

## CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE REPORT ON SALMON ENDANGERED SPECIES ACT CONSULTATION

As part of the Endangered Species Act (ESA) section 7 consultation process the Pacific Fishery Management Council (Council) requested National Marine Fisheries Service (NMFS) evaluate alternative fishing regimes to better describe and define the potential impacts to listed salmon caught as bycatch in groundfish fisheries.

Re-initiation of the Biological Opinion (BiOp) was initially prompted in 2013 following adoption of new groundfish trawl fishery regulations. While this re-consultation was in progress, the incidental salmon bycatch quotas were exceeded by the at-sea whiting fishery in 2013, a condition which automatically triggered re-consultation under the existing BiOp. The salmon bycatch quota was again exceeded by the at-sea whiting fishery in 2014. As a result, NMFS extended the re-consultation analysis to address the effects on listed salmonids in all fisheries under the Pacific Coast Groundfish Fishery Management Plan, including the Pacific whiting and non-whiting fisheries and all gears.

Throughout the consultation process, NMFS has requested input on characterizing the groundfish fishery taking into account potential Council actions which could affect salmon bycatch rates (e.g., distribution of the fleets relative to area, depth, and time; changes in gear technology).

In this report, CDFW provides a summary of existing data to inform stock composition of salmon bycatch which is not included in the NMFS Report and expected impacts of salmon bycatch in California's groundfish fisheries if at-sea processing is permitted.

### Salmon Bycatch Stock Composition Expectations

West Coast salmon management occurs at the individual stock level, with conservation objectives and consultation standards designed to provide adequate stock protections and maintain sustainable fisheries. Below CDFW describes proprietary coded-wire tag (CWT) data available to evaluate stock-specific salmon bycatch in historic groundfish fisheries off California that were not included in the NMFS report<sup>1</sup>, which focused analyses at a broader Evolutionary Significant Unit (ESU)-level using Genetic Stock Identification (GSI) datasets. CDFW

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<sup>1</sup> Agenda Item I.1.b, NMFS Report 1, March 2017.

acknowledges that existing data may be insufficient to manage salmon bycatch at the stock level; however, evaluating the potential stocks in the bycatch relative to an individual stock's status is, nonetheless, informative.

#### *Coded Wire Tag Data*

Coded-wire tag data available from the California shorebased whiting fishery from 1998 through 2009 can help inform expected stock composition of salmon bycatch in California groundfish fisheries (Table 1). An average of 64 percent of CWT recoveries were from the Klamath-Trinity Basin, an ESU which frequently limits directed salmon fisheries south of Cape Falcon, Oregon and throughout California.

The proportion of Klamath River fall Chinook (KRFC, includes Klamath and Trinity Rivers), a surrogate stock used to minimize impacts on ESA-threatened California Coastal Chinook (CC Chinook), averaged 48 percent of all recoveries. CC Chinook generally do not have a CWT component as there are no Chinook hatcheries on those rivers; however, tagging of natural-origin fish has been conducted intermittently. Two CWTs were recovered from known CC Chinook caught in the California shorebased whiting fishery - one Russian River Chinook in 1998 and one Eel River Chinook in 2004.

CWT data from the 1988-1991 California at-sea whiting fishery are available (Table 2), though tagging was conducted inconsistently and at low rates in some cases during that time. Klamath-Trinity Basin Chinook stocks comprised between 49 and 65 percent of the salmon bycatch in California's at-sea whiting fishery during that time. Additionally, several CC Chinook stocks were represented in the CWT recoveries.

CWT data are largely unavailable from California-origin salmon species other than Chinook, such as Endangered Central California Coastal coho, which may also be contacted as bycatch in groundfish fisheries.

#### *Genetic Stock Identification Data*

The NMFS analysis relies on only GSI data to examine impacts at the ESU level, although some CWT data are available, including as described above. Genetic samples from salmon bycatch are largely limited to the at-sea whiting fishery north of 43° N. lat. (approximately 10 miles north of Cape Blanco); therefore, little GSI data are currently available for salmon bycatch caught in southern Oregon and California. Additionally, salmon GSI data are not currently available from Chinook bycatch in any other groundfish fishery in California. These areas represent the geographic location where CC Chinook, and their surrogate KRFC, are most likely to be caught. As a result, important information may be missing from groundfish fisheries operating south of 42° N. lat.

