Comparison of GSI-based and PSC Chinook Model-based Catch Compositions in the Southeast Alaska Troll Fishery

John K. Carlile, *Alaska Department of Fish and Game, Juneau, Alaska*

A Very Brief History of the PSC Chinook Model

- The original PSC Chinook Model was designed to evaluate the effects of management actions on the rebuilding status of stocks (escapements, terminal runs).
- The version of the model at the signing of the PST in 1985 contained only 4 stocks and 9 fisheries.

Current State and Uses of the PSC Chinook Model

- The model currently contains 30 stocks and 25 fisheries.
- It provides and index of abundance for the AABM (Aggregate Abundance Based Management) Fisheries – Southeast Alaska Troll, Net and Sport; North BC Troll and QC Sport; and WCVI Troll and Outside Sport.
- Catch Composition estimates (despite some drawbacks and limitations).
- It still provides information on the effect of proposed management actions

Stocks and Fisheries in the PSC Chinook Model

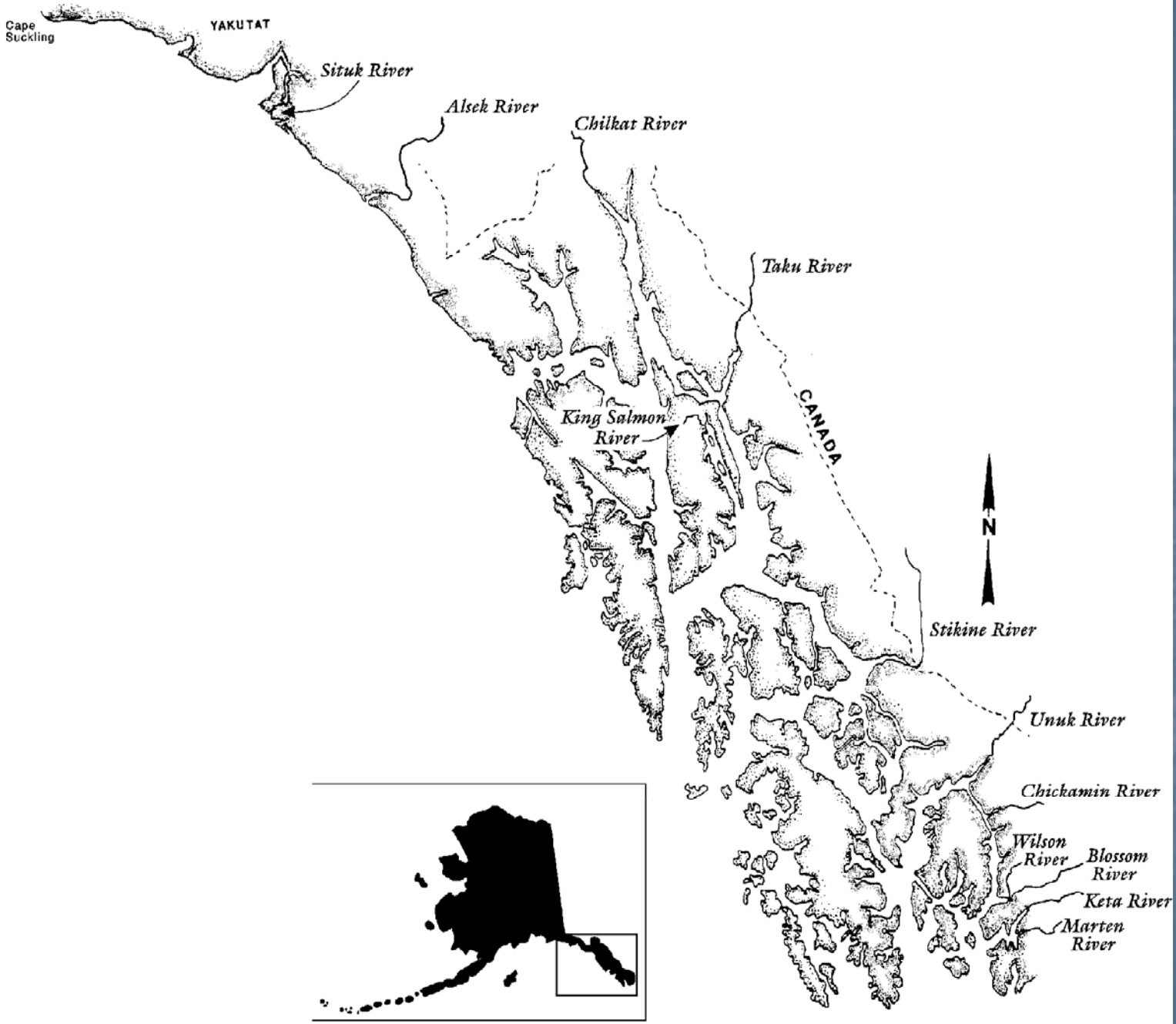
STOCK #	STOCK	FISHERY #	FISHERY
1	**Southeast Alaska**	1	**Alaska Troll**
2	North/Central BC	2	North BC Troll
3	Fraser Early	3	Central BC Troll
4	Fraser Late	4	WCVI Troll
5	West Coast Vancouver Island Hatchery	5	WA/OR Troll
6	West Coast Vancouver Island Natural	6	Georgia Strait Troll
7	Georgia Strait Upper	7	**Alaska Net**
8	Georgia Strait Lower Natural	8	North BC Net
9	Georgia Strait Lower Hatchery	9	Central BC Net
10	Nooksack Fall	10	WCVI Net
11	Puget Sound Hatchery Fingerling	11	Juan De Fuca Net
12	Puget Sound Natural Fingerling	12	Puget North Net
13	Puget Sound Hatchery Yearling	13	Puget South Net
14	Nooksack Spring	14	Washington Coastal Net
15	Skagit Wild	15	Columbia River Net
16	Stillaguamish Wild	16	Johnstone Strait Net
17	Snohomish Wild	17	Fraser Net
18	Washington Coastal Hatchery	18	**Alaska Sport**
19	Columbia UpRiver Brights	19	North/Central BC Sport
20	Spring Creek Hatchery	20	WCVI Sport
21	Lower Bonneville Hatchery	21	WA Ocean Sport
22	Fall Cowlitz Hatchery	22	Puget North Sport
23	Lewis River Wild	23	Puget South Sport
24	Willamette River	24	Georgia Strait Sport
25	Spring Cowlitz Hatchery	25	Terminal (Col Riv) Sport
26	Columbia River Summer		
27	Oregon Coastal		
28	Washington Coastal Wild		
29	Lyons Ferry (Snake River Fall)		
30	Mid-Columbia River Brights		

