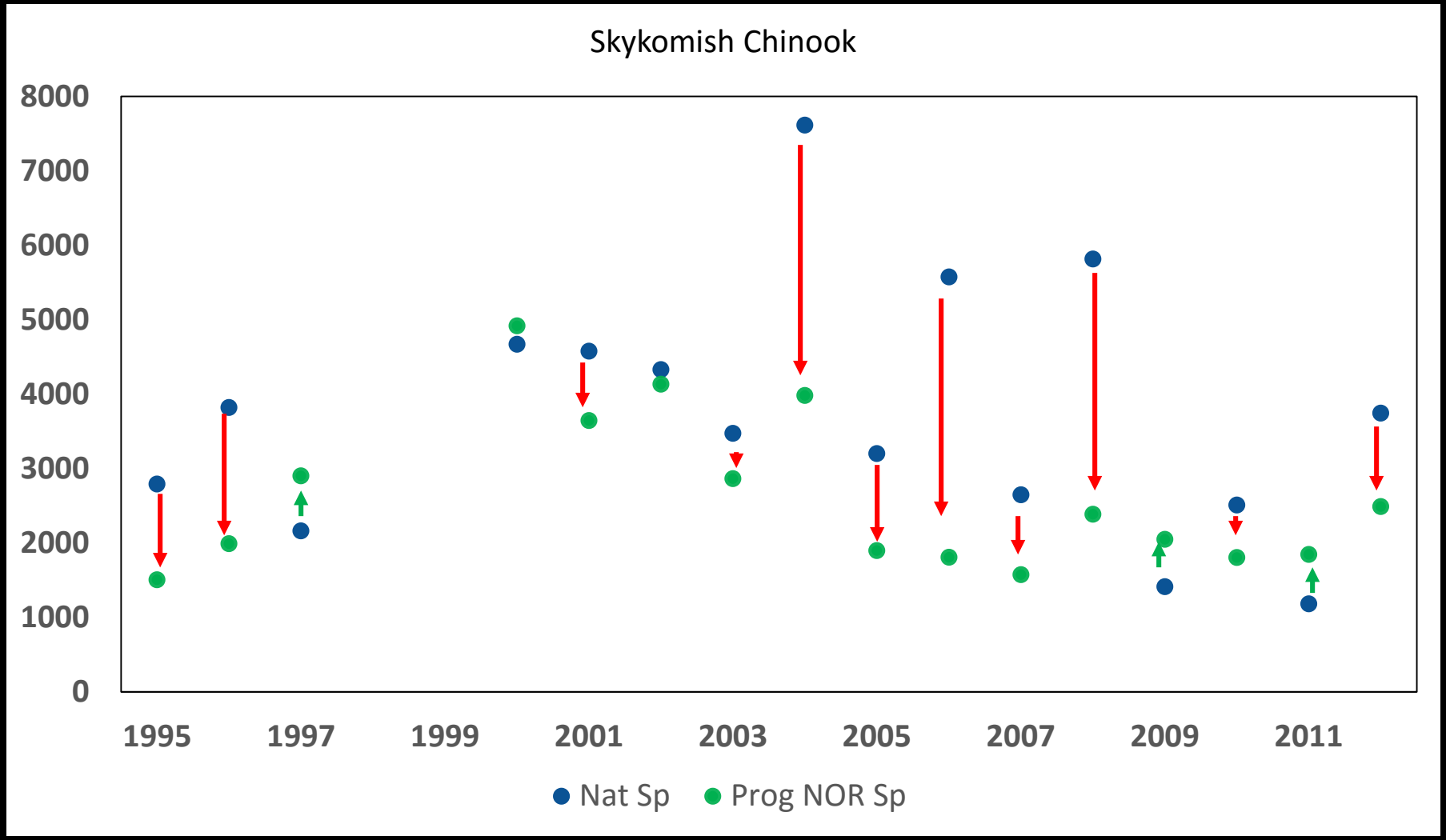
What determines productivity?



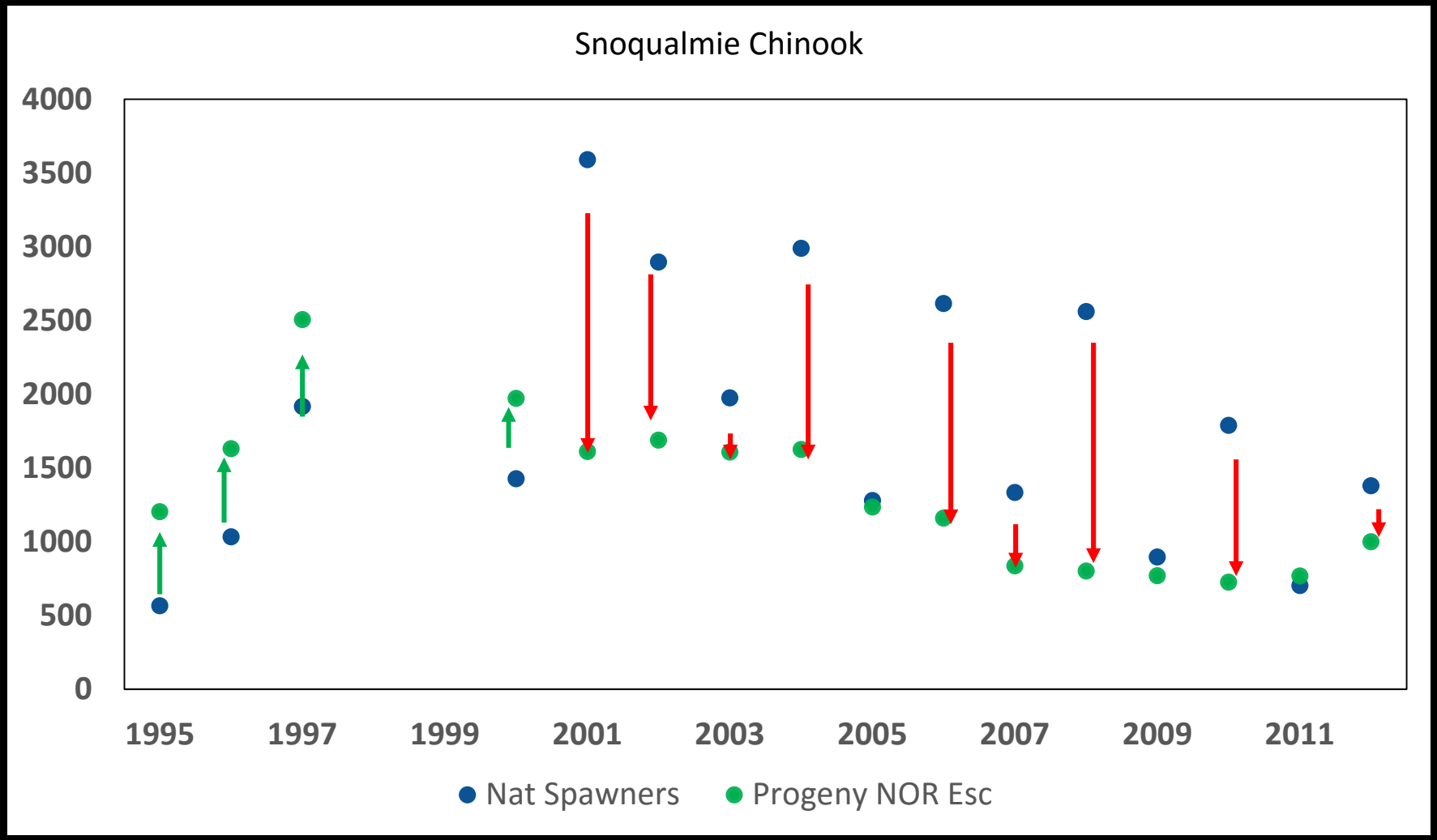
If we have the right habitat conditions, we don’t need 64,000 returning to produce a sustainable and healthy fishery.