## Salmon Bycatch in California's Whiting Fishery

CDFW provides the following information to inform expected salmon bycatch in California's groundfish fisheries under the Council alternative allowing at-sea processing of up to 10 percent of the at-sea whiting catch in federal waters off California (south of 42° N. lat.).

Historically, the highest salmon bycatch rates in groundfish fisheries (coastwide) were observed in the area south of 42° N. lat., in particular the region between the OR/CA Border and 40°10' N. lat. In 1994, CDFW participated in a cooperative state/federal/industry observation program under an Exempted Fishing Permit (EFP) to monitor bycatch of salmon and other sensitive species in the Pacific whiting fishery. High bycatch rates were observed in the vicinity of the Eel River Canyon under this EFP, where 69 percent of the total California salmon bycatch occurred in only a few hauls (Quirollo 1994). Similar results were also reported for the EFP in other years (e.g., 1995-1996), with a majority of the bycatch occurring around the Eel River (Quirollo 1995; Quirollo 1996).

Data available to evaluate reintroduction of at-sea processing in California are limited to the time period when the whiting mothership sector operated from 1988-1991<sup>2</sup>. Chinook bycatch rates (number of Chinook per metric ton of whiting) in California during this time were generally higher than all other management areas (Table 3a).

Between 1988 and 1991, at-sea whiting harvest averaged 145,600 mt coastwide, of which an average of 42,700 mt (29 percent) was taken south of 42° N. lat. (Table 3b). Salmon bycatch during this time averaged 7,800 Chinook coastwide with an average 2,900 Chinook taken off California. The Chinook bycatch rate per metric ton of whiting off California ranged from 0.05 to 0.11, averaging 0.08.

The Council's alternative assumes 10 percent of the total at-sea whiting catch (based on the most recent 5 year average) is taken off California. Between 2010 and 2014, the most recent 5 years of data available, total at-sea whiting harvest averaged 120,200 mt, of which 12,000 metric tons (10 percent) are assumed to be harvested in California (Table 3c).

Application of the average historical salmon bycatch rate (0.08) to the Council's 10 percent assumption results in expected bycatch of over 900 Chinook south of 42° N. lat., and may range from 500 to 1,300 fish if historical minimum and maximum bycatch rates were applied (Table 3d).

Historically, at-sea whiting harvest in California was much higher than contemplated under the Council's alternative, ranging from 17 to 41 percent (average 29 percent) of coastwide catches.

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<sup>2</sup> At-sea whiting harvest and salmon bycatch data obtained from at-sea observers and fish tickets provided by NMFS.

If one assumed whiting harvest south of 42 N. lat. was closer to the historical average (42,700 mt) bycatch using the average bycatch rate (0.08) is expected to result in 2,700 Chinook and range between 1,600 and 3,900. If whiting harvest was to closer to the maximum observed during 2010-2014 (41 percent of total at-sea catch), Chinook bycatch could be as high as 5,500 fish.

It is important to note that the impacts of salmon bycatch in the groundfish fisheries will have differential effects depending on the stock's level of abundance. That is, even low levels of bycatch in the groundfish fisheries can have a significant effect on sensitive salmon stocks if they are at low abundance levels. While expected numbers of total salmon bycatch south of 42 N. lat. is moderate under the Council's alternative, the number of salmon taken relative to that stock's status should also be considered, particularly under low abundance scenarios. The potential for a 'disaster tow' under these circumstances also warrants analysis, given the wide variation in the number of fish taken as bycatch per tow.

#### References:

Quirollo, Lawrence F. 1994. Report on California's Pacific Whiting Observation Program for 1994. California Department of Fish and Game, Eureka, CA 95501.

Quirollo, Lawrence F. 1995. Report on California's Pacific Whiting Observation Program for 1995. California Department of Fish and Game, Eureka, CA 95501.

Quirollo, Lawrence F. 1996. Report on California's Pacific Whiting Observation Program for 1996. California Department of Fish and Game, Eureka, CA 95501.

Table 1. Chinook coded-wire tags (CWT) recovered from the California shore-based whiting fishery, 1998-2009. Recoveries have been expanded for the proportion of the release group that were CWT tagged; they have not been expanded for the proportion of the sampled bycatch due to the lack of data availability.