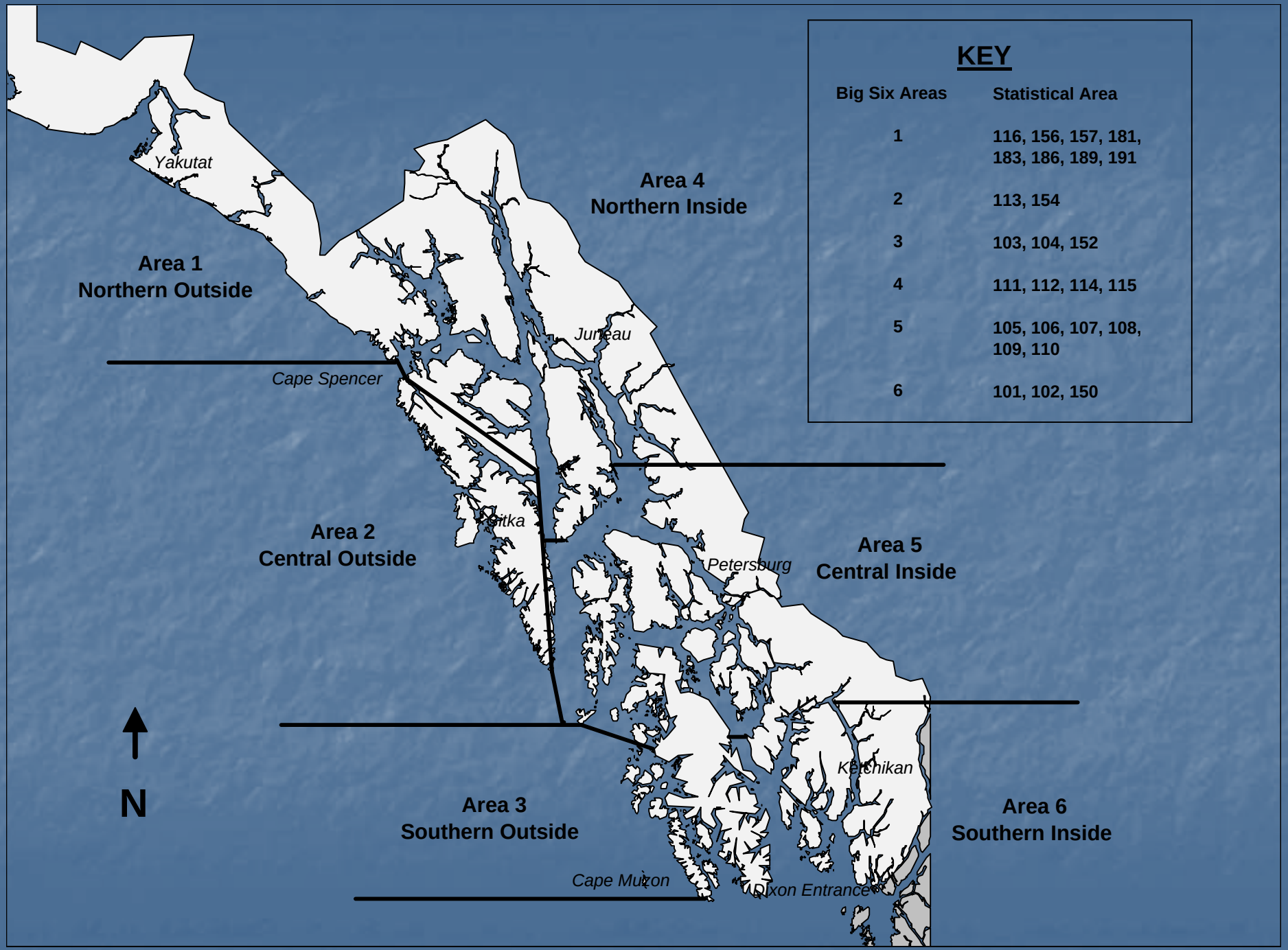
Using the Chinook Model to Estimate Stock Compositions Has Problems.

- Model catches are “treaty” catches not total catches.
- In Southeast Alaska: Total Catch = Treaty catch + Alaska Hatchery Addon + Transboundary River Exclusions
- Not all stocks present in the fishery are in the model.
- Assumptions in the model affect the stock composition estimates (ER data from CWT indicator stocks are applicable, assumptions about stock distribution, etc.)

Why focus on the Alaska Troll Fishery?

- Longer and more complete set of data that the net and sport fisheries. (2001-2005)
- Better base period data in the Chinook model than for the other gear types.


Cape Suckling
YAKUTAT
Situk River
Alsek River
Chilkat River
Taku River
CANADA
King Salmon River
N
Stikine River
Unuk River
Chickamin River
Wilson River
Blossom River
Keta River
Marten River


KEY
Big Six Areas
Statistical Area
1
116, 156, 157, 181, 183, 186, 189, 191
2
113, 154
3
103, 104, 152
4
111, 112, 114, 115
5
105, 106, 107, 108, 109, 110
6
101, 102, 150
Area 1
Northern Outside
Area 2
Central Outside
Area 3
Southern Outside
Area 4
Northern Inside
Area 5
Central Inside
Area 6
Southern Inside
Yakutat
Juneau
Cape Spencer
Sitka
Petersburg
Ketchikan
Cape Muzon
Dixon Entrance
N

Making the Stock Composition Estimates Comparable

- Due to lack of one-to-one correspondence between PSC Chinook model and GSI stocks. Stock aggregates were produced.
- These aggregates also helped simplify stock composition comparison both in figures and tables.
- The Chinook Model works on a yearly time step. However, GSI composition estimates for the troll fishery were taken during different troll periods throughout the year. This required weighting the estimates by the total catch from each period (Early Winter, Late Winter, Spring and Summer).