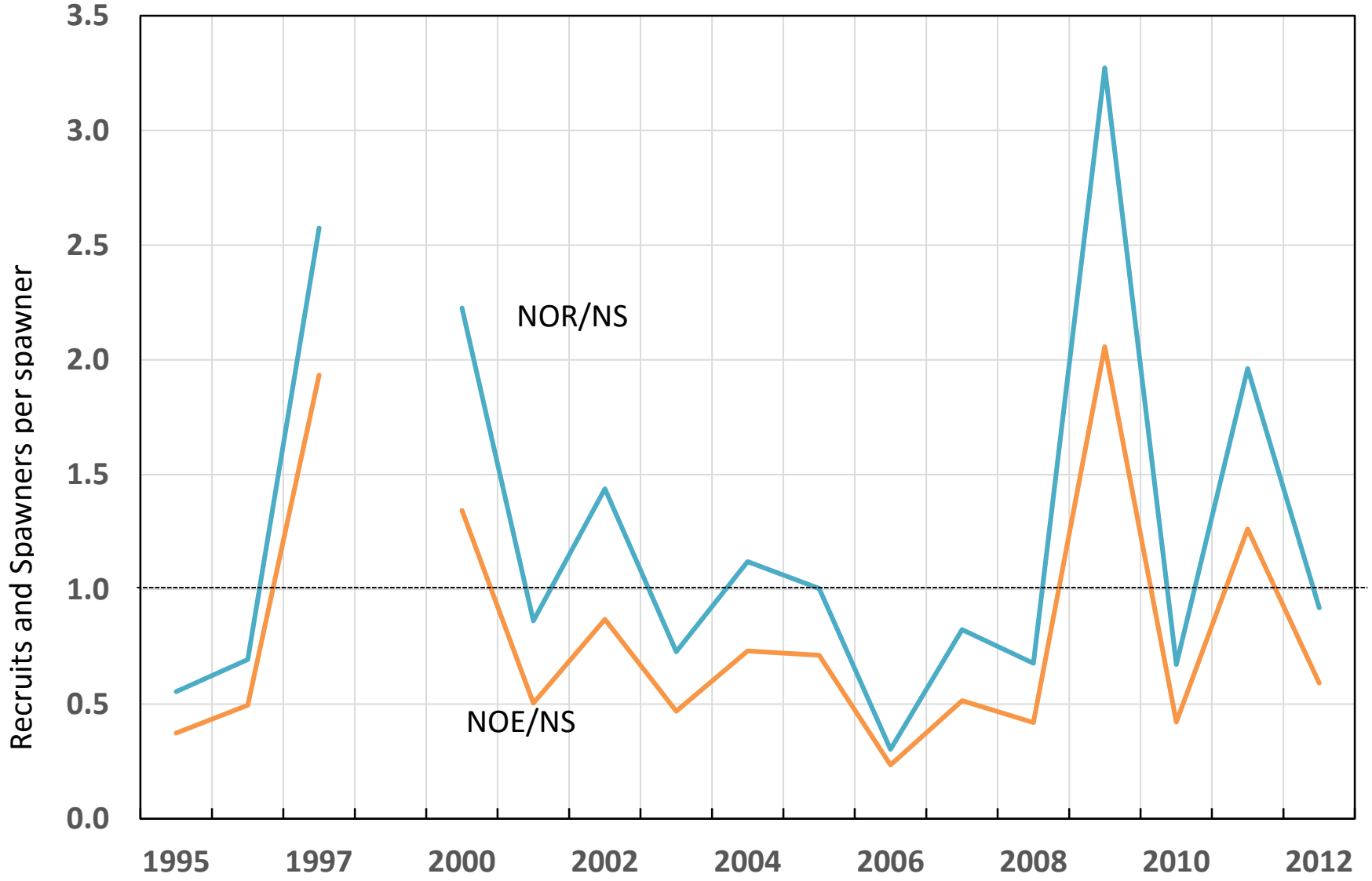
Chinook Productivity



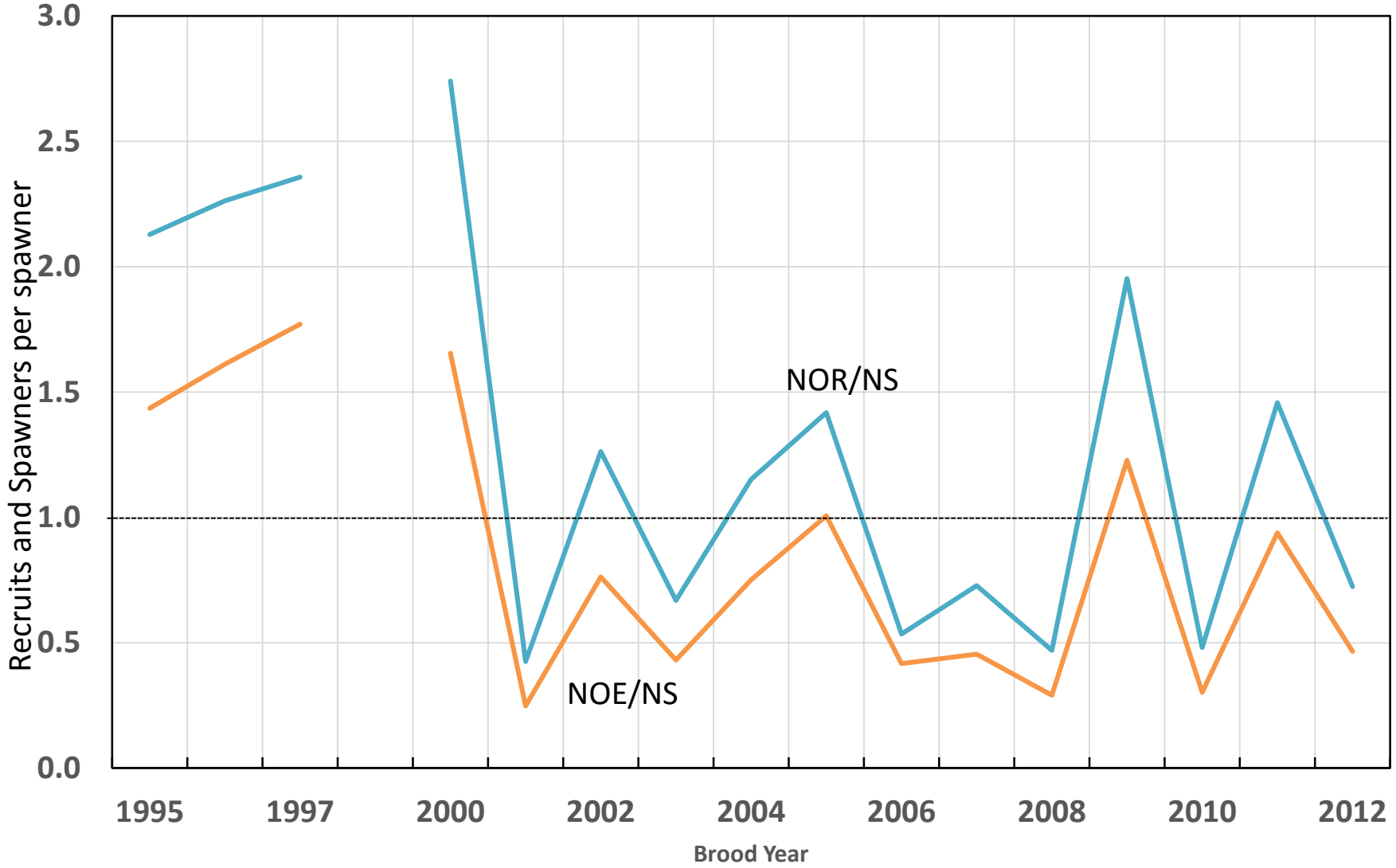
Chinook Productivity



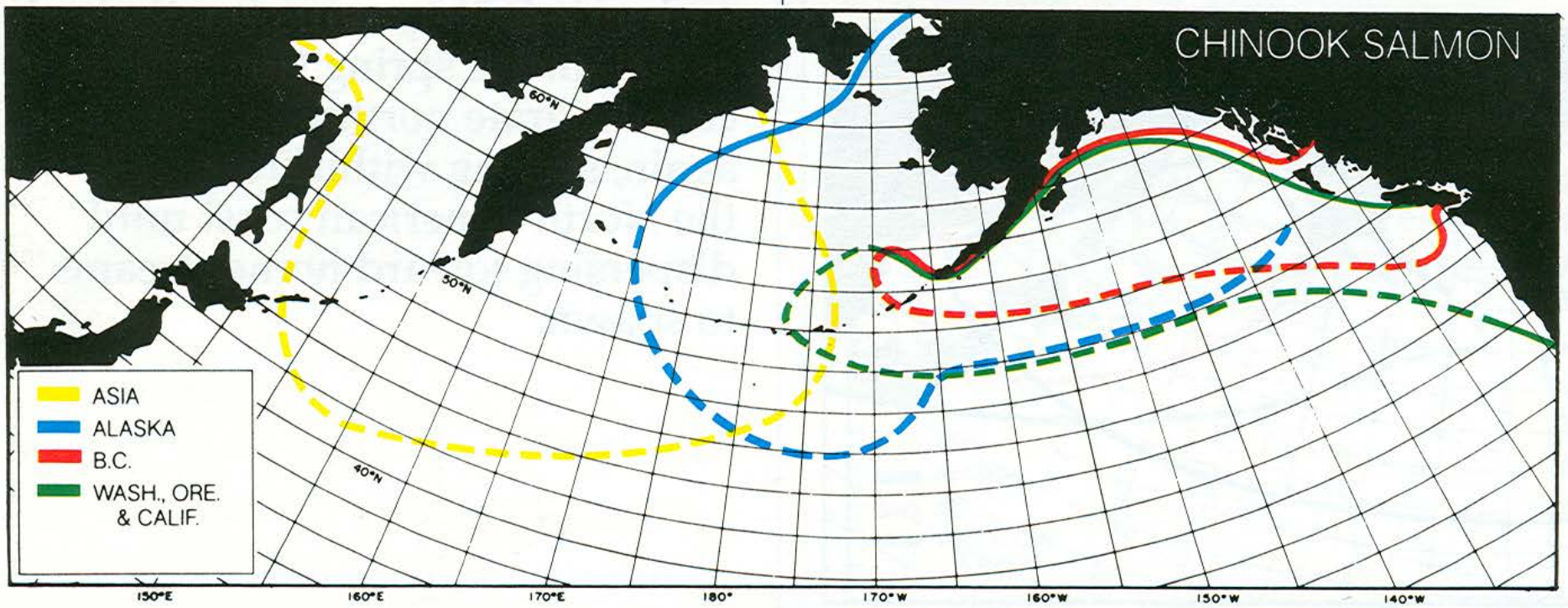
Chinook Productivity - Skykomish