Recovery					Recovery				
Year	Run	Chinook Stock	Number of CWTs	Production Expanded	Year	Run	Chinook Stock	Number of CWTs	Production Expanded
1998	NA	no CWT found	1		2005	NA	no CWT found	5	
1998	Fall	Cole Rivers, OR	1	1	2005	Fall	Klamath River	2	42.14
1998	Fall	Feather River	2	2.04	2005	Fall	Lower Rogue R., OR	1	1.93
1998	Fall	Hunter Cr., Elk R., OR	1	1.06	2005	Fall	Trinity River	7	28.19
1998	Fall	Klamath River	2	14.87	2005	Spring	Cole Rivers, OR	1	32.58
1998	Fall	<b>Russian River</b>	1	1.09			valid CWTs	11	104.84
1998	Fall	Trinity River	3	17.54			Proportion Klamath-Trinity stocks	0.82	0.67
1998	Late Fall	Camp Cr., Klamath R.	1	1.06			Proportion KRFC	0.82	0.67
1998	Spring	Cole Rivers, OR	1	1.93					
1998	Spring	Trinity River	1	5.43	2006	NA	no CWT found	7	
		valid CWTs	13	46.02	2006	Fall	Trinity River	1	4.02
		Proportion Klamath-Trinity stocks	0.54	0.85	2006	Fall	Umpqua R., OR	1	5.86
		Proportion KRFC	0.38	0.70	2006	Spring	Cole Rivers, OR	1	5.13
					2006	Spring	Trinity River	4	16.34
2000	NA	no CWT found	5				valid CWTs	7	31.35
2000	Fall	Klamath River	1	26.42			Proportion Klamath-Trinity stocks	0.71	0.65
2000	Fall	Merced River	1	1.06			Proportion KRFC	0.14	0.13
2000	Fall	Lower Rogue R., OR	1	1.18					
2000	Fall	Trinity River	4	19.39	2007	NA	no CWT found	19	
2000	Late Fall	Battle Cr., Coleman NFH	1	1.01	2007	Fall	Chetco R., OR	1	5.74
2000	Spring	Cole Rivers, OR	1	8.06	2007	Fall	Cole Rivers, OR	2	9.41
2000	Spring	Trinity River	2	5.7	2007	Fall	Elk R., OR	1	1.41
2000	Spring	Umpqua R., OR	2	15.22	2007	Fall	Trinity River	10	41.8
		valid CWTs	13	78.04	2007	Late Fall	Battle Cr., Coleman NFH	3	3.21
		Proportion Klamath-Trinity stocks	0.54	0.66	2007	Spring	Trinity River	5	21.87
		Proportion KRFC	0.38	0.59			valid CWTs	22	83.44
							Proportion Klamath-Trinity stocks	0.68	0.76
							Proportion KRFC	0.45	0.50
2001	NA	no CWT found	9						
2001	Fall	Merced River	1	1.04	2008	NA	no CWT found	3	
2001	Fall	Trinity River	2	5.8	2008	Fall	Trinity River	1	4.31
2001	Spring	Cole Rivers, OR	1	18.9			valid CWTs	1	4.31
		valid CWTs	4	25.74			Proportion Klamath-Trinity stocks	1.00	1.00
		Proportion Klamath-Trinity stocks	0.50	0.23			Proportion KRFC	1.00	1.00
		Proportion KRFC	0.50	0.23					
2003	NA	no CWT found	22		2009	NA	no CWT found	7	
2003	Fall	American River	1	12.3	2009	Fall	Cole Rivers, OR	2	30.51
2003	Fall	Feather River	2	5.63	2009	Fall	Trinity River	4	16.33
2003	Fall	Lower Rogue R., OR	1	1.07	2009	Spring	Trinity River	3	12.03
2003	Fall	Trinity River	1	4.49	2009	Spring	Cole Rivers, OR	2	10.54
2003	Spring	Cole Rivers, OR	1	9.89			valid CWTs	11	69.41
		valid CWTs	6	33.38			Proportion Klamath-Trinity stocks	0.64	0.41
		Proportion Klamath-Trinity stocks	0.17	0.13			Proportion KRFC	0.36	0.24
		Proportion KRFC	0.17	0.13					
2004	NA	no CWT found	15				Summary of 1998 through 2009 shorebased CWTs		
2004	Fall	American River	1	1.15			Total valid CWTs	101	531.54
2004	Fall	<b>Eel River</b>	1	1.01			Proportion Klamath-Trinity stocks	0.63	0.64
2004	Fall	Klamath River	2	19.23			Proportion KRFC	0.44	0.48
2004	Fall	Lower Rogue R., OR	1	1.07					
2004	Fall	Trinity River	3	12.09					
2004	Spring	Trinity River	5	20.46					
		valid CWTs	13	55.01					
		Proportion Klamath-Trinity stocks	0.77	0.94					
		Proportion KRFC	0.38	0.57					

