A Review of Escapement Goals for Salmon Stocks in Lower Cook Inlet, Alaska, 2016

RC-3, Tab 1:
EG Written Report

RC-3, Tab 2:
McNeil Action Plan

RC-3, Tab 4:
EG Oral Report

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Outline

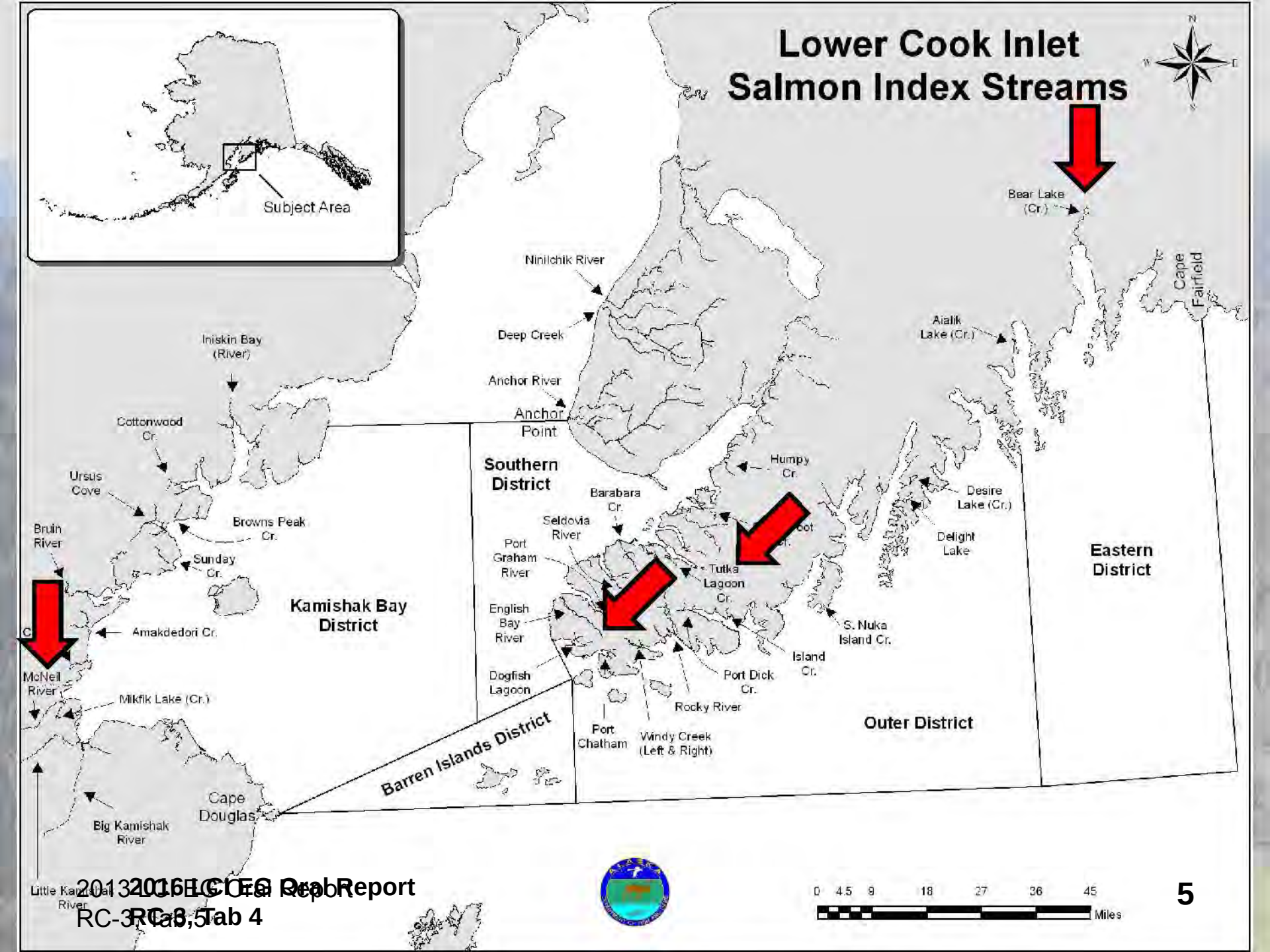
- Escapement Goal Review Process
- Key terms
- Lower Cook Inlet (LCI) Management Area
- Methods & Rationale for revising LCI goals
- Review of recent escapement performance
- 2016 Recommendations
- King salmon

Escapement Goal Review Process

1. Establish a review committee (CF, SF)
2. Review and evaluate existing goals
3. Propose new goals and modify or eliminate existing goals
4. Provide written and oral reports to BOF
5. Memo to CF and SF division directors for approval of recommended changes

Definition of Key Terms

- *Maximum Sustained Yield (MSY): greatest average annual yield over long term*
- *Biological Escapement Goal (BEG):* The escapement that provides the greatest potential for maximum sustained yield (MSY)
- *Sustainable Escapement Goal (SEG):* The level of escapement, indicated by an index or estimate, that is known to provide for sustained yield over a 5-10 year period; used in situations where a BEG cannot be estimated