Chinook Productivity - Snoqualmie



PS Chinook Salmon are Widely Distributed



Ocean Conditions - PDO

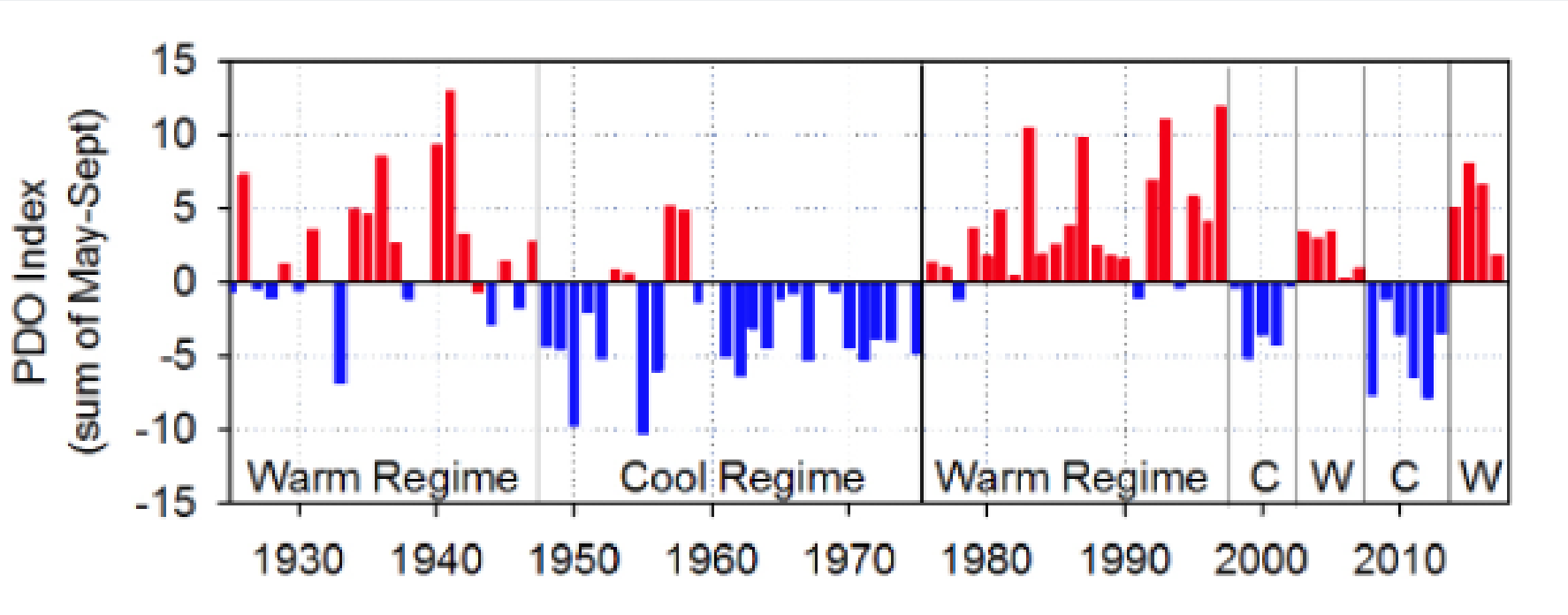
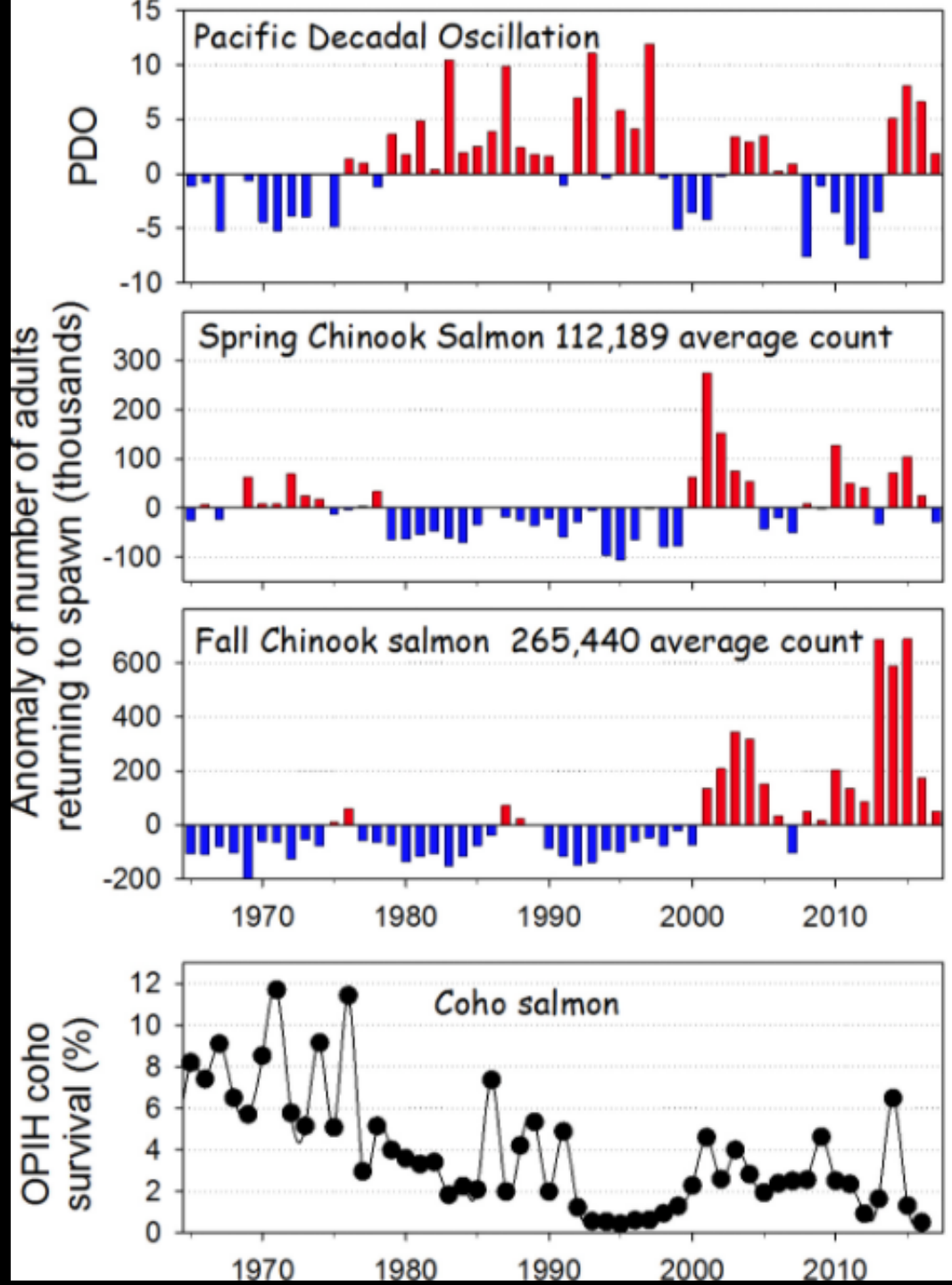