Table 2. Chinook coded-wire tags (CWT) recovered from the California at-sea whiting fishery, 1988-1991. Recoveries have been expanded for the proportion of the release group that were CWT tagged; they have not been expanded for the proportion of the sampled bycatch due to the lack of data availability.

Recovery Location						Recovery Location					
Year	Caught	Run	Chinook Stock	Number of CWTs	Production Expanded	Year	Caught	Run	Chinook Stock	Number of CWTs	Production Expanded
1988	40N 124W	Spring	Cole Rivers, OR	2	7.23	1990	39N 123W	Fall	American River	1	7.36
1988	40N 124W	Spring	Feather River	1	1.04	1990	39N 123W	Late Fall	Mill Cr., Trinity R.	1	1.18
1988	40N 124W	Spring	Rogue River	1	2.49	1990	40N 124W	Spring	Coquille R., OR	1	1.6
1988	40N 124W	Fall	Klamath River	3	27.03	1990	40N 124W	Spring	Trinity River	1	13.76
1988	40N 124W	Fall	<b>Redwood Cr., Eel R.</b>	1	1.04	1990	40N 124W	Fall	Chetco R., OR	2	2.62
1988	40N 124W	Fall	Trinity River	1	10.48	1990	40N 124W	Fall	Cole Rivers, OR	1	1
1988	41N 124W	Spring	Anadromous	1	1.17	1990	40N 124W	Fall	<b>Eel River</b>	1	1.02
1988	41N 124W	Spring	Cole Rivers, OR	9	115.09	1990	40N 124W	Fall	Klamath River	1	2.33
1988	41N 124W	Spring	Ore Pacific Salmon	1	1	1990	40N 124W	Fall	Trinity River	3	12.95
1988	41N 124W	Spring	Trinity River	5	36.43	1990	41N 124W	Spring	Chetco R., OR	1	1.19
1988	41N 124W	Spring	Umpqua R., OR	1	1.3	1990	41N 124W	Fall	Cole Rivers, OR	1	2.14
1988	41N 124W	Fall	Chetco R., OR	4	21.88				valid CWTs	14	47.15
1988	41N 124W	Fall	Cole Rivers, OR	2	2.05			Proportion Klamath-Trinity stocks		0.43	0.64
1988	41N 124W	Fall	Elk R., OR	2	3.4			Proportion KRFC		0.36	0.35
1988	41N 124W	Fall	Klamath River	1	1.23						
1988	41N 124W	Fall	Trinity River	8	73.76	1991	40N 124W	Spring	Cole Rivers, OR	2	32.12
			valid CWTs	43	306.62	1991	40N 124W	Spring	Rogue River	1	1.01
			Proportion Klamath-Trinity stocks	0.42	0.49	1991	40N 124W	Spring	Umpqua R., OR	1	5.9
			Proportion KRFC	0.28	0.33	1991	40N 124W	Fall	American River	1	5.42
1989	40N 124W	Spring	Cole Rivers, OR	1	3.73	1991	40N 124W	Fall	Bogus Cr., Klamath R.	1	1.07
1989	40N 124W	Spring	Trinity River	2	9.62	1991	40N 124W	Fall	Chetco R., OR	2	2.38
1989	40N 124W	Fall	Cole Rivers, OR	1	1	1991	40N 124W	Fall	Cole Rivers, OR	2	4.83
1989	40N 124W	Fall	<b>Eel River</b>	1	1.02	1991	40N 124W	Fall	Klamath River	3	46.89
1989	40N 124W	Fall	Feather River	3	3.07	1991	40N 124W	Fall	Pistol R., OR	1	1.32
1989	40N 124W	Fall	Horse Linto Creek	1	1.25	1991	40N 124W	Fall	Trinity River	1	10.93
1989	40N 124W	Fall	Klamath River	3	3.83	1991	41N 124W	Spring	Cole Rivers, OR	1	4.25
1989	40N 124W	Fall	Trinity River	2	18.8	1991	41N 124W	Fall	Chetco R., OR	1	1.19
1989	40N 124W	Late Fall	Mill Cr., Trinity R.	1	1.18	1991	41N 124W	Fall	Cole Rivers, OR	1	3.83
1989	41N 124W	Spring	Cole Rivers, OR	5	18.51	1991	41N 124W	Fall	Klamath River	3	12.94
1989	41N 124W	Spring	Feather River	1	1.04	1991	41N 124W	Fall	Trask R., OR	1	5.93
1989	41N 124W	Spring	Ore Pacific Salmon	1	1	1991	41N 124W	Fall	Trinity River	1	1.06
1989	41N 124W	Spring	Trinity River	3	14.43				valid CWTs	23	141.07
1989	41N 124W	Fall	Chetco R., OR	5	7.3			Proportion Klamath-Trinity stocks		0.39	0.52
1989	41N 124W	Fall	Cole Rivers, OR	2	3.03			Proportion KRFC		0.39	0.52
1989	41N 124W	Fall	Battle Cr., Coleman NFH	1	21.75						
1989	41N 124W	Fall	<b>Eel River</b>	2	2.04			Summary of 1988 through 1991 at-sea CWTs			
1989	41N 124W	Fall	Klamath River	5	13.77			Total valid CWTs		126	675.49
1989	41N 124W	Fall	Trinity River	6	54.28			Proportion Klamath-Trinity stocks		0.44	0.55
			valid CWTs	46	180.65			Proportion KRFC		0.36	0.44
			Proportion Klamath-Trinity stocks	0.50	0.65						
			Proportion KRFC	0.39	0.52						