Table 1. PSC Chinook Model Stocks and Stock Group Aggregations for Comparison Purposes.

PSC Model Stock	Stock Group
Alaska TBR	AK/BC Transboundary
Fraser Early	Fraser
Fraser Late	Fraser
Fall Cowlitz Hat	Lower Columbia
Lewis R Wild	Lower Columbia
Lwr Bonneville Hat	Lower Columbia
Spr Cowlitz Hat	Lower Columbia
Spring Creek Hat	Lower Columbia
Willamette R	Lower Columbia
Col R Summer	Mid/Upper Columbia
Lyons Ferry	Mid/Upper Columbia
Mid Col R Brights	Mid/Upper Columbia
UpRiver Brights	Mid/Upper Columbia
North/Centr	North/Central BC
Oregon Coast	Oregon Coast
Nooksack Fall	Puget Sound
Nooksack Spring	Puget Sound
Pgt Sd Fing	Puget Sound
Pgt Sd NatF	Puget Sound
Pgt Sd Year	Puget Sound
Skagit Wild	Puget Sound
Snohomish Wild	Puget Sound
Stillaguamish Wild	Puget Sound
Alaska South SE	Southeast Alaska
Alaska Hatchery[1]	Southeast Alaska (H)
Georgia St. Lwr Ha	Strait of Georgia
Georgia St. Lwr Na	Strait of Georgia
Georgia St. Upper	Strait of Georgia
Unknown	Unknown
WA Coastal Hat	Washington Coast
WA Coastal Wild	Washington Coast
WCVI Hatchery	WCVI
WCVI Natural	WCVI

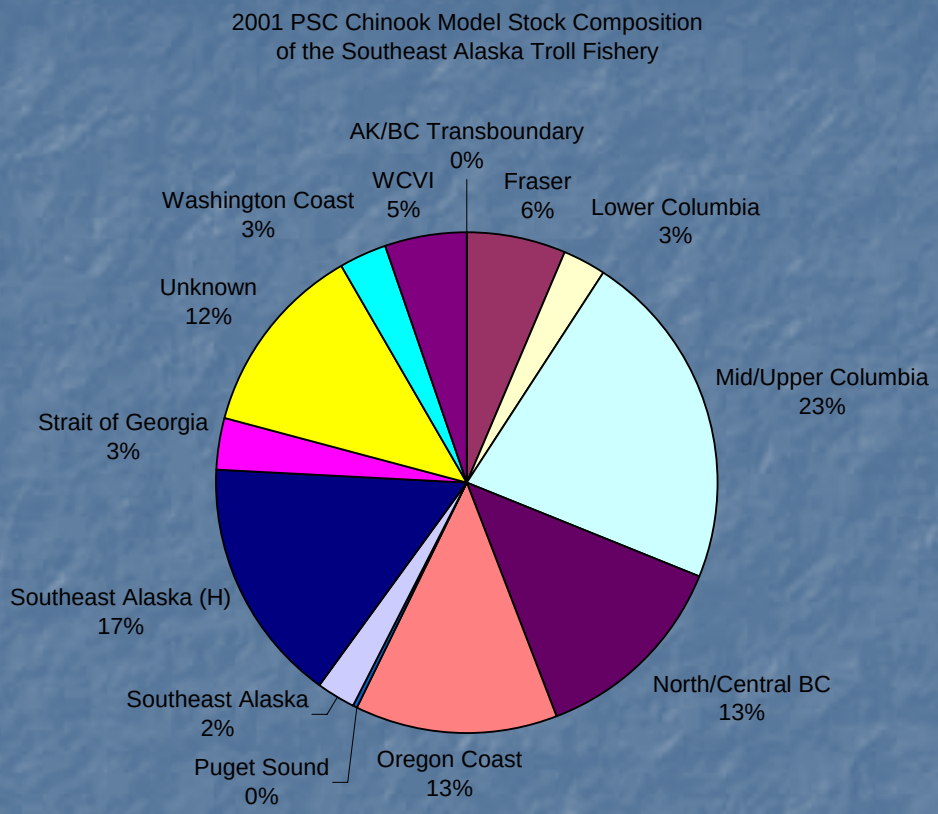
Table 2. GSI Stocks from 2001-2003 Allozyme-Based Estimates and Stock Group Aggregations for Comparison Purposes.

Stock	Stock Group
AK/BC Transboundary	AK/BC Transboundary
California, S. Oregon Coastal	California
Central Valley (Sp, F, W)	California
Klamath (Sp and F)	California
Lower Fraser	Fraser
Mid and Upper Fraser	Fraser
Thompson River	Fraser
Lower Columbia Spring and Fall	Lower Columbia
Willamette	Lower Columbia
Mid and Upper Columbia, Snake Sp	Mid/Upper Columbia
Upper Columbia (Su, F), Snake F	Mid/Upper Columbia
Central BC Coastal	North/Central BC
Nass	North/Central BC
Skeena	North/Central BC
Mid and North Oregon Coastal	Oregon Coast
AK Peninsula	Other Alaska
Gulf of Alaska	Other Alaska
Kodiak	Other Alaska
Susitna	Other Alaska
Western AK	Other Alaska
Puget Sound	Puget Sound
Chilkat	Southeast Alaska
King Salmon River	Southeast Alaska
Southern SE AK	Southeast Alaska
Strait of Georgia	Strait of Georgia
Unknown	Unknown
Upper Canadian Yukon	Upper Canadian Yukon
Washington Coastal	Washington Coast
WCVI	WCVI

Table 3. GSI Stocks from 2004-2005 Microsatellite-Based Estimates and Stock Group Aggregations for Comparison Purposes.