Lower Cook Inlet
Salmon Index Streams
Subject Area
Bear Lake (Cr.)
Ninilchik River
Deep Creek
Anchor River
Anchor Point
Iniskin Bay (River)
Cottonwood Cr.
Ursus Cove
Browns Peak Cr.
Bruin River
Sunday Cr.
Amakdedori Cr.
McNeil River
Mikfik Lake (Cr.)
Big Kamishak River
Cape Douglas
Little Kamishak River
Kamishak Bay District
Southern District
Barabara Cr.
Seldovia River
Port Graham River
English Bay River
Dogfish Lagoon
Port Chatham
Windy Creek (Left & Right)
Rocky River
Port Dick Cr.
Tutka Lagoon Cr.
Humpy Cr.
Barren Islands District
Outer District
Aialik Lake (Cr.)
Cape Fairfield
Desire Lake (Cr.)
Delight Lake
Eastern District
S. Nuka Island Cr.
Island Cr.
0 4.5 9 18 27 36 45
Miles

Review of Current Goals

- 41 salmon stocks in LCI have escapement goals: 12 chum, 18 pink, 8 sockeye, and 3 king
- LCI goals are SEGs because we lack sufficient data to calculate the # of spawners needed to achieve Maximum Sustained Yield (MSY)

Methods

- LCI SEGs since 2001 developed using the Percentile Approach (Bue and Hasbrouck, *unpublished Report to BOF in 2001*).
  - Tier 1: 25th–75th percentiles for stocks with high escapement contrast (>8) and moderate harvest rates
  - Tier 2: 15th–75th percentiles for stocks with medium escapement contrast (4-8) and low harvest rates
  - Tier 3: 15th–85th percentiles for stocks with medium escapement contrast (4-8) and unknown harvest
  - Tier 4: 15th–100th percentiles for stocks with low escapement contrast and unknown harvest

Methods

- Percentile Approach used to develop half of the SEGs currently in use in Alaska
- Department initiated comprehensive review of the Percentile Approach (Clark et al. 2014)
- Multi-level Review:
  - Theoretical Analysis: range of productivities, harvest rates, and process and measurement errors
  - Simulation Analysis: Monte Carlo simulation model
  - Empirical Meta-Analysis: compared percentile-based SEGs with MSY-based SEGs for 76 stocks around AK

Methods

- Clark et al. (2014) evaluation of the Percentile Approach found the following:
  - Each of the 4 tiers were sub-optimal as proxies for an SEG range that captures MSY
  - The upper bound percentiles for each tier were too high, likely exceeding carrying capacity
  - The lower bound percentile (25%) of Tier 1 was too high
  - Escapements in the lower 60 to 65th percentiles are optimal across a wide range of stocks

Methods

- Clark et al. (2014) "3-tier" Percentile Approach
  - Tier 1: 20th–60th percentiles for stocks with high escapement contrast (>8), high measurement error monitoring (e.g., aerial or foot survey), and low-moderate harvest rates
  - Tier 2: 15th–65th percentiles for stocks with high escapement contrast (>8). Low measurement error monitoring (e.g. weir) and low-moderate harvest rates
  - Tier 3: 5th–65th percentiles for stocks with low escapement contrast (≤8) and low-moderate harvest

Bue-Hasbrouck vs. Clark et al.

"4-Tier" Percentile Approach "3-Tier"

	Percentiles Used		Escapement	Average	Measurement
Tier	**4-Tier**	**3-Tier**	**Contrast**	**Harvest**	**Error**
Tier 1	25th–75th	20th–60th	>8	<0.4	High
Tier 2	15th–75th	15th–65th	>8	<0.4	Low
Tier 3	15th–85th	5th–65th	≤8	<0.4	NA
Tier 4	15th–100th	NA	<4	<0.4	NA

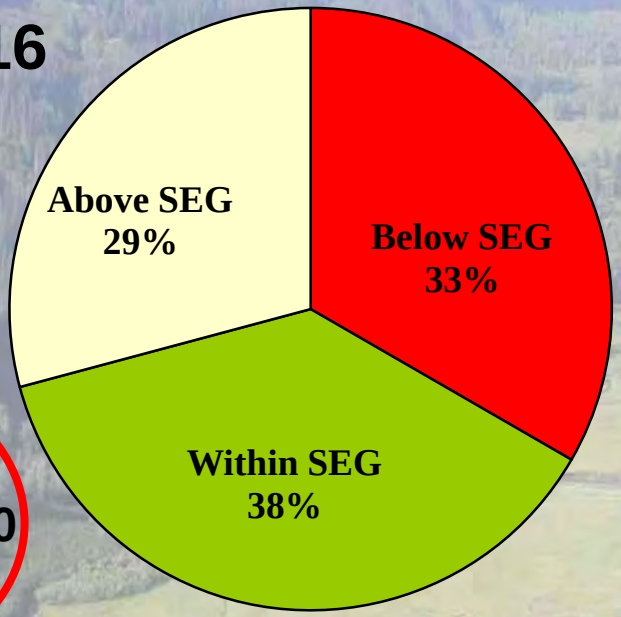
Clark et al. (2014)

