West Coast Salmon
Genetic Stock Identification Collaboration

http://projectcroos.com/west-coast-genetic-stock-identification-collaboration

Project Summary *(as of October 15, 2010)*

Progress

- At-sea sampling and standardized data collection occurred from May through September 2010 in open and closed areas across California, Oregon, and Washington.
- Over 350 salmon fishermen representing 15 counties in Oregon, California, and Washington signed up to sample in 2010. In Oregon and California 168 boats collected samples.
- 9600 fish were sample in 2649 boat-days (preliminary estimate). To date 7448 genetic samples have been analyzed (Table 1).
- Members of Oregon and California fishing communities, including vessel operators and crew members, fleet managers, and port-liaisons have received more than $2,100,000 in compensation in 2010.
- PFMC allocated sampling impacts and NMFS, NWR issued a Scientific Research Permit to support non-retention sampling in closed times and areas.
- California and Oregon state-based projects are uploading data directly to a new centralized database through the www.pacificfishtrax.org website.
- Genetic analysis techniques are being developed to improve discrimination of stocks in Council-managed fisheries.
- Prototype electronic at-sea data entry systems were successfully tested.
- Two fishery-independent sampling designs were evaluated for use in pre-season test fisheries.

Background

- The West Coast Salmon Genetic Stock Identification Collaboration is an interdisciplinary partnership between the commercial salmon fishing industry and university, federal, state and tribal agency scientists and managers.
- Independent projects in California, Oregon (Project CROOS) and Washington (Ocean Genetics Project) united in 2007 to develop strategies to achieve common goals and objectives.
- Federal Klamath River disaster relief, the Oregon Watershed Enhancement Board, a Saltonstall-Kennedy Grant and other state and federal funds provide support for California and/or Oregon Projects. Washington projects were supported by the Pacific Salmon Commission and Washington State General Funds.
- The concept for this project emerged in 2005 during discussions with Oregon's Congressional delegation in developing approaches to address the Klamath salmon disaster.
- Sampling protocols developed in 2006 have produced three years of fine-scale fishing effort, distribution, and stock contribution rate data designed to support long term ecosystem-based fisheries science and management.

Project Goals and Objectives

- Improve salmon management by avoiding harvest of weak salmon stocks, thereby enhancing economic benefits to the salmon fishery and fishery-dependent coastal communities.
- Identify – in "real time" – movement and location of individual stocks in relation to oceanographic conditions.
- Improve ecosystem-based fisheries management by applying ecological, economic, and environmental information to management decisions.

- Link management of freshwater, estuarine, and coastal salmon ecosystems, and maintain salmon fisheries while conserving salmon stocks.
- Evaluate ocean life history and etiology of the *Shasta* parasite to determine the effects of parasites during the marine life phase of Klamath salmon.
- Create an interactive, "real time," and "market driven" website to enable fishery managers, scientists, fishermen, consumers, marketers, educators, and the public to effectively use project data and findings.
- Support innovative market development through use of bar codes and digital technologies.

Organization

- Leadership: Oregon Salmon Commission, California Salmon Council and Washington Department of Fish and Wildlife.
- Partnership: Oregon State University, Oregon Department of Fish and Wildlife, Oregon Sea Grant, Community Seafood Initiative, National Marine Fisheries Service Northwest and Southwest Fisheries Science Centers, California Department of Fish and Game, University of California, Santa Cruz, Washington Trollers Association, Columbia River Inter-Tribal Fish Commission, Northwest Indian Fisheries Commission.