Figure PDO-01. Time series of shifts in sign of the Pacific Decadal Oscillation (PDO), 1925 to present. Values are summed over the months of May through September. Red bars indicate positive (warm) years; blue bars negative (cool) years. Note that 2008 and 2012 were the most negative values recorded since 1956.

www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/ca-pdo.cfm

Ocean Conditions - PDO



https://www.nwfsc.noaa.gov/research/divisions/fe/estuarine/oeip/ca-pdo.cfm

Figure PDO-02. Upper panel shows summer PDO (sum of May–Sept), 1965—present; middle panels show anomalies in counts of adult spring and fall Chinook salmon passing Bonneville Dam from 1965—present; lower panel shows survival of hatchery coho salmon from 1965—present. Vertical lines indicate climate—shift points in 1977 and 1998.

Ocean conditions: indicators

	Year																			
Ecosystem Indicators	*1998*	*1999*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
PDO (Sum Dec-March)	17	6	3	12	7	19	11	15	13	9	5	1	14	4	2	8	10	20	18	16
PDO (Sum May-Sept)	10	4	6	5	11	16	15	17	12	13	2	9	7	3	1	8	18	20	19	14
ONI (Average Jan-June)	19	1	1	6	13	15	14	16	8	11	3	10	17	4	5	7	9	18	20	12
46050 SST (°C; May-Sept)	16	9	3	4	1	8	20	15	5	17	2	10	7	11	12	13	14	19	18	6
Upper 20 m T (°C; Nov-Mar)	19	11	8	10	6	14	15	12	13	5	1	9	16	4	3	7	2	20	18	17
Upper 20 m T (°C; May-Sept)	16	12	14	4	1	3	20	18	7	8	2	5	13	10	6	17	19	9	15	11
Deep temperature (°C; May-Sept)	20	6	8	4	1	10	12	16	11	5	2	7	14	9	3	15	19	18	13	17
Deep salinity (May-Sept)	19	3	9	4	5	16	17	10	7	1	2	14	18	13	12	11	20	15	8	6
Copepod richness anom. (no. species; May-Sept)	18	2	1	7	6	13	12	17	15	10	8	9	16	4	5	3	11	19	20	14
N. copepod biomass anom. (mg C m^{-3}; May-Sept)	18	13	9	10	3	15	12	19	14	11	6	8	7	1	2	4	5	16	20	17
S. copepod biomass anom. (mg C m^{-3}; May-Sept)	20	2	5	4	3	13	14	19	12	10	1	7	15	9	8	6	11	17	18	16
Biological transition (day of year)	17	8	5	7	9	14	13	18	12	2	1	3	15	6	10	4	11	20	20	16
Ichthyoplankton biomass (log (mg C 1000 m^{-3}); Jan-Mar)	20	11	3	7	9	18	17	13	16	15	2	12	4	14	10	8	19	5	6	1
Ichthyoplankton community index (PCO axis 1 scores; Jan-Mar)	9	13	1	6	4	10	18	16	3	12	2	14	15	11	5	7	8	17	20	19
Chinook salmon juvenile catches (no. km^{-1}; June)	18	4	5	15	8	12	16	19	11	9	1	6	7	14	3	2	10	13	17	20
Coho salmon juvenile catches (no. km^{-1}; June)	18	7	12	5	6	2	15	19	16	4	3	9	10	14	17	1	11	8	13	20
Mean of ranks	17.1	7.0	5.8	6.9	5.8	12.4	15.1	16.2	10.9	8.9	2.7	8.3	12.2	8.2	6.5	7.6	12.3	15.9	16.4	13.9
Rank of the mean rank	20	6	2	5	2	14	16	18	11	10	1	9	12	8	4	7	13	17	19	15