Stock	Stock Group
Taku River	AK/BC Transboundary
Upper Stikine R	AK/BC Transboundary
California Coast	California
Central Valley Fa	California
Central Valley Sp	California
Central Valley Wi	California
Kalamath R Basin	California
Lower Fraser	Fraser
Lower Thompson	Fraser
Mid Fraser	Fraser
North Thompson R	Fraser
South Thompson	Fraser
Upper Fraser	Fraser
Lower Columbia Fa	Lower Columbia
Lower Columbia Sp	Lower Columbia
Willamette River	Lower Columbia
Deschutes R fa	Mid/Upper Columbia
Mid and Upp Columbia	Mid/Upper Columbia
Mid Columbia tule	Mid/Upper Columbia
Snake R fa	Mid/Upper Columbia
Snake River Sp Su	Mid/Upper Columbia
Upp Columbia Su Fa	Mid/Upper Columbia
Central BC Coast	North/Central BC
Lower Skeena	North/Central BC
Nass River	North/Central BC
Upper Skeena	North/Central BC
Mid Oregon Coast	Oregon Coast
North CA, South OR coast	Oregon Coast
North OR Coast	Oregon Coast
Rogue River	Oregon Coast
Hood Canal	Puget Sound
Juan de Fuca	Puget Sound
North Puget Sound	Puget Sound
South Puget Sound	Puget Sound
Alsek R	Southeast Alaska
Andrew Creek	Southeast Alaska
Chilkat R	Southeast Alaska
King Salmon	Southeast Alaska
S. Southeast AK	Southeast Alaska
Situk R	Southeast Alaska
East Vancouver	Strait of Georgia
South BC Mainland	Strait of Georgia
Unknown	Unknown
Washington Coast	Washington Coast
West Vancouver	WCVI

Figure 1. 2001 PSC Model and GSI Stock Composition Estimates for the SEAK Troll Fishery



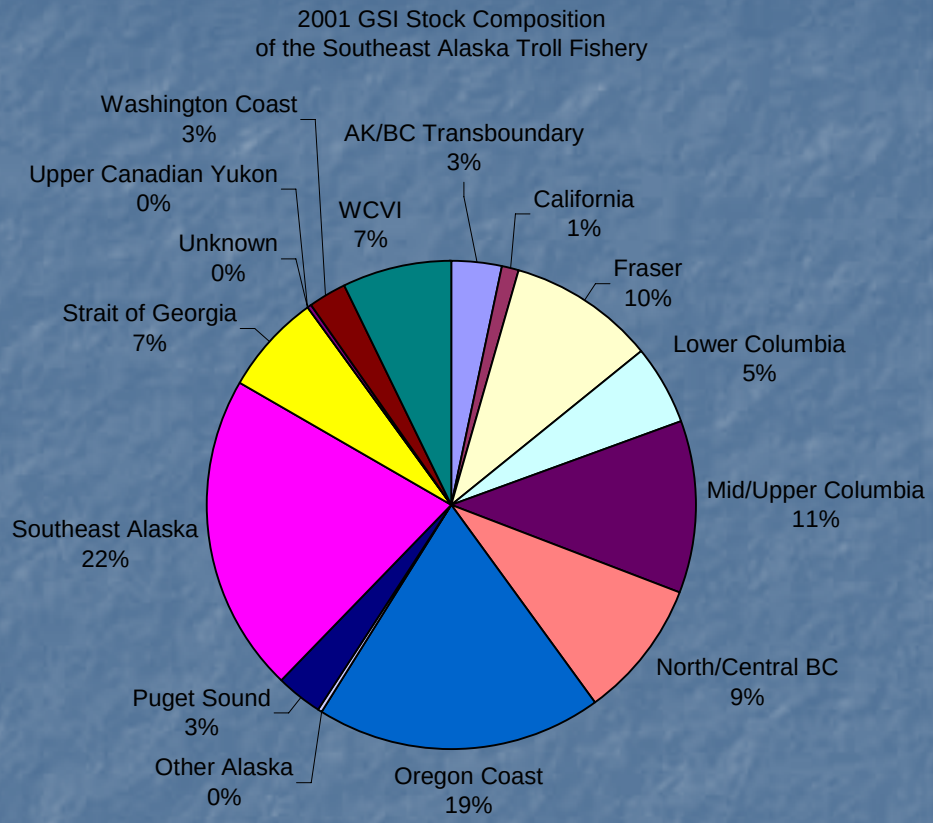
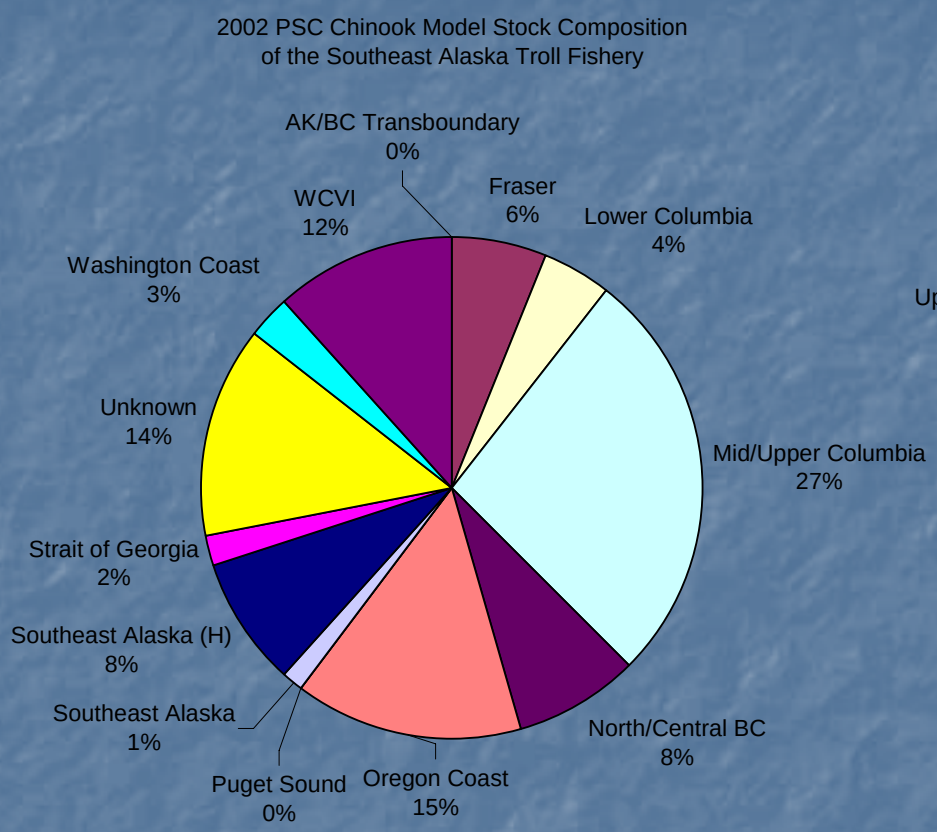


Figure 2. 2002 PSC Model and GSI Stock Composition Estimates for the SEAK Troll Fishery.