Scope of sampling

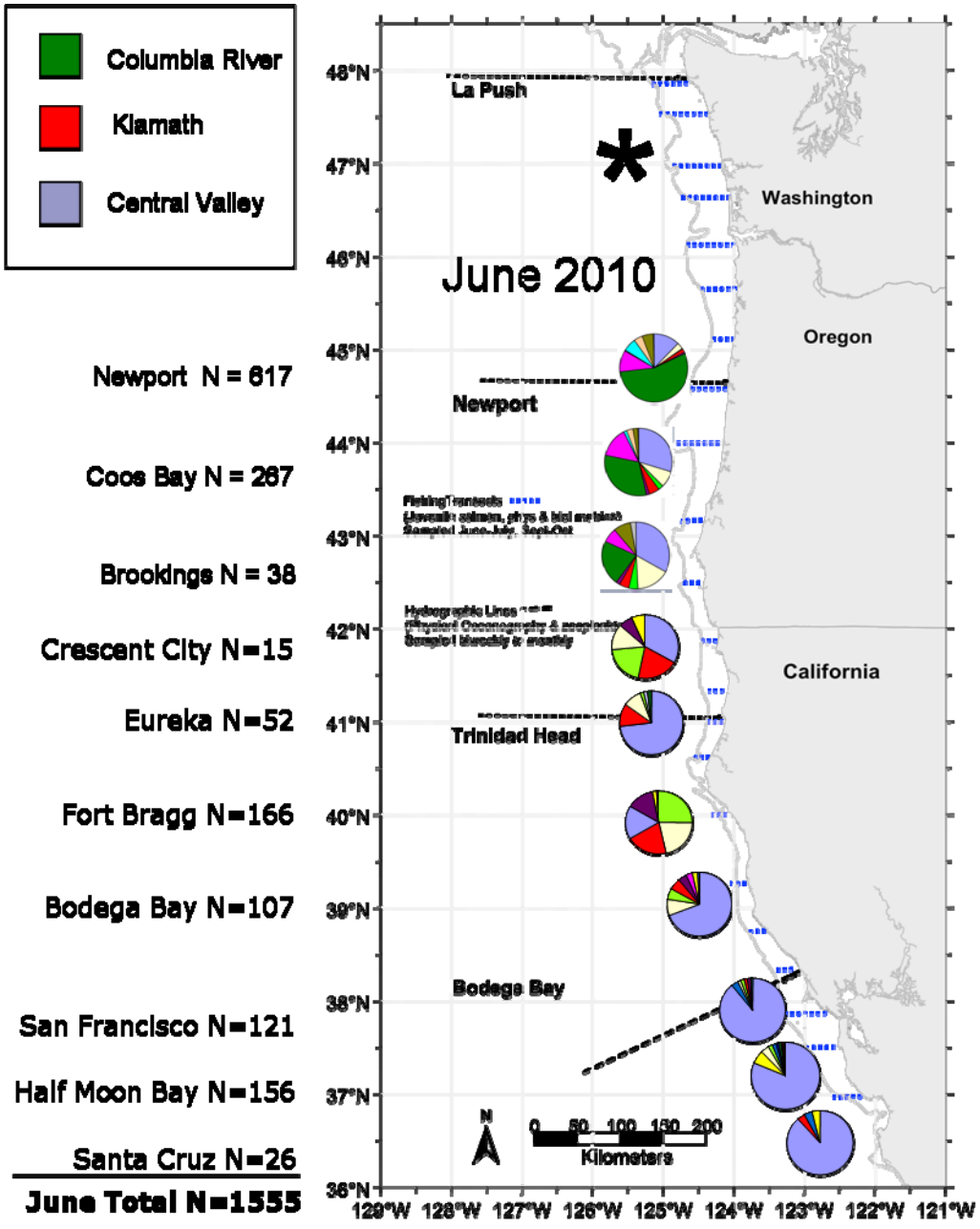
Sampling was conducted from Cape Falcon, Oregon, to Santa Barbara, California, from May through September. Washington State also collected samples which will be analyzed as funds become available. Coast-wide June stock compositions are presented in Figure 1. The majority of sampling in California was hook-and-release (non-retention) in closed times and areas, while Oregon sampling was primarily during regular commercial fishing activities. The sampling goal was to collect 200 fish per week in each fishery management area. This goal was achieved in only a few weeks because catch rates were low, ranging from 2.3 to 5.6 fish per day (Table 1), and because boats were not uniformly

Table 1. Summary of fish sampled, number genotyped to date, days fished and fish per day in ten fishery management areas in Oregon and California, May through September 2010. Data are preliminary.