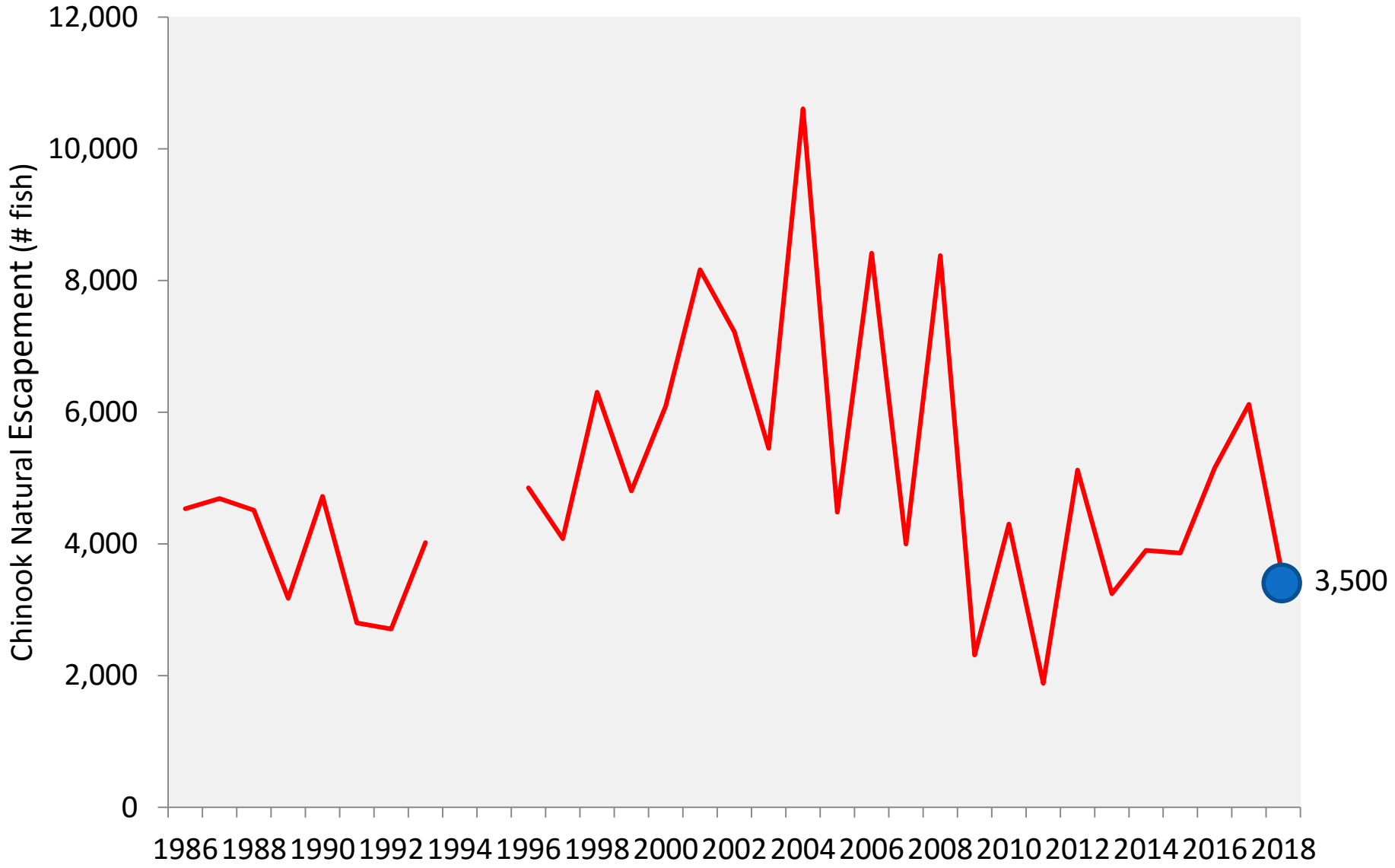
Outlook for Coho and Chinook

	Juvenile Migration Year				Adult Return Outlook	
	2014	2015	2016	2017	coho 2018	Chinook 2018
Large– scale ocean and atmospheric indicators						
PDO (May - Sept)	poor conditions for salmon	poor conditions for salmon	poor conditions for salmon	intermediate conditions for salmon	intermediate returns expected	poor returns expected
ONI (Jan - Jun)	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	intermediate conditions for salmon	intermediate returns expected	poor returns expected
Local and regional physical indicators						
Sea surface temperature	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	good conditions for salmon	good returns expected	poor returns expected
Deep water temperature	poor conditions for salmon	poor conditions for salmon	intermediate conditions for salmon	poor conditions for salmon	poor returns expected	intermediate returns expected
Deep water salinity	poor conditions for salmon	poor conditions for salmon	intermediate conditions for salmon	poor conditions for salmon	intermediate returns expected	poor returns expected
Local biological indicators						
Copepod biodiversity	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	intermediate conditions for salmon	intermediate returns expected	poor returns expected
Northern copepod anomalies	good conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor returns expected	poor returns expected
Biological spring transition	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor returns expected	poor returns expected
Winter ichthyoplankton biomass	poor conditions for salmon	good conditions for salmon	good conditions for salmon	good conditions for salmon	good returns expected	good returns expected
Winter ichthyoplankton community	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor returns expected	poor returns expected
Juvenile Chinook salmon catch – June	intermediate conditions for salmon	intermediate conditions for salmon	poor conditions for salmon	poor conditions for salmon	poor returns expected	poor returns expected
Juvenile coho salmon catch – June	intermediate conditions for salmon	intermediate conditions for salmon	intermediate conditions for salmon	poor conditions for salmon	poor returns expected	intermediate returns expected

Key
- ■ good conditions for salmon
- ■ intermediate conditions for salmon
- ■ poor conditions for salmon
- ● good returns expected
- ● intermediate returns expected
- ● poor returns expected