http://www.adfg.alaska.gov/FedAidPDFs/FMS14-06.pdf

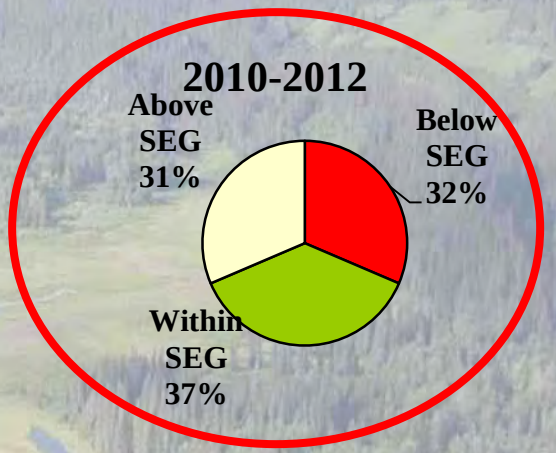
Chum Salmon

Chum Salmon Escapement Performance

2013–2016



Avg. Annual Harvest: ~79,000 chum salmon



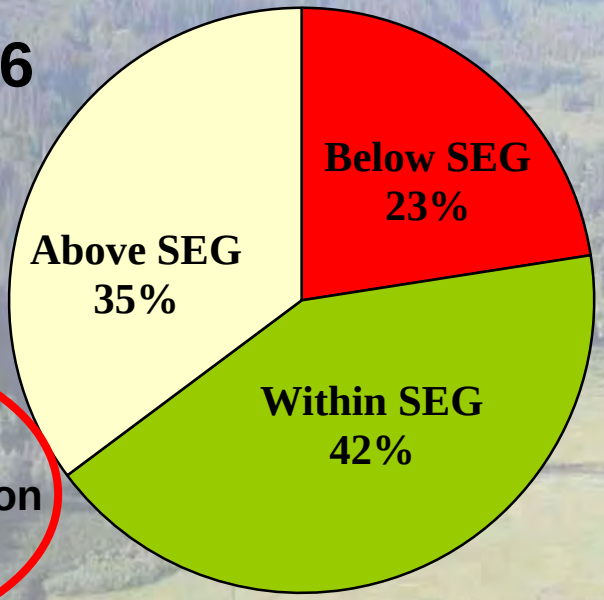
Avg. Annual Harvest: 61,000 chums

n = 48 chum salmon escapement observations (12 stocks over 4 years)

Pink Salmon

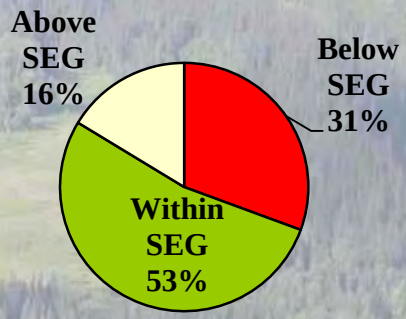
Pink Salmon Escapement Performance

2013–2016



Avg. Annual Harvest: >2.2 Million pink salmon

2010-2012



Avg. Annual Harvest: 299,000 pinks

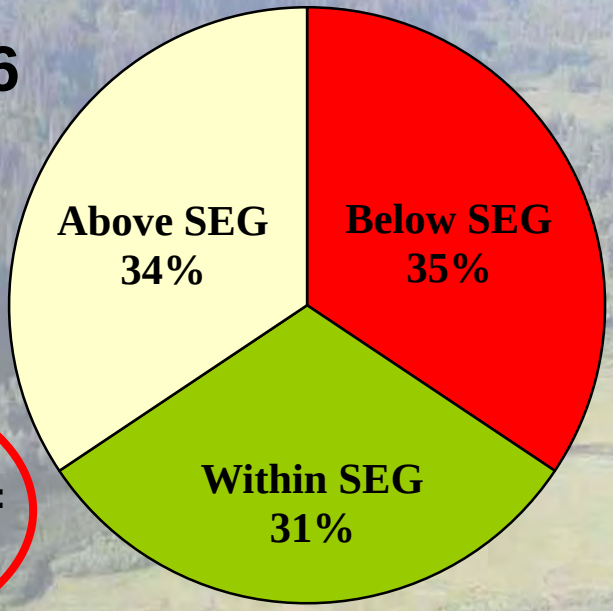
n = 71 pink salmon escapement observations* (18 stocks over 4 years)

Insufficient data to estimate escapement one year for one stock (Dogfish Lagoon)