Management area	Fish	N genotyped	Boat days	Fish/day
Cape Falcon to Florence south jetty (NOC)	2440	2029	627	3.9
Florence south Jetty to Humbug Mountain (SOC)	1832	1810	501	3.7
Humbug Mountain to California/Oregon border (KMZ-OR)	249	125	91	2.7
OR/CA border to Humboldt south jetty (KMZ-CA)	1054	769	219	4.8
Horse Mountain to Point Arena (Ft. Bragg)	1802	1235	321	5.6
Point Arena to Point Reyes (SF-N)	772	719	284	2.7
Point Reyes to Pigeon Point (SF-S)	727	644	313	2.3
Pigeon Point to Mexican Border (Monterey)	724	617	293	2.5
Totals	9600	7448	2649	3.6

available to collect samples. This is the first time at-sea GSI sampling has been conducted on a coast-wide scale. The data collected will contribute to a comprehensive picture of stock distributions, migration patterns, and catch rates in the waters off Oregon and California. Samples were collected voluntarily in Washington, but the sampling design was not comprehensive, and these samples have yet to be integrated with the Oregon and California collections.

Figure 1. Preliminary stock contributions from Santa Cruz, CA to Newport, OR from June, 2010 GSI sampling, superimposed on a map of proposed juvenile salmon sampling. * indicates that Washington samples are not displayed.



California Sampling

From 24 May, 2010 through 30 September, 2010, 86 members of the California commercial salmon fleet conducted 1054.4 days of hook-and-release sampling in closed areas from the Oregon border to Santa Barbara. An additional 375.5 days of sampling were conducted during retention periods in July (south of Humboldt jetty) and August (Horse Mountain to Point Arena only). Sampling activities during non-retention periods were conducted under a Scientific Research Permit issued by NMFS, NWR to Dr. Churchill Grimes, and coordinated with the California Department of Fish and Game. Catch rates were communicated with the Department of Fish and Game as soon as they were available in order to monitor progress towards the quota fishery between Horse Mountain and Point Arena.

A total of 5081 tissue and scale samples were collected. Genotypic analysis is ongoing, and preliminary stock composition estimates from May, June and July have been distributed to the project participants, Pacific Fishery Management Council (Council) staff, Salmon Technical Team members, and the other interested stakeholders. The remaining samples are expected to be analyzed by November, and more detailed analyses of spatial and temporal distribution will then be completed. One interest of the California project is the evaluation of Point Reyes as a distributional break that should be recognized in fisheries management. Preliminary estimates indicate consistent differences in stock composition to the north and south of Point Reyes.

In response to a request by the Salmon Technical Team to use GSI data to evaluate the contribution of Mitchell Act hatcheries to Council-managed fisheries, the SWFSC project participants are evaluating a new set of single nucleotide polymorphism (SNP) markers and associated genetic baseline for use in estimating stock composition in PFMC managed fisheries. Part of this evaluation includes development of new maximum likelihood methods for evaluating whether a fish assigned to one of the baseline stocks actually came from a genetically similar stock not represented in the baseline. This is important because neither the novel SNP baseline nor the coast-wide microsatellite baseline can always accurately identify fish that come from these hatcheries. This method is also intended to identify non-Chinook salmon, which have comprised almost 1% of the sampled fish in California.

Oregon sampling

Sampling in Oregon was conducted from May through September in three management zones: Cape Falcon to Florence south jetty (NOC), Florence South Jetty to Humbug Mountain (SOC), and Humbug Mountain to the California border (KMZ-OR). Non-retention sampling was used in the KMZ-OR in June and in all areas in September, under a Scientific Research Permit issued by NMFS, NWR to Dr. Peter Lawson and a Scientific Collecting Permit issued by the State of Oregon. A total of 4521 fish were sampled in 1219 boat days (Table 1). In Oregon, sampling was concentrated north of Humbug Mountain, with lower effort and lower catches in the KMZ-OR, except for September, when a body of fish moved through the area during non-retention sampling.

Table 2. Fish sampled and boat days of effort by month, in eight fishery management areas in Oregon and California, May through September 2010. Area abbreviations from Table 1. Data are preliminary.

	May		June		July		August		September	
Area	Fish	Boat days	Fish	Boat days	Fish	Boat days	Fish	Boat days	Fish	Boat days
NOC	403	77	1086	209	401	85	520	222	30	34
SOC	450	107	611	148	73	28	597	186	101	32
KMZ-OR	0	0	43	29	10	9	61	26	135	27
KMZ-CA	0	0	71	38	133	51	478	58	372	60
Ft. Bragg	99	9	173	45.5	494	94	544	116.5	492	67
SF-N	47	24	114	58	398	82	160	60	53	60
SF-S	115	53	290	58.5	120	79.5	119	56	83	66
Monterey	19	44	26	54	413	99	158	60	108	37
Totals	1133	314	2414	640	2042	527.5	2637	784.5	1374	383