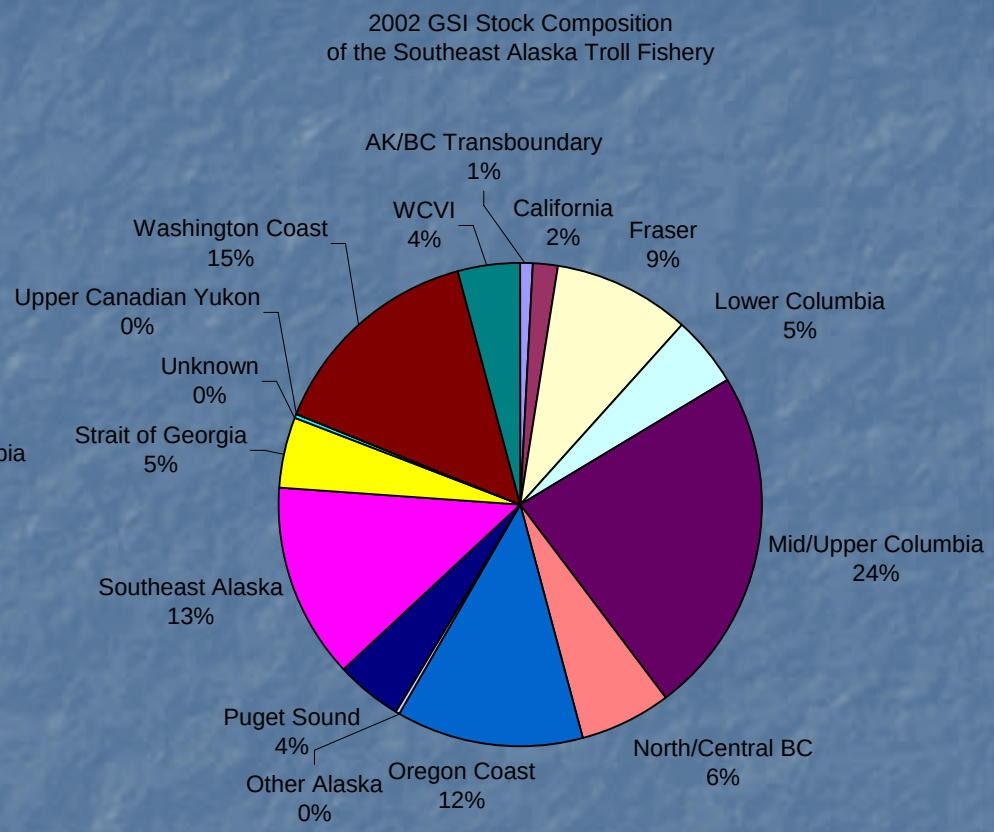
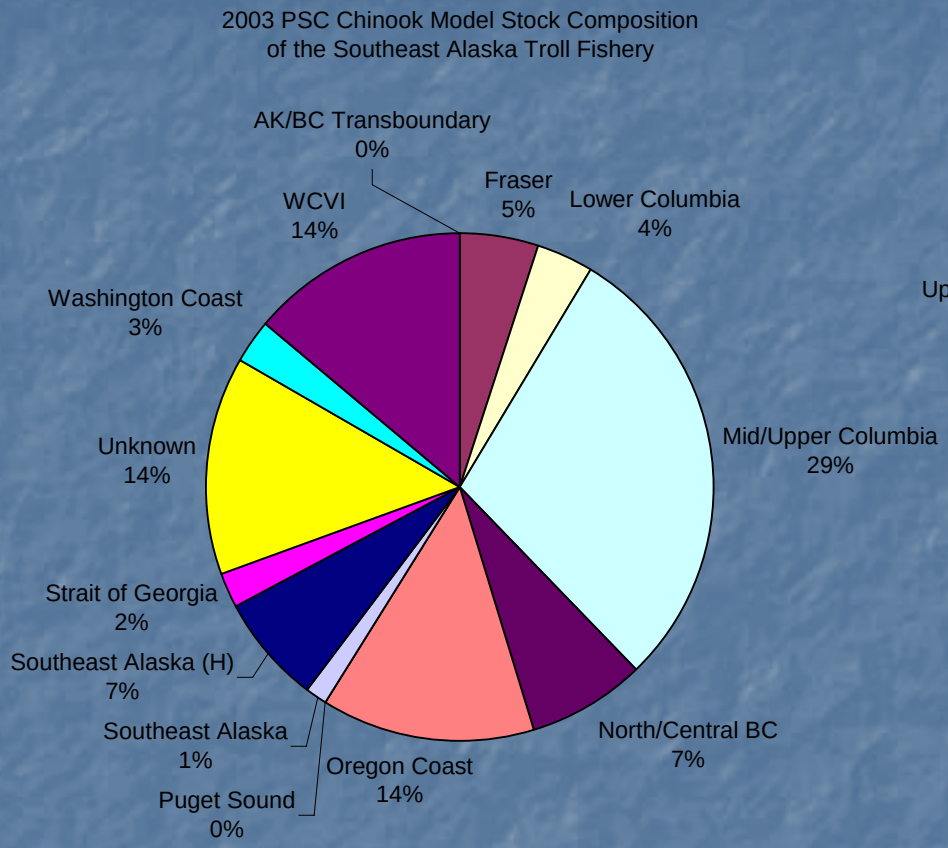


Figure 3. 2003 PSC Model and GSI Stock Composition Estimates for the SEAK Troll Fishery.