Table 3a. Chinook bycatch rates in the at-sea whiting fishery by region, 1988-1991

Year	North of Cape Falcon	Cape Falcon to C. Blanco	Cape Blanco to 42° N. Lat.	42° N. Lat. South
1988	0.08	0.07	0.07	0.10
1989	0.04	0.06	0.02	0.05
1990	0.03	0.04	0.01	0.11
1991	0.02	0.01	0.00	0.05
average	0.04	0.05	0.03	0.08

Table 3b. At-sea whiting fishery harvest and salmon bycatch, 1988-1991.

Year	Total At-Sea		At-Sea South of 42° N. Lat.				
	Whiting (mt)	Total At-Sea Chinook (N)	Whiting (mt)	Whiting Prop.	Chinook (N)	Chinook Prop.	Bycatch Rate
1988	146,256	11,709	25,504	17%	2,488	21%	0.10
1989	177,047	8,546	59,813	34%	2,697	32%	0.05
1990	137,181	7,212	35,880	26%	3,997	55%	0.11
1991	121,920	3,614	49,727	41%	2,425	67%	0.05
average	145,601	7,770	42,731	29%	2,902	37%	0.08

Table 3c. Most recent 5-year average at-sea whiting harvest, 2011-2014

Year	Total At-Sea Whiting (mt)	PFMC Alternative* (10%)	Historical Minimum* (17%)	Historical Average* (29%)	Historical Maximum* (41%)
2010	90,006	9,001	15,695	26,415	36,710
2011	121,730	12,173	21,227	35,725	49,650
2012	93,743	9,374	16,347	27,512	38,235
2013	130,422	13,042	22,743	38,276	53,195
2014	165,301	16,530	28,825	48,513	67,421
average	120,240	12,024	20,967	35,288	49,042

\* The proportion of at-sea whiting expected to be harvested S. of 42

Table 3d. Chinook bycatch expectations under various S. 42 at-sea whiting harvest scenarios

Proportion Whiting Harvested S. 42	Min. Bycatch Rate (5%)	Avg. Bycatch Rate (8%)	Max. Bycatch Rate (11%)
PFMC Proposal (10%)	542	910	1,339
Min. Observed (17%)	945	1,587	2,336
Historical Avg (29%)	1,591	2,671	3,931
Max. Observed (41%)	2,211	3,713	5,463