Freshwater habitat

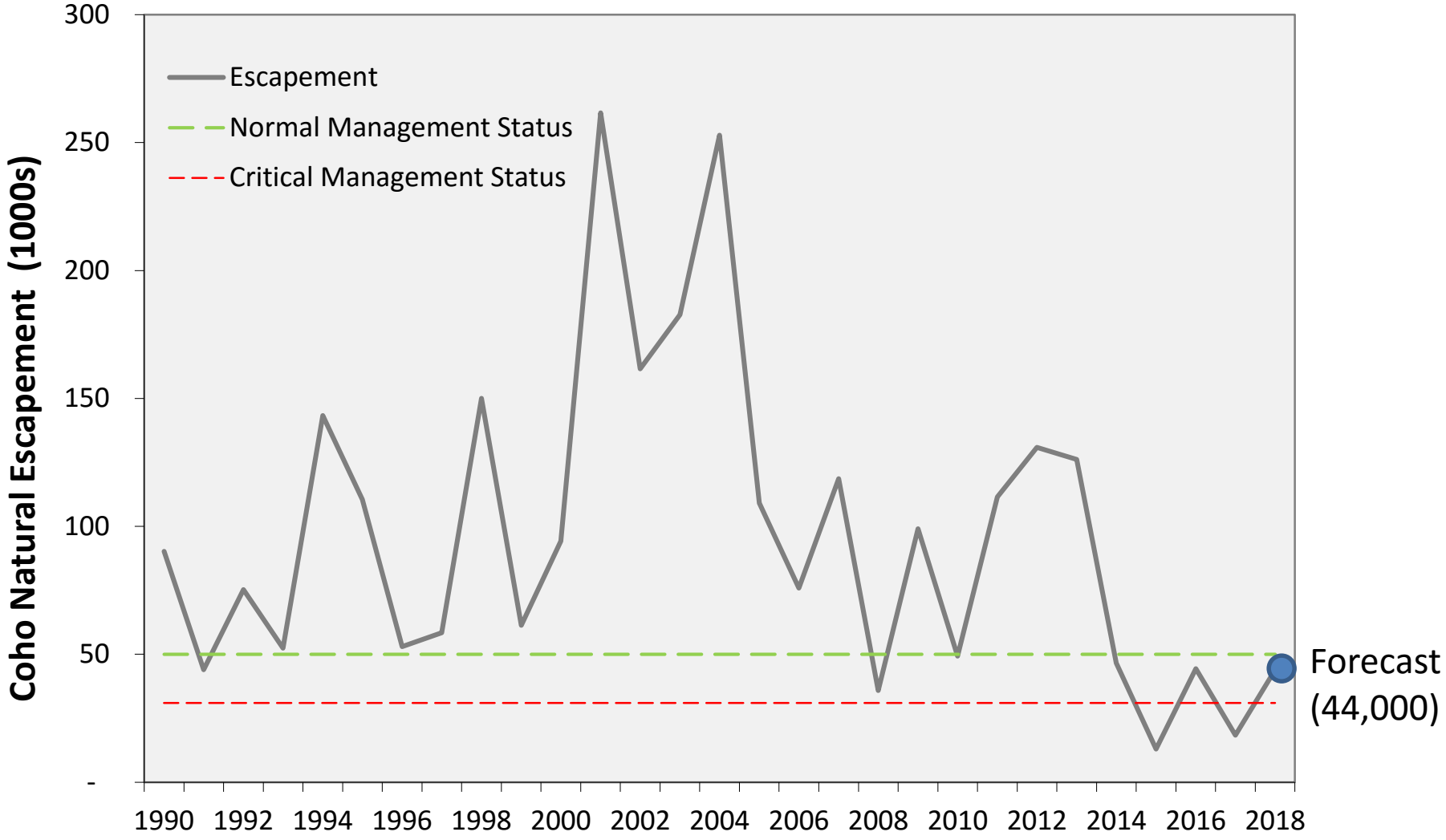
2018 Chinook Forecast



2017 Coho Forecast

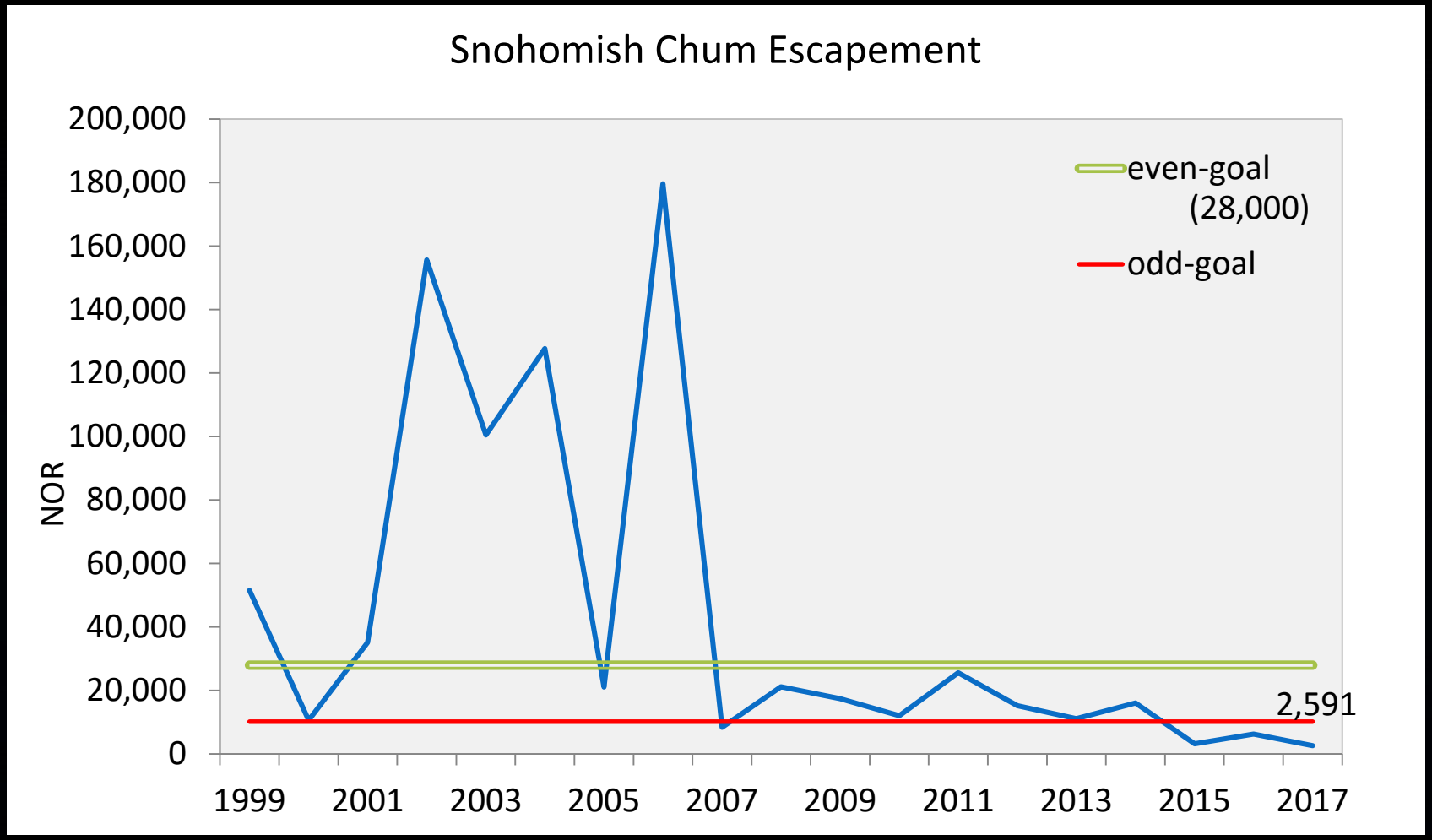
- 65,925 (Ocean Age 3)
- 44,000 terminal escapement

2017 Coho Forecast

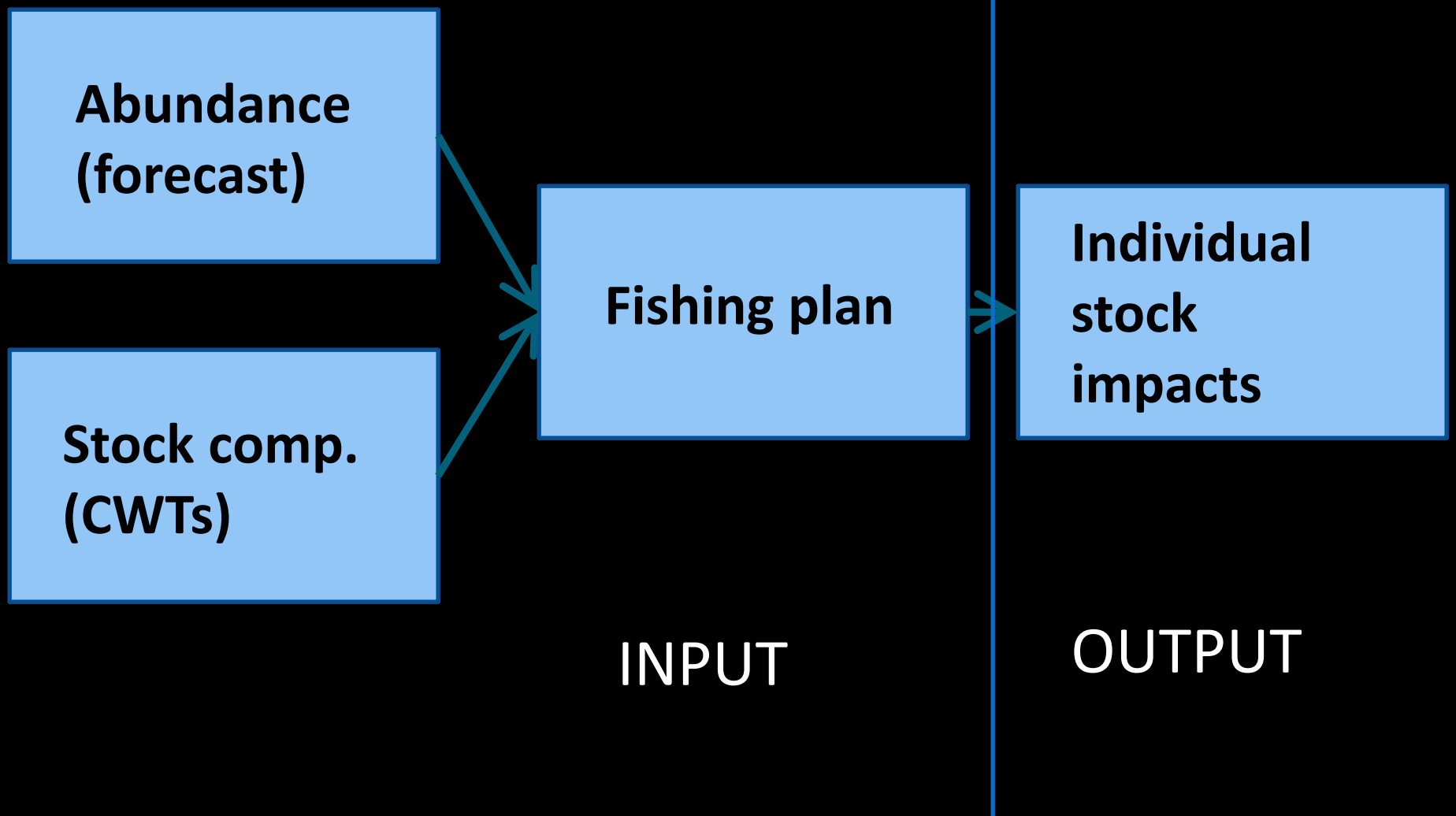


Chum forecast

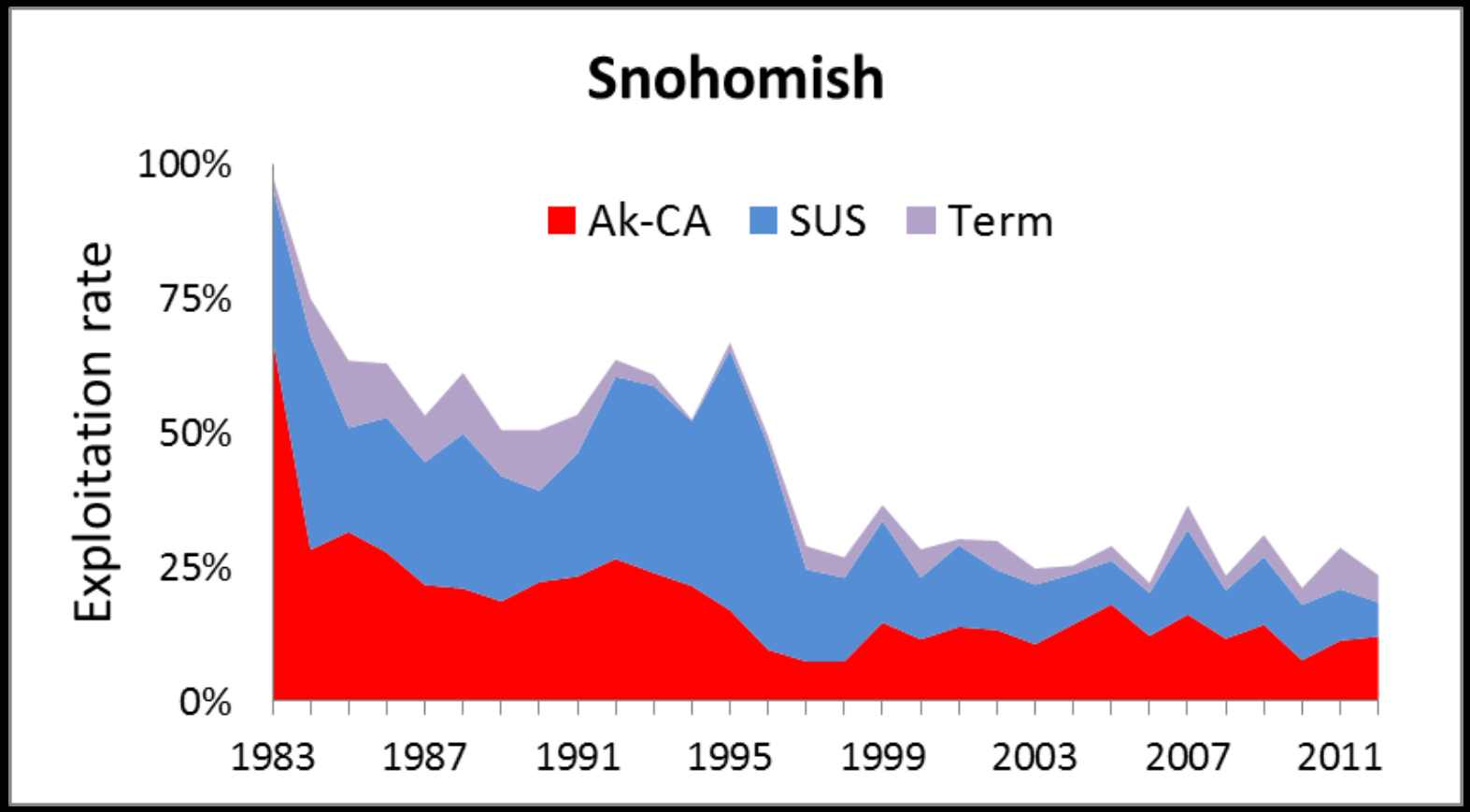
- Chum = 13,957
  - Escapement goal: 28,000