At-sea data entry systems

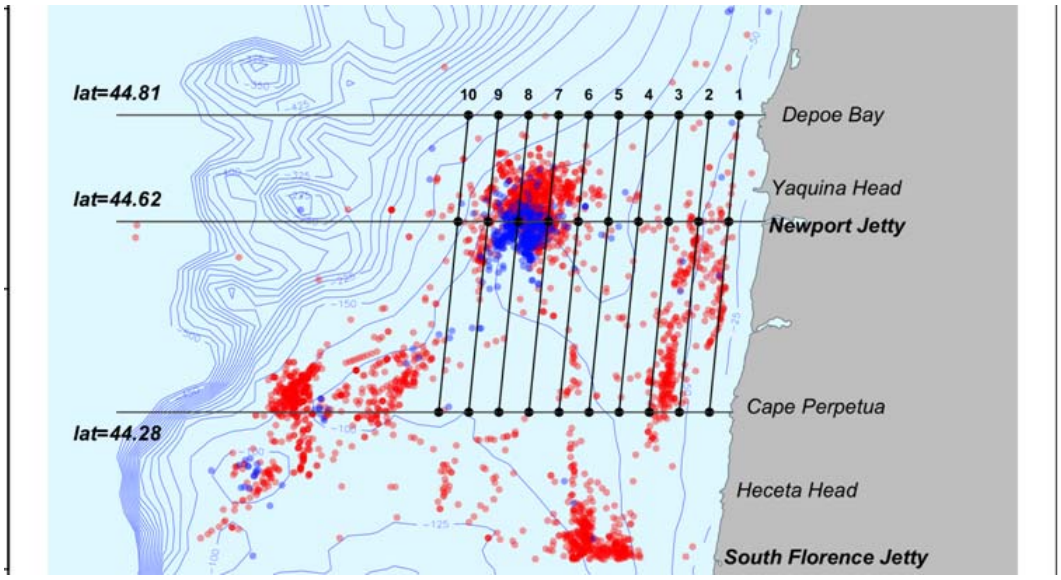
There are several advantages to enabling fishermen to enter data at sea during the normal course of fishing. It potentially speeds and simplifies the data entry process, reduces errors, and permits transmission of catch locations and effort patterns shore-side to reduce the time-lag for management. We developed and tested two prototype devices, including an at-sea trial. One prototype is based on standard flat-panel touch screens. The other is a custom-designed box with easily-readable LCD displays. Both designs have merit, but neither implementation was satisfactory in our tests. Further development is underway.

Fishery-independent surveys

Two experiments were conducted in August to test the design of fishery-independent surveys that could be used pre-season to sample stock distributions and catch composition. Tests were located in an area off the coast of Newport with a history of GSI sampling (Figure 2). These studies were designed to compare catch statistics in the fishery-independent surveys with statistics from simultaneous commercial fishing. In each study, nine or ten boats were commissioned to survey for one day and to fish normally for one day. Boats were equipped with oceanographic data loggers to measure sea temperatures and calibrate depth of gear.

The first test specified ten parallel transects, each 20.76 miles long and spaced at 3-mile intervals (Figure 2a.). Boats started at the north end of their assigned transect and fished to the south. Reaction of the fishermen to this design was that this was not a normal or efficient pattern of fishing; they were not permitted to “back-tack” over areas where they caught fish, or to avoid water that showed little promise of producing fish. In response we designed a second sampling pattern based on a 9-cell (3 x 3) grid in the same area as the transects they had run previously (Figure 2b.). Nine fishermen were each assigned a grid cell, with the instruction to catch as many fish as they could within that cell. They fished their cell for one day, and fished normally for one day.

a.