Sockeye Salmon

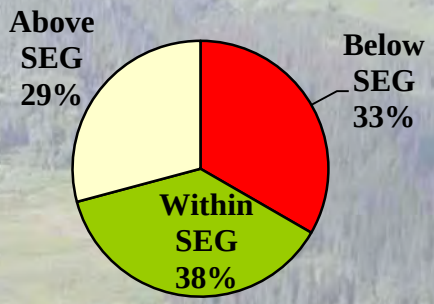
Sockeye Salmon Escapement Performance

2013–2016



Avg. Annual Harvest:
237,000 sockeyes

2010-2012



Avg. Annual Harvest:
224,000 sockeyes

RC-3, Tab 1

n = 32 sockeye salmon escapement observations (8 stocks over 4 years)

Recommendations: Chum

Stock	Current SEG Range Lo	Current SEG Range Hi	Year Adopted	Recommended SEG Range Lo	Recommended SEG Range Hi	n	% Change Lo	% Change Hi
Port Graham River	1,450	4,800	2002	1,200	2,700	40	-17%	-44%
Dogfish Lagoon	3,350	9,150	2002	3,500	8,600	40	4%	-6%
Rocky River	1,200	5,400	2002	1,500	4,400	39	25%	-19%
Port Dick Creek	1,900	4,450	2002	1,900	4,300	40	0%	-3%
Island Creek	6,400	15,600	2002	5,100	11,900	40	-20%	-24%
Big Kamishak River	9,350	24,000	2002	6,800	15,600	35	-27%	-35%
Little Kamishak River	6,550	23,800	2002	8,000	16,800	37	22%	-29%
McNeil River	24,000	48,000	2008	24,000	48,000	40	0%	0%
Bruin River	6,000	10,250	2002	5,200	10,000	40	-13%	-2%
Ursus Cove	6,050	9,850	2002	5,900	10,100	40	-2%	3%
Cottonwood Creek	5,750	12,000	2002	5,200	12,200	40	-10%	2%
Iniskin Bay	7,850	13,700	2002	5,900	13,600	40	-25%	-1%
				Average for stocks with SEG change:			-6%	-14%

RC-3, Tab 1
Appendix B

Recommendations: Pink

Stock	Current SEG Range Lo		Current SEG Range Hi	Year Adopted	Recommended SEG Range Lo		Recommended SEG Range Hi	n	% Change Lo	% Change Hi
Humpy Creek	21,650	–	85,550	2002	17,500	–	51,400	40	-19%	-40%
China Poot Creek	2,900	–	8,200	2002	2,500	–	6,300	40	-14%	-23%
Tutka Creek	6,500	–	17,000	2002	6,500	–	17,000	25	0%	0%
Barabara Creek	1,900	–	8,950	2002	2,000	–	5,600	40	5%	-37%
Seldovia Creek	19,050	–	38,950	2002	21,800	–	37,400	40	14%	-4%
Port Graham River	7,700	–	19,850	2002	7,700	–	19,700	22	0%	-1%
Dogfish Lagoon Creeks	1,200	–	8,400	2014	800	–	7,100	38	-33%	-15%
Port Chatham	7,800	–	21,000	2002	7,800	–	18,100	39	0%	-14%
Windy Creek Right	3,350	–	10,950	2002	3,400	–	11,200	40	1%	2%
Windy Creek Left	3,650	–	29,950	2002	5,400	–	27,100	40	48%	-10%
Rocky River	9,350	–	54,250	2002	11,700	–	54,800	40	25%	1%
Port Dick Creek	18,550	–	58,300	2002	17,900	–	49,800	40	-4%	-15%
Island Creek	7,200	–	28,300	2002	9,600	–	32,500	39	33%	15%
S. Nuka Island Creek	2,700	–	14,250	2002	2,800	–	11,200	36	4%	-21%
Desire Lake	1,900	–	20,200	2002	1,500	–	18,000	37	-21%	-11%
Bruin River	18,650	–	155,750	2002	17,800	–	103,000	40	-5%	-34%
Sunday Creek	4,850	–	28,850	2002	4,400	–	24,900	40	-9%	-14%
Brown's Peak Creek	2,450	–	18,800	2002	2,600	–	17,500	40	6%	-7%
					Average for stocks with SEG change:				2%	-13%

Recommendations: Sockeye

Stock	Current SEG Range Lo	Current SEG Range Hi	Year Adopted	Recommended SEG Range Lo	Recommended SEG Range Hi	n	% Change Lo	% Change Hi
English Bay	6,000	13,500	2002	6,000	13,500	40	0%	0%
Delight Lake	7,550	17,650	2011	5,100	10,600	35	-32%	-40%
Desire Lake	8,800	15,200	2002	4,800	11,900	40	-45%	-22%
Bear Lake	700	8,300	2002	700	8,300	37	0%	0%
Aialik Lake	3,700	8,000	2002	3,200	5,400	40	-14%	-33%
Mikfik Lake	3,400	13,000	2014	3,400	11,000	17	0%	-15%
Chenik Lake	3,500	14,000	2011	2,900	13,700	20	-17%	-2%
Amakdedori Creek	1,250	2,600	2002	1,200	2,600	40	-4%	0%
				Average for stocks with SEG change:			-19%	-19%