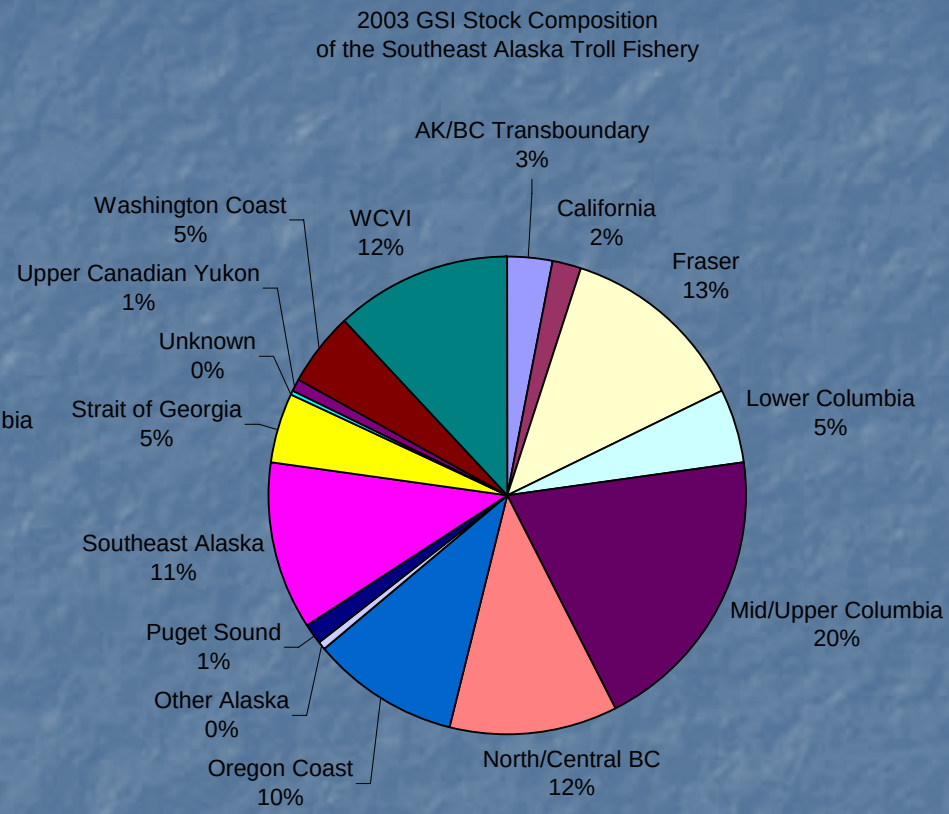
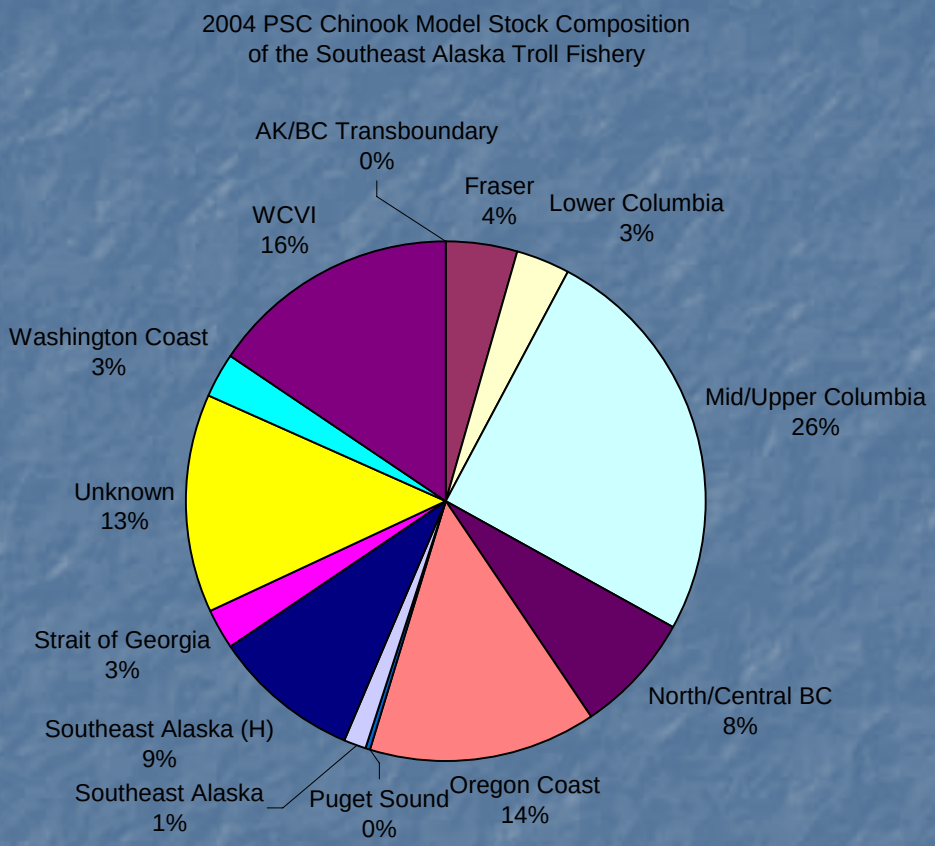


Figure 4. 2004 PSC Model and GSI Stock Composition Estimates for the SEAK Troll Fishery.