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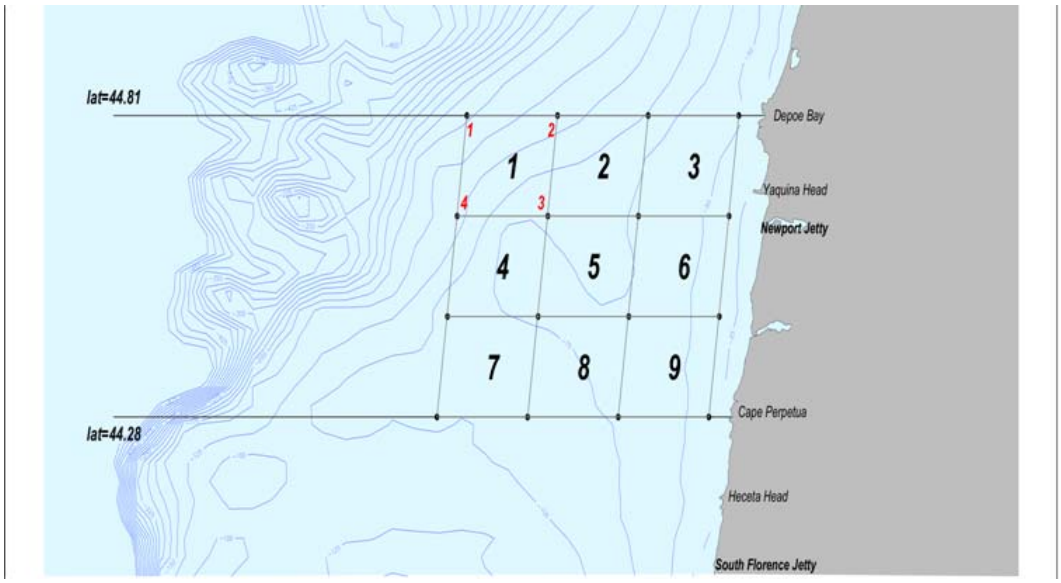

Figure 2. Two fishery-independent survey designs tested near Newport, Oregon in August 2010. a. ten transects, 20.76 miles in length, spaced at 3 mile intervals. Dots indicate locations of fish caught in 2006 (red) and 2007 (blue). b. a nine-cell grid covering the same area as the transects in a.

Catch rates were low during the tests, and boats fishing the survey patterns caught fewer fish than boats fishing normally. Data are being analyzed, but it is clear that the fishery-independent surveys will need to catch fish at a higher rate than we achieved in 2010 in order to provide information useful for fishery management. Experience gained with this experiment will allow us to conduct further tests more efficiently.

Hake bycatch

Chinook salmon bycatch in the shoreside hake fishery was sampled in Oregon and Washington. Approximately 850 samples were collected in 2010, compared with 166 (2009) and 450 (2008). Most of the Chinook in the hake fishery bycatch are young fish below the legal length limit for the commercial salmon fishery. The samples this year give us our first opportunity to compare stock composition in the hake fishery with a simultaneous commercial troll fishery.

Future actions

Data compilation and analysis are on-going. A more complete report will be available to the Council at the March 2011 meeting. A workshop for fishermen, managers, and the general public will be held in California prior to the March Council meeting to communicate results and solicit feedback. Limited funds are available to the WC-GSI Collaboration in 2011. Long term funds for ocean research need to be a part of federal efforts to aid the fishery and improve management and science. Based on research findings, this project will help industry access healthy stocks, protect weak stocks, improve economic benefits, and become a model for future collaborative fishery research. The tri-state partnership between California, Oregon and Washington will support a Coast-wide integrated approach to salmon science, management, and has potential to provide economic benefits to the fishing industry.

STATUS REPORT OF THE 2010 OCEAN SALMON FISHERIES OFF WASHINGTON, OREGON, and CALIFORNIA.
Preliminary Data Through October 31, 2010.[a/]