RC-3, Tab 1
Appendix D

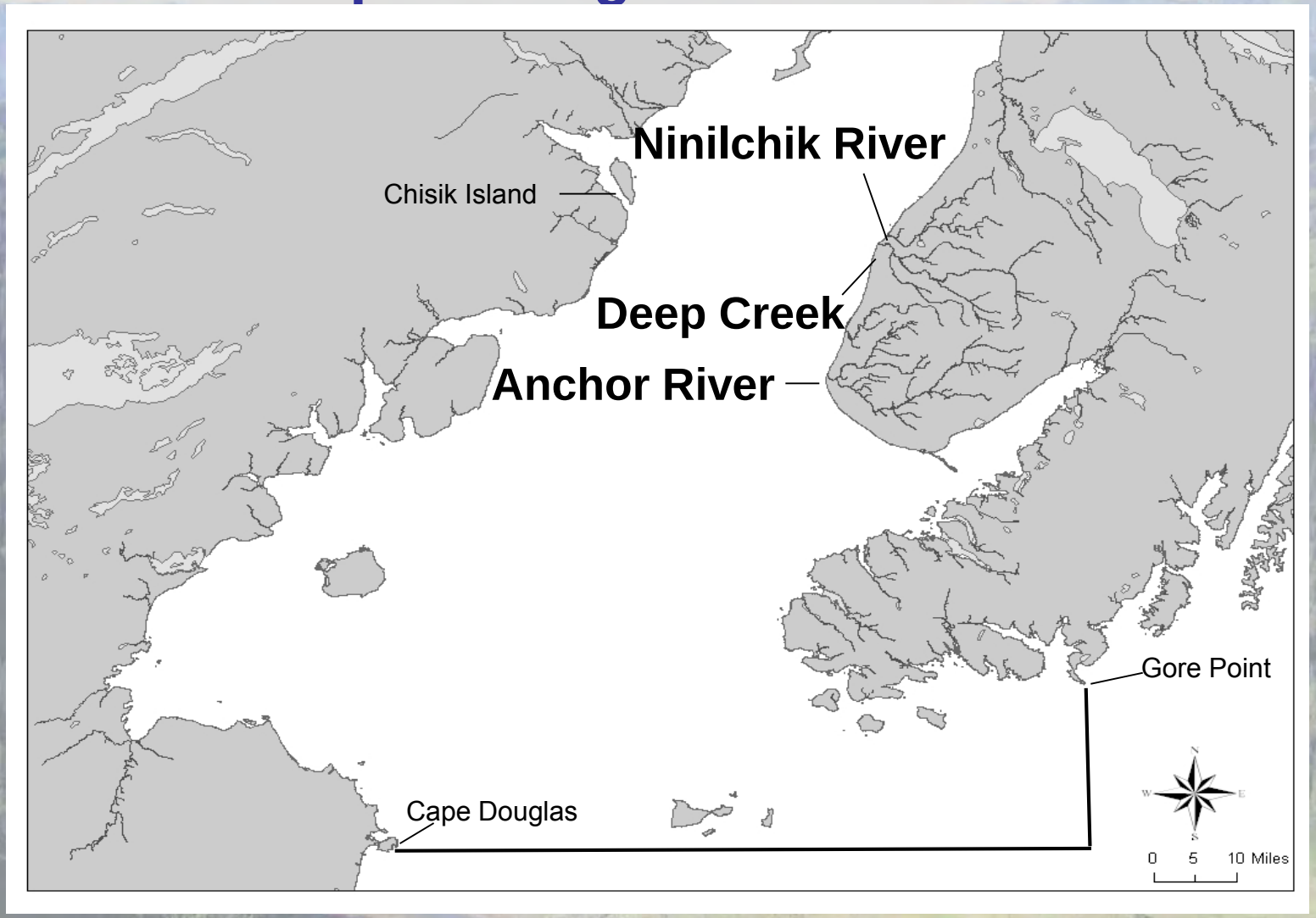
Summary

- 14 years of additional escapement data and updated percentile methods led to recommendations to change 37 of 41 LCI SEGs
- The relative decrease in SEGs is equivalent to the change in recommended percentiles used
- Recommending McNeil River chum salmon as a stock of management concern

Outline (Continued)

- Overview of the EG review process and definition of key terms
- Description of the LCI Management Area
- Methods & Rationale for revising LCI goals
- Review of recent escapement performance relative to the current goals
- Recommendations for 2016 goals
- McNeil River chum salmon: stock of concern
- **Review of king salmon goals**