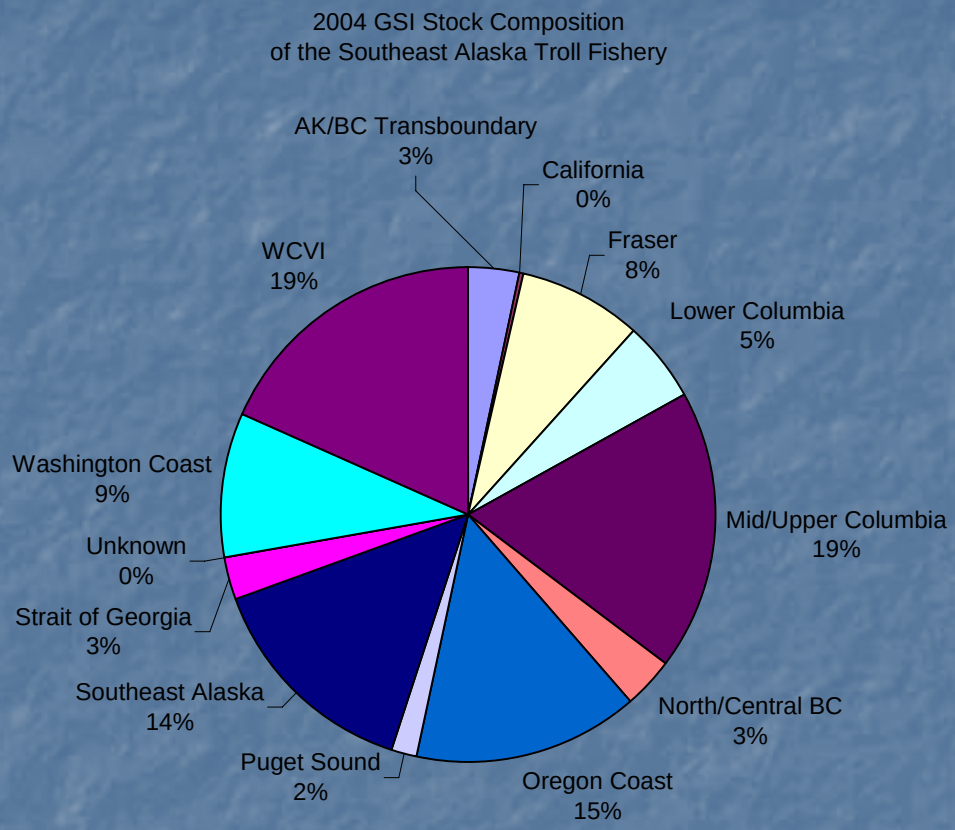
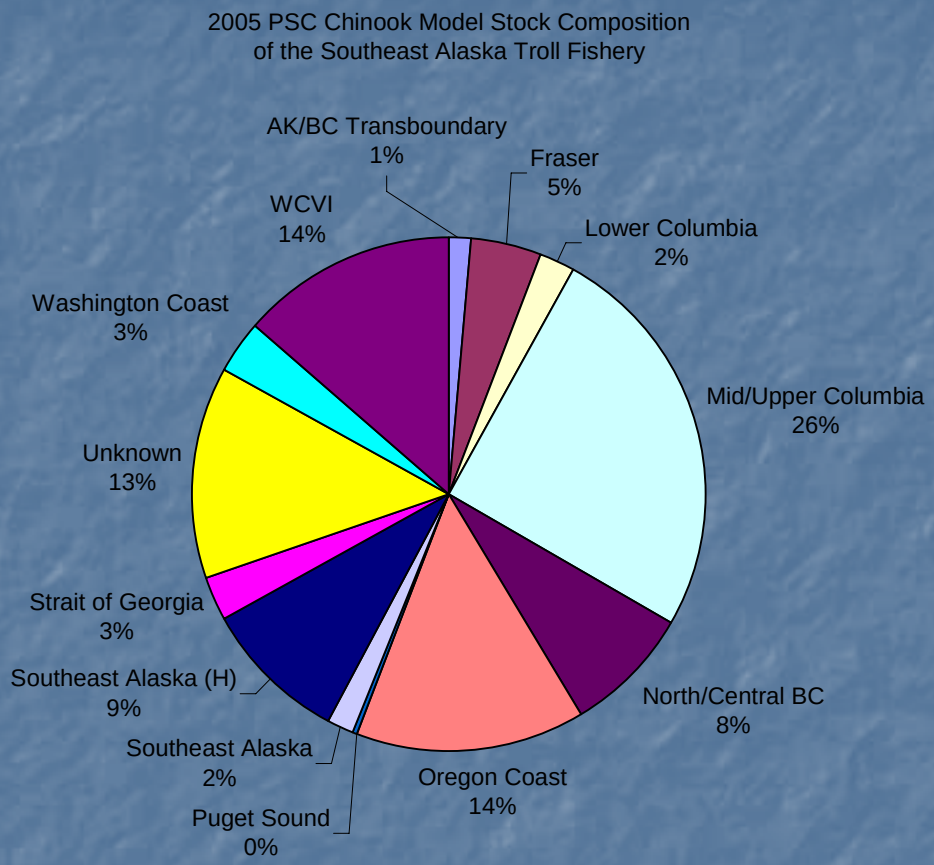


Figure 5. 2005 PSC Model and GSI Stock Composition Estimates for the SEAK Troll Fishery.