Fishery and Area	Season Dates	Effort Days Fished	CHINOOK Catch	CHINOOK Quota	CHINOOK Percent	COHO[b/] Catch	COHO[b/] Quota	COHO[b/] Percent
COMMERCIAL								
Treaty Indian[c/]	*5/1-6/30*	498	14,980	27,500	54%		Non-Retention	
	7/1-9/15	314	16,925	27,500	62%	11,216	41,500	27%
Non-Indian North of Cape Falcon[d/]	*5/1-6/30*	1,794	38,228	42,000	91%		Non-Retention	
	7/1-9/7	1,211	17,735	18,350	97%	3,126	4,800	65%
Cape Falcon - Humbug Mt.	*5/1-8/25*	3,338	26,004	None	NA		Non-Retention	
Tillamook State Waters	*9/1-10/31*	44	64	600	11%		Non-Retention	
Elk State Waters	*10/15-11/30*	150	1,250	1,250	100%		Non-Retention	
Humbug Mt. - OR/CA Border	*5/1-5/31*	43	164	NA	NA		Non-Retention	
	7/1-7/30	28	51	1,500	3%		Non-Retention	
	8/1-8/31	43	125	1,500	8%		Non-Retention	
Chetco State Waters	*10/13-15, 10/20*	66	526	500	105%		Non-Retention	
OR/CA Border - Humboldt S. Jetty				Closed				
Humboldt S. Jetty - Horse Mt.				Closed				
Horse Mt. - Pt. Arena	*7/1-7/4;7/8-7/11*	160	1,900	None	NA		Non-Retention	
	7/15-7/29	490	4,800	18,000	27%		Non-Retention	
	8/1-8/31	840	6,100	9,375	65%		Non-Retention	
Pt. Arena - U.S./Mexico Border	*7/1-7/4;7/8-7/11*	480	2,500	None	NA		Non-Retention	
RECREATIONAL								
U.S./Canada Border - Cape Falcon[e/]	*6/12 - 6/30*	10,261	5,017	12,000	42%		Non-Retention	
U.S./Canada Border - Cape Alava[d/]	*7/1-9/19*	10,252	3,147	5,284	60%	3,689	6,990	53%
Cape Alava-Queets River[d/]	*7/1-7/19*	3,271	1,100	2,396	46%	1,170	1,700	69%
	9/25-10/10	154	87	50	174%	72	50	144%
Queets River - Leadbetter Pt.[d/]	*7/4-9/19*	30,934	22,514	27,398	82%	12,684	24,860	51%
Leadbetter Pt.-Cape Falcon[d/]	*7/1-9/30*	36,771	7,042	10,372	68%	24,751	40,600	61%
Cape Falcon - OR/CA border	*5/29-9/6*	36,390	2,111	None	NA		Non-Retention	
	6/26-9/6	Included Above		NA	NA	12,173	26,000	47%
Tillamook State Waters	*9/7-10/31*	2,481	244	None	NA		Non-Retention	
Chetco State Waters	*10/1-12*	2,669	543	None	NA		Non-Retention	
OR/CA Border - Horse Mt. (CA-KMZ)	*5/29-9/6*	4,230	700	None	NA		Non-Retention	
Horse Mt. - Pt. Arena (Ft. Bragg)	*4/17-4/30*	1,270	200	None	NA		Non-Retention	
	5/1-9/6	5,440	1,500	None	NA		Non-Retention	
Pt. Arena - U.S./Mexico Border	*4/17-4/30*	15,650	5,000	None	NA		Non-Retention	
	5/1-9/6	21,390	6,900	None	NA		Non-Retention	

TOTALS TO DATE (through 8/31)	Effort 2010	Effort 2009	Effort 2008	Chinook Catch 2010	Chinook Catch 2009	Chinook Catch 2008	Coho Catch[g/] 2010	Coho Catch[g/] 2009	Coho Catch[g/] 2008
TROLL									
Treaty Indian	**812**	805	580	**31,905**	12,407	20,903	**11,216**	60,086	14,266
Washington Non-Indian	**2,374**	1,991	1,223	**44,866**	12,316	8,636	**2,088**	20,055	1,706
Oregon	**4,343**	1,213	761	**39,281**	1,145	5,954	**1,038**	21,951	435
California	**1,970**	-	-	**15,300**	-	-	**0**	-	-
Total Troll	**9,499**	4,009	2,564	**131,352**	25,868	35,493	**14,342**	102,092	16,407
RECREATIONAL									
Washington Non-Indian	**81,765**	101,560	37,610	**37,158**	12,351	14,635	**36,465**	138,493	18,870
Oregon	**51,418**	84,545	30,418	**4,647**	1,581	1,578	**18,074**	89,628	12,085
California	**47,980**	5,359	391	**14,300**	672	6	**0**	8	0
Total Recreational	**181,163**	191,464	68,419	**56,105**	14,604	16,219	**54,539**	228,129	30,955
PFMC Total	**N/A**	N/A	N/A	**187,457**	40,472	51,712	**68,881**	330,221	47,362

a/ Preliminary.

b/ All non-Indian coho fisheries are mark-selective.

c/ Treaty Indian effort is reported as landings.

d/ Numbers shown as chinook quotas for non-Indian troll and recreational fisheries North of Falcon are guidelines rather than quotas; only the total Chinook allowable catch is a quota.