There are 3 king salmon systems with escapement goals in LCI

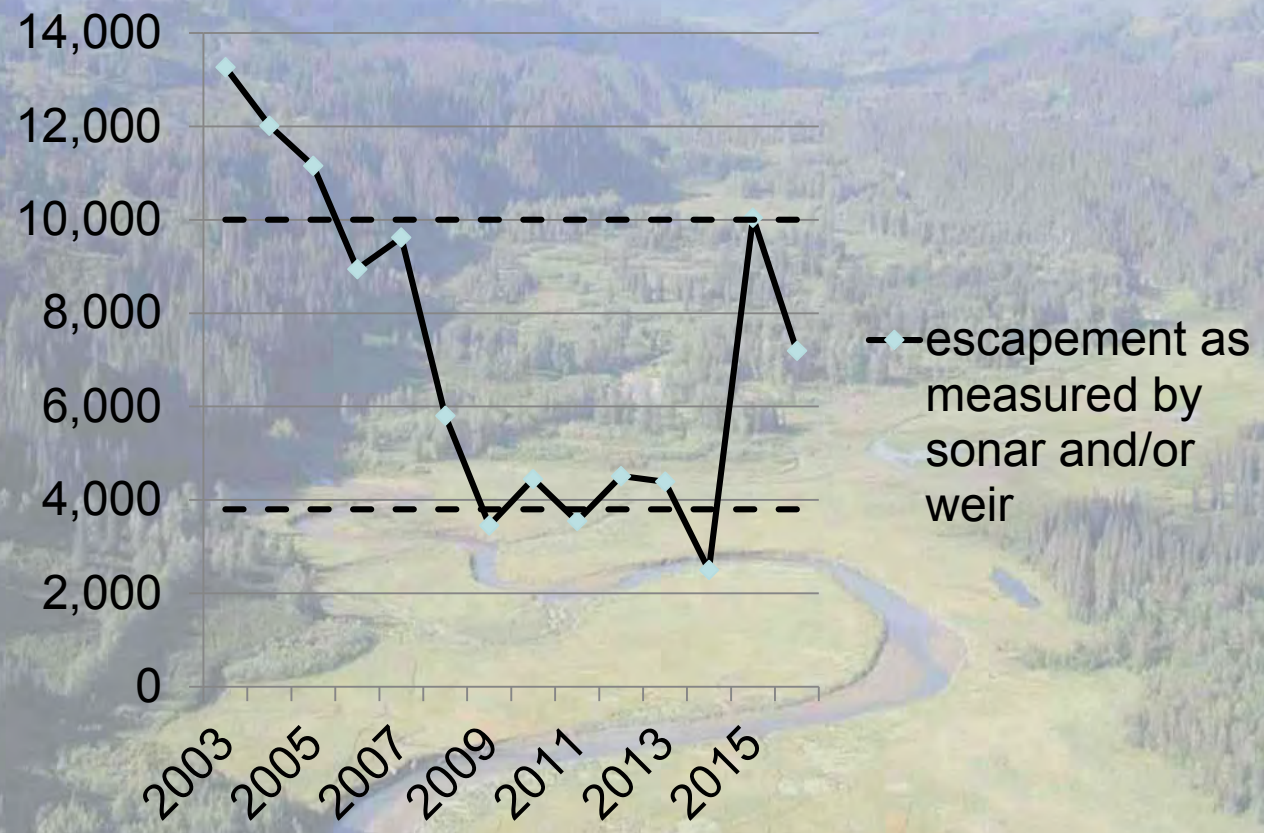


Escapements have generally been achieved in each system

We recommend changes to all 3 king salmon SEG's

- Anchor River: lower the upper end of the SEG
- Deep Creek: change to a lower bound SEG
- Ninilchik River: change from an index, to the entire run