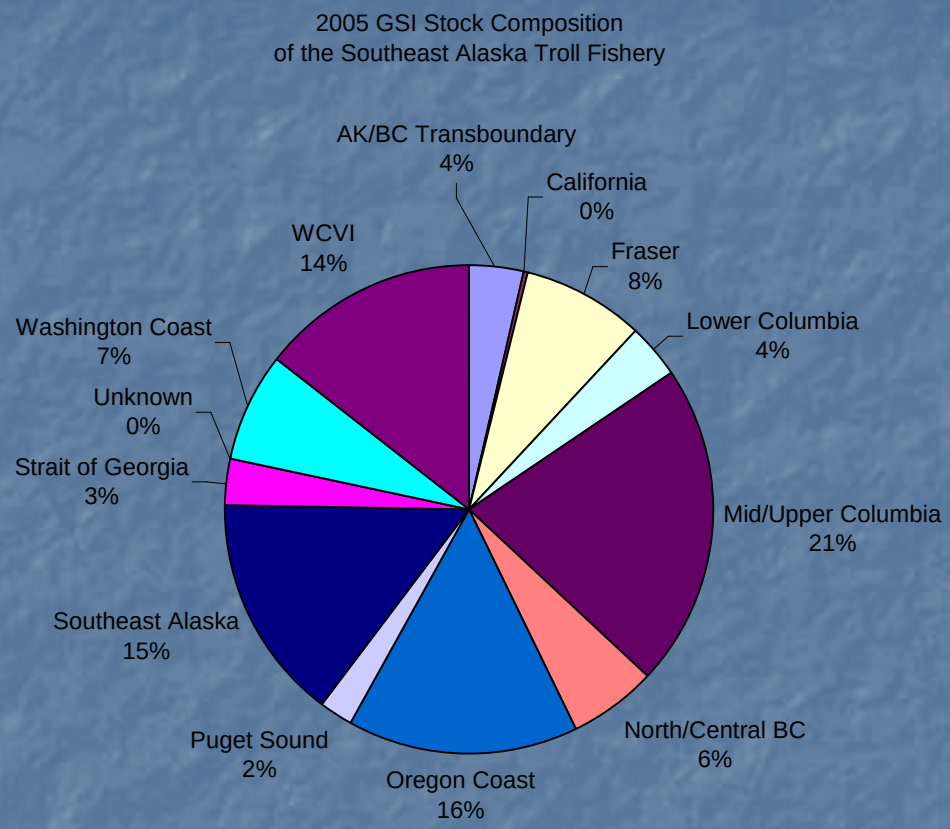


Table 10. Side by Side comparison of Yearly PSC Chinook Model and GSI Catch Composition Estimates for the Southeast Alaska Troll Fishery from 2001 to 2005.

	PSC Chinook Model Catch Composition Estimates.					GSI Catch Composition Estimates.				
Stock Group	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
AK/BC Transboundary	0	0	0	0	4,288	4,936	2,839	10,148	11,946	12,495
California						1,840	4,991	6,831	873	492
Fraser	9,622	19,755	16,288	15,668	15,435	15,130	30,470	41,414	28,371	27,851
Lower Columbia	4,355	14,268	11,944	11,587	7,355	8,085	15,459	17,349	18,771	12,098
Mid/Upper Columbia	33,697	88,085	97,093	89,723	85,936	17,474	75,255	64,538	64,765	71,977
North/Central BC	20,178	25,893	23,953	26,792	27,281	13,767	20,390	38,076	12,155	19,476
Oregon Coast	19,727	47,794	45,251	50,238	48,626	28,980	40,629	33,200	52,562	52,478
Other Alaska						597	875	1,586		
Puget Sound	458	537	571	731	701	4,503	14,625	4,603	5,652	6,673
Southeast Alaska	3,781	3,825	3,838	4,795	6,249	32,369	42,496	37,414	51,179	51,163
Southeast Alaska (H)	24,588	27,176	23,312	32,724	31,074					
Strait of Georgia	4,950	6,859	7,831	9,157	9,467	10,439	15,225	15,687	10,280	10,023
Unknown[1]	19,100	44,247	45,620	47,781	44,981	-18	217	1,336	8	24
Upper Canadian Yukon						337	74	2,087		
Washington Coast	4,748	9,367	8,627	10,316	10,817	3,892	47,843	16,679	33,219	24,799
WCVI	8,076	37,502	46,366	55,152	46,227	10,950	13,920	39,746	64,882	48,887
Grand Total	153,280	325,308	330,692	354,664	338,437	153,280	325,308	330,692	354,664	338,437

[1] The Unknown component from the PSC Chinook Model is due to factors such as unrepresented stock groups or poor choices for CWT indicator stocks. However, the Unknown category for GSI estimates is due to the inability to assign all fish in a sample to a stock group.

Table 11. Absolute and Relative Deviations of the Yearly PSC Chinook Model from the GSI Catch Composition Estimates for the Southeast Alaska Troll Fishery from 2001 to 2005.

	Deviation of PSC Model from GSI.					Relative Deviation of PSC Model from GSI.				
Stock Group	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
AK/BC Transboundary	-4,936	-2,839	-10,148	-11,946	-8,206	-100%	-100%	-100%	-100%	-66%
California	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fraser	-5,508	-10,715	-25,126	-12,703	-12,417	-36%	-35%	-61%	-45%	-45%
Lower Columbia	-3,729	-1,191	-5,406	-7,185	-4,743	-46%	-8%	-31%	-38%	-39%
Mid/Upper Columbia	16,223	12,829	32,555	24,959	13,959	93%	17%	50%	39%	19%
North/Central BC	6,411	5,503	-14,123	14,637	7,805	47%	27%	-37%	120%	40%
Oregon Coast	-9,253	7,166	12,051	-2,325	-3,852	-32%	18%	36%	-4%	-7%
Other Alaska	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Puget Sound	-4,045	-14,088	-4,032	-4,920	-5,972	-90%	-96%	-88%	-87%	-89%
Southeast Alaska[1]	-4,000	-11,495	-10,263	-13,659	-13,840	-12%	-27%	-27%	-27%	-27%
Strait of Georgia	-5,489	-8,365	-7,856	-1,124	-556	-53%	-55%	-50%	-11%	-6%
Unknown[2]										
Upper Canadian Yukon	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Washington Coast	856	-38,476	-8,053	-22,903	-13,982	22%	-80%	-48%	-69%	-56%
WCVI	-2,874	23,581	6,620	-9,730	-2,661	-26%	169%	17%	-15%	-5%

[1] The deviations for the Southeast Alaska stock were computed using the combination of the Southeast Alaska and Southeast Alaska (H) stocks.

[2] Comparisons for the Unknowns from the PSC Chinook Model and from GSI were not made due to the disparate nature of the Unknowns from these two methods.

Summary

- The PSC Chinook Model was not originally designed to produce total catch composition estimates.
- However, with the addition of auxiliary information (Alaska Hatchery Addon and TBR exclusion catches) and some stock aggregations, comparisons can be made between the catch compositions from the PSC Chinook Model and GSI estimates in the Southeast Alaska troll fishery.
- Due to an incomplete representation of stocks in the model, the use of potentially inappropriate CWT indicator stocks and other factors the stock composition estimates from the PSC Chinook Model has a fairly large unknown component.
- Given the shortcomings of the model the comparisons between the model estimates and the GSI estimates were surprisingly similar, although there were some consistent biases for several stock groups. The Fraser, Lower Columbia and Puget Sound stock groups were consistently underestimated and the Mid/Upper Columbia stock group was consistently over-estimated by the PSC Chinook Model.