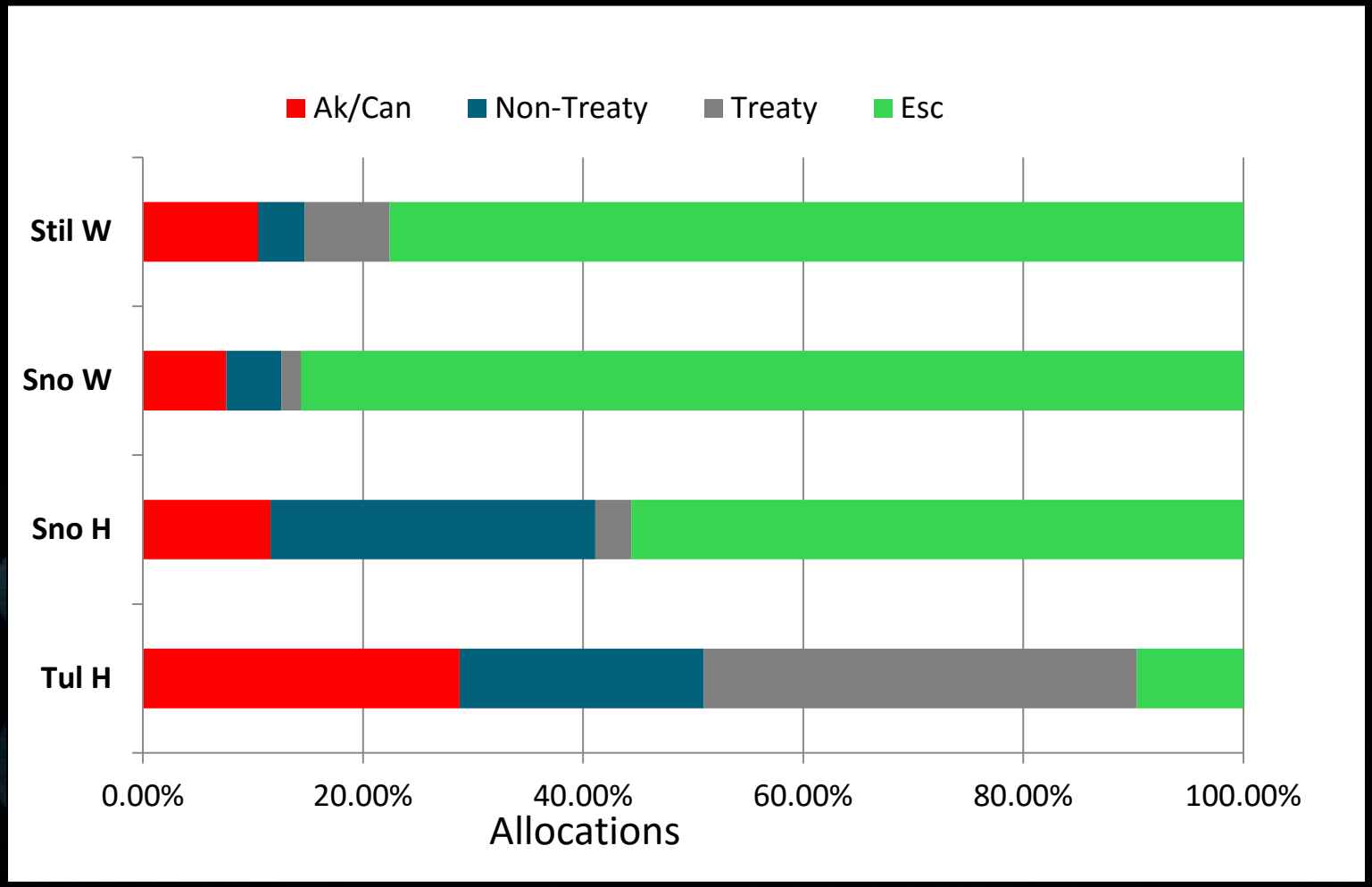
Fishery Regulation Assessment Model (FRAM)



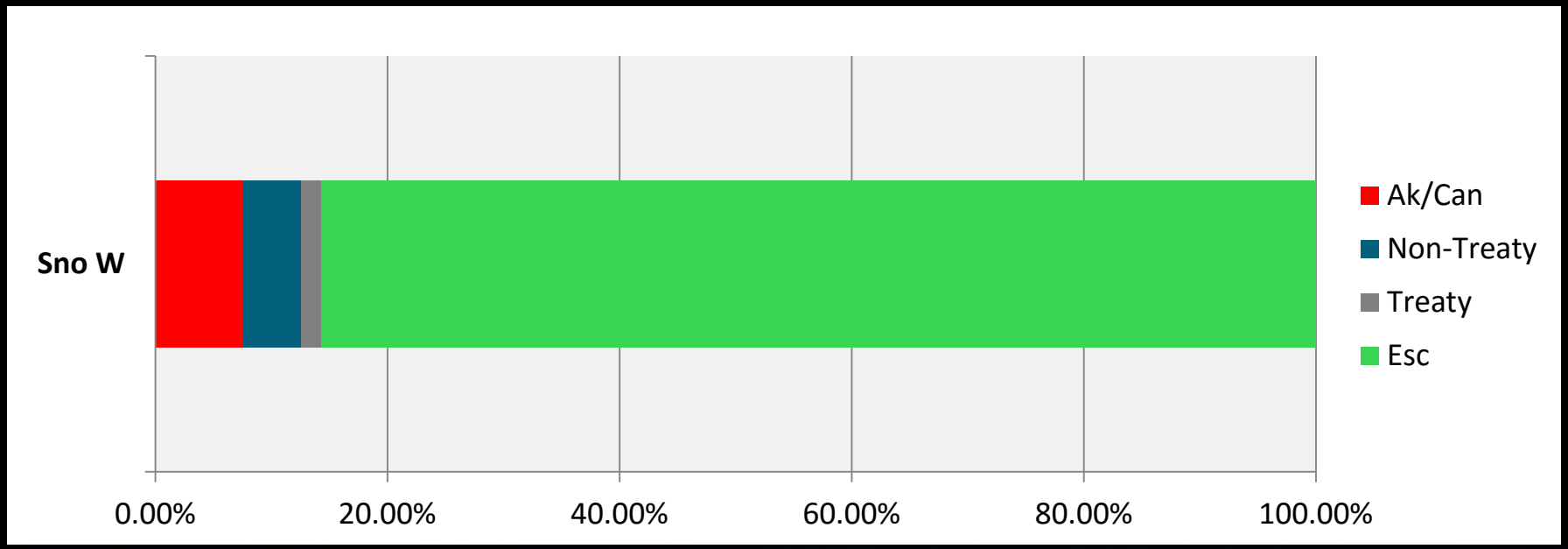
Snohomish Chinook exploitation rate trend