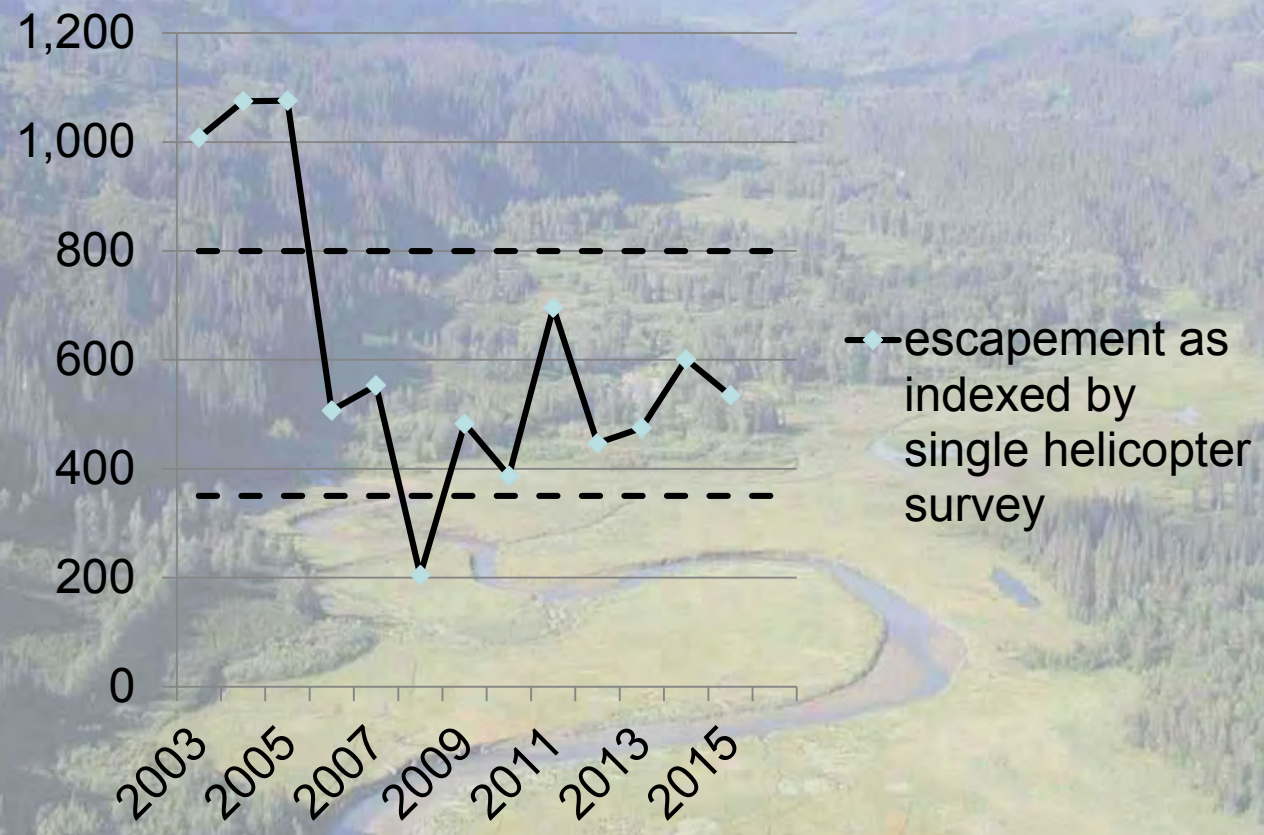
Anchor River king salmon: With management actions during the downturn in production, the SEG has been achieved in 5 of the last 8 years, including 2 of the last 3



Anchor River king salmon SEG: Lower the upper end

- Current SEG is 3,800-10,000
- Updated stock-recruit analysis suggests 7,600 is a more appropriate upper end
- Recommend SEG of 3,800-7,600

Deep Creek king salmon: The SEG has been achieved in all recent years but one (2008). Poor weather conditions precluded a survey in 2016.



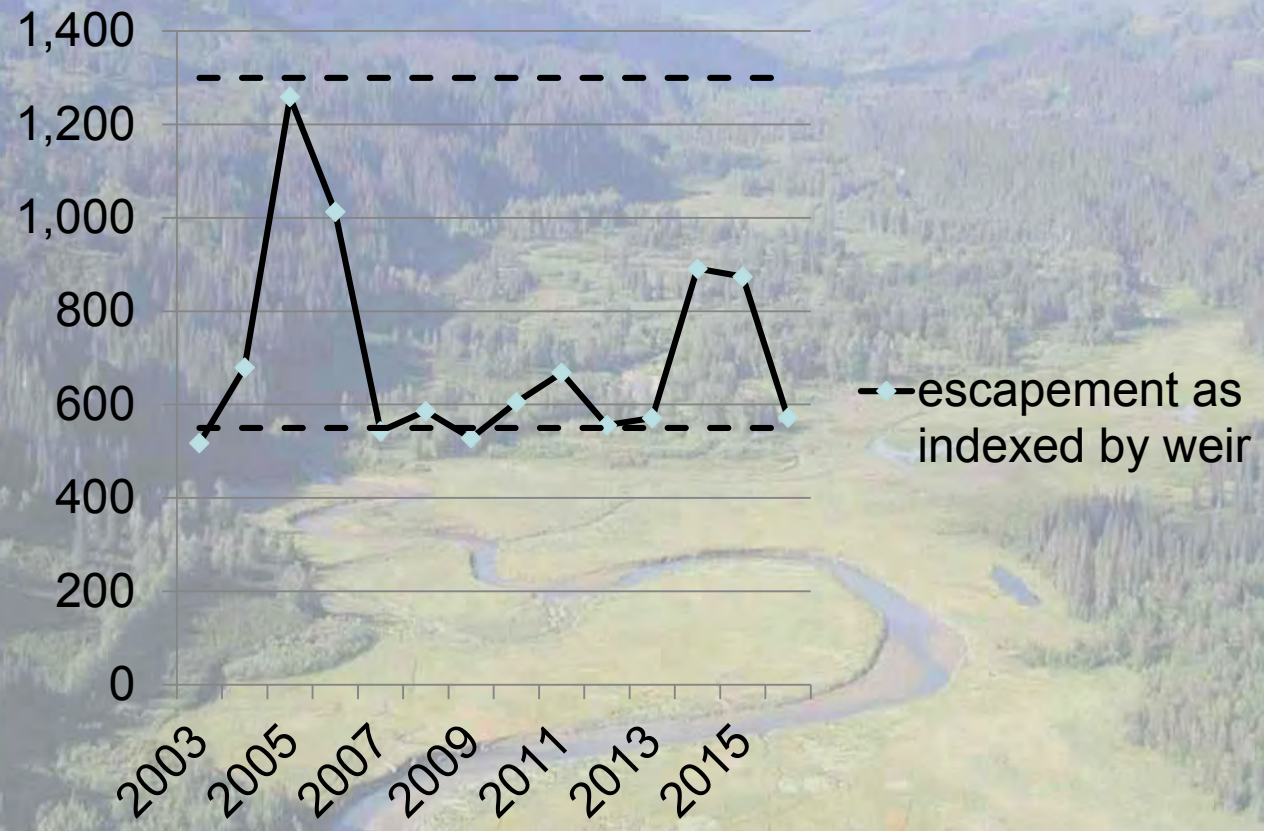
Deep Creek king salmon SEG: change to lower bound SEG