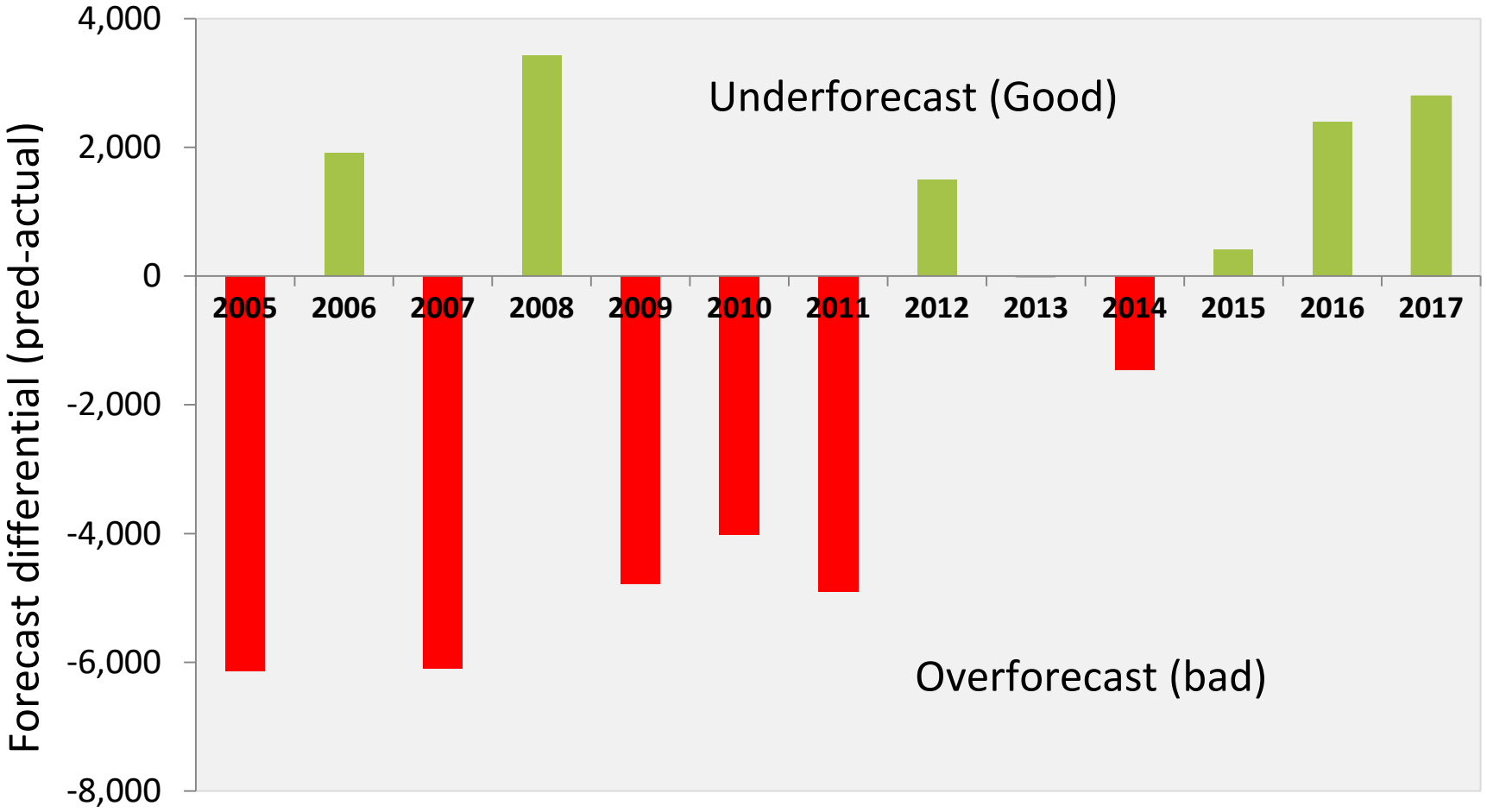
Are we fishing selectively?



Wild Chinook exploitation



Forecast accuracy (Predicted – Actual)



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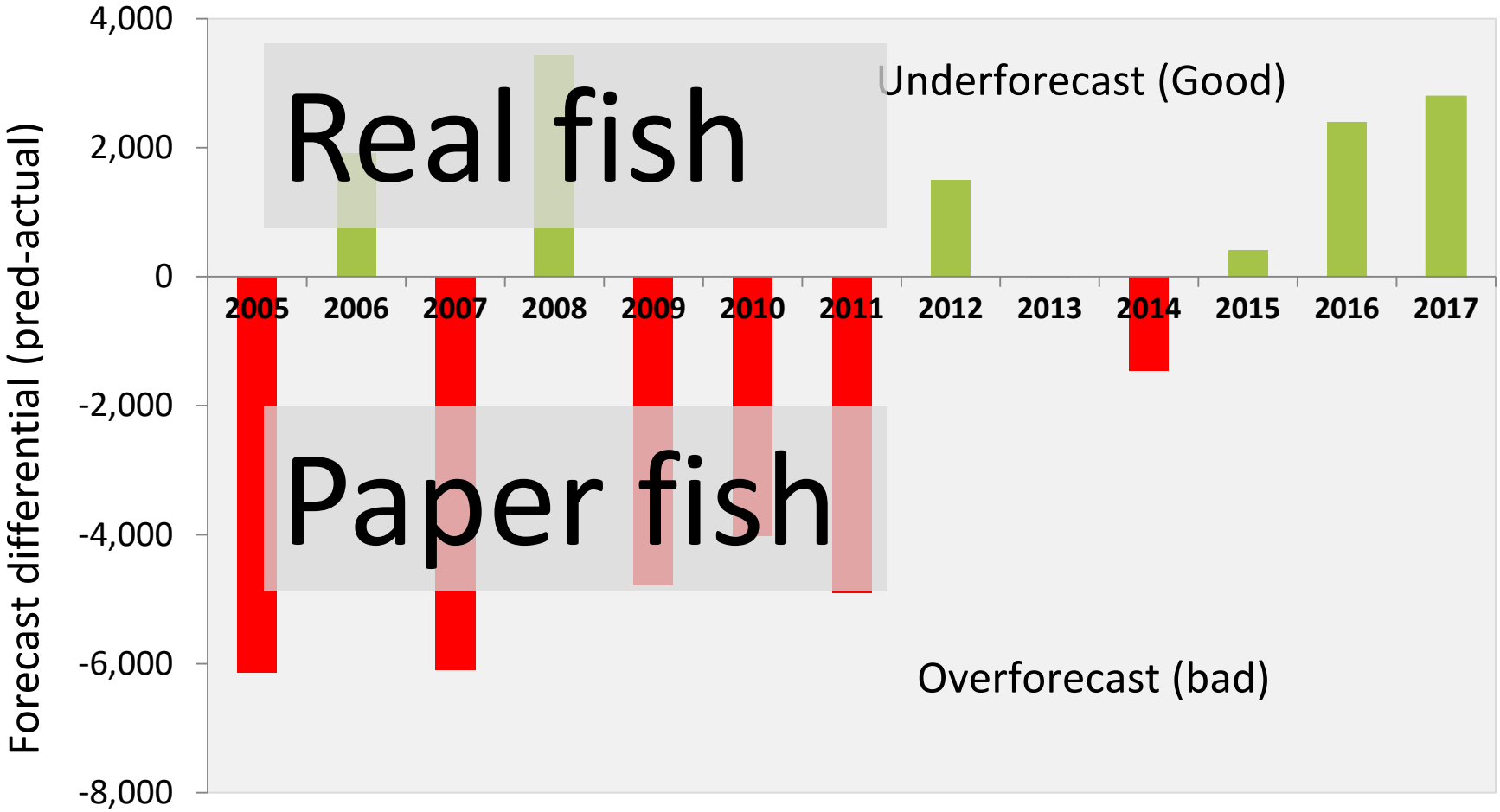

Questions?