1. Current SEG is 350-800

2. Range from update with recent years and new percentile approach too narrow

3. Recommend lower bound SEG of 350

Ninilchik River king salmon: The SEG has been achieved in all recent years except 2003, 2007, & 2009.



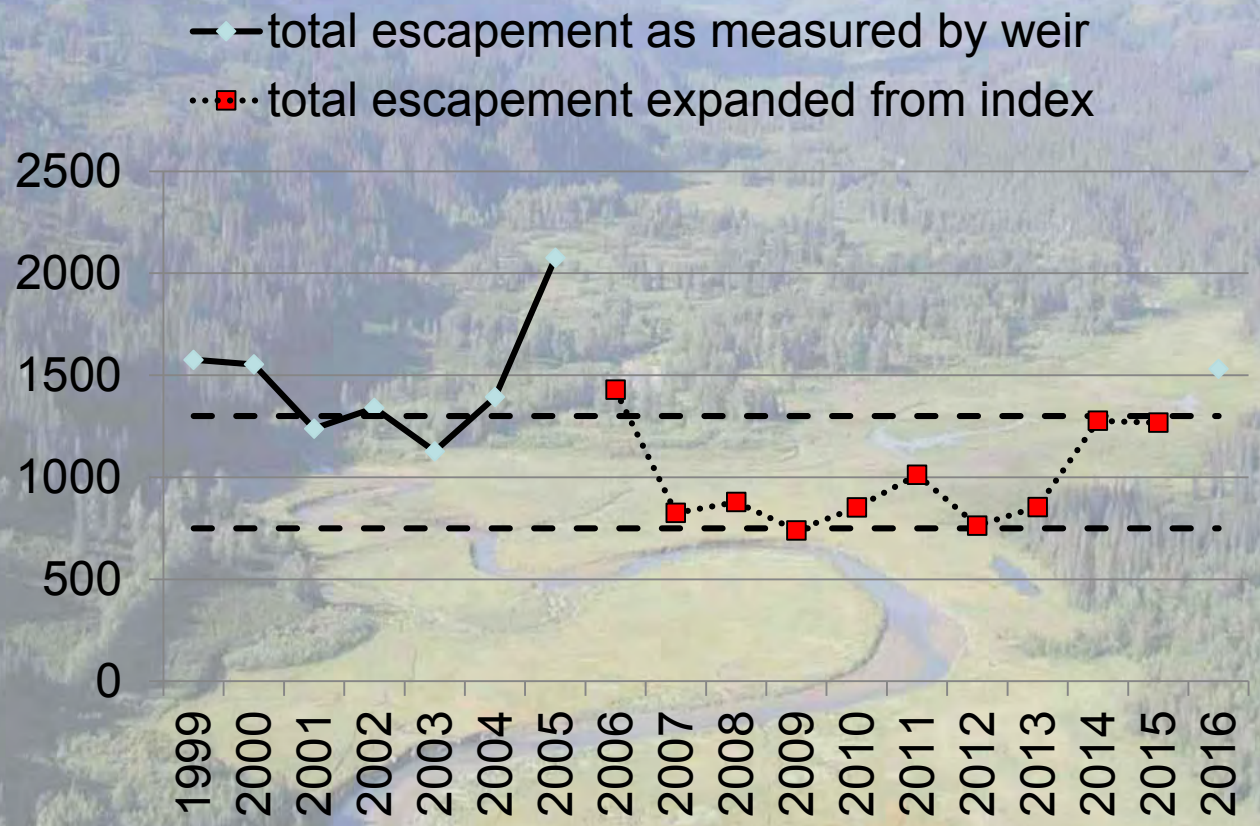
Ninilchik River king salmon SEG: change from an index to a goal and assessment for the entire escapement

1. Current index SEG is 550-1,300

2. a. Reconstructed entire escapement for index years

   b. Assessed with new percentile approach

Ninilchik River king salmon: In most years the escapement would have been within the recommended SEG of 750-1,300



Questions?