

INTEGRATION OF MANAGEMENT IN OCEAN AND COLUMBIA RIVER FISHERIES IN 2005 TO MEET CONSERVATION REQUIREMENTS FOR OREGON COASTAL NATURAL AND LOWER COLUMBIA RIVER NATURAL COHO SALMON

Introduction

Oregon Coastal Natural (OCN) coho and lower Columbia River Natural (LCN) coho populations are assumed to have similar temporal and spatial distributions in ocean fisheries. OCN coho are listed as threatened under the federal Endangered Species Act (ESA), LCN coho are proposed for listing under the federal ESA, and LCN coho populations in Oregon have been listed as endangered under Oregon's ESA. A federally approved management plan prepared for the Pacific Fishery Management Council (PFMC) constrains overall allowable fishery impacts on OCN. A management plan for LCN coho that has been approved by the Oregon Fish and Wildlife Commission (OFWC) includes allowable overall impact rates for all salmon fisheries and separate allowable harvest rates for Columbia River salmon fisheries and ocean salmon fisheries. Whereas all salmon fisheries that affect OCN coho can be controlled under federal ESA jeopardy standards, only a few of the fisheries that impact LCN coho are within the exclusive jurisdiction of Oregon's endangered species law and the Oregon Department of Fish and Wildlife (ODFW). ODFW's goal is to achieve both federal and state management objectives for OCN and LCN coho. Beginning in 2002, ODFW requested that the PFMC consider the conservation needs for OCN and LCN coho concurrently when setting ocean salmon fisheries. What follows are synopses of management plans for OCN and LCN coho and a discussion of their integration.

Management of OCN Coho

In 1995, the National Marine Fisheries Service (NMFS) proposed coho populations in both the Oregon Coastal and Southern Oregon/ Northern California evolutionarily significant units (ESUs) for listing under the federal ESA. In August of 1998, OCN coho in the Oregon Coast ESU north of Cape Blanco were listed as threatened. In an attempt to restore OCN coho and avert the proposed ESA listings the state of Oregon initiated the Governor's Coastal Salmon Restoration Initiative (Oregon Plan). Concurrently the PFMC began to consider an amendment to their Fishery Management Plan (FMP) that would insure that fishery related impacts would not act as a significant impediment to the recovery of depressed OCN coho stocks.

The PFMC approved Amendment 13 to the FMP in November 1997 (PFMC 1999). Amendment 13 manages fisheries based upon exploitation rates, not spawner escapement objectives. Maximum allowable exploitation rates in Amendment 13 vary in response to changes in observed brood year specific parental spawner abundance and marine survival. Spawner abundance is expressed as a percent of spawners required for full seeding of high quality habitat. Full seeding is estimated from a habitat based production model. Marine survival is estimated as the jack to smolt ratio for hatcheries in the Oregon Production Index area. To implement this approach, managers constructed "Low", "Medium", and "High" categories across the range of observed historic values for both OCN coho parental spawner abundance and jack to smolt survival (marine survival). The categories for parental spawner abundance and marine survival defined the two axes of a three by three harvest management matrix. Maximum allowable exploitation rates calculated for each matrix intersection are based upon estimates of habitat production potential, for the given combination of parental spawner abundance and marine survival.

In November 1999, the PFMC approved the formation of an ad hoc OCN work group composed of representatives from ODFW, PFMC, and NMFS to complete a year 2000 review of Amendment 13. The review focused on parental spawner criteria, marine survival criteria, and allowable impact rates in the harvest management matrix. The amended matrix that the OCN work group recommended includes new "Critical" and "Very Low" parental spawner categories, a new "Extremely Low" marine survival category, allowable fishery impacts for new cells, and some adjustments of allowable impacts in pre-existing cells (Table 1). The new harvest management matrix was adopted as scientific guidance by the PFMC in November 2000.

Management of LCN Coho

Under terms of the Oregon's ESA, the OFWC listed lower Columbia River natural coho salmon as an endangered species in July 1999. Under provisions of that same law, the ODFW, with the assistance of staff from the Washington Department of Fish and Wildlife (WDFW) prepared an endangered species management plan that was adopted by the OFWC in July 2001. One of the several required elements in this plan is a description of how state agencies will manage state lands, including a harvest management plan.

The harvest management section of the endangered species management plan for LCN coho is designed to manage mortality associated with ocean and Columbia River fisheries in a manner that is consistent with the conservation and recovery of the species. The approach to accomplish this goal will be to scale annual fishery impacts to the forecast run strength of each year's return of naturally produced coho.

The method to determine the annual maximum fishery impact rates for LCN coho salmon are based upon the same two predictive variables that are used in the Amendment 13 for OCN coho; parental spawner abundance and ocean survival. The integration of these two factors in setting maximum harvest rates is accomplished using the same harvest matrix approach as described for the management of OCN stocks of coho through the Amendment 13 in the annual PFMC management process for ocean fisheries. However, for LCN coho three harvest matrices are used: one for ocean fisheries (Table 2), one for freshwater fisheries (Table 3), and one that depicts the maximum allowable cumulative fishery impact rates for ocean and freshwater fisheries combined (Table 4). In all three matrices, the index of marine survival is the same as the one used for OCN coho in Amendment 13 and parental escapement is the observed number of natural adult coho spawning in the Sandy and Clackamas rivers expressed as a fraction of full seeding. Full seeding in each case is estimated from spawner recruitment analyses. The parental status for each of the two populations is applied to the harvest matrices and a maximum harvest rate for each population is estimated. These allowable maximum harvest rates for the two populations are then averaged to obtain the overall maximum impact rate for LCN coho.

Integration of Management for OCN and LCN Coho

In many instances, fishery constraints to protect LCN coho under Oregon's ESA and fishery constraints to protect OCN coho under Plan Amendment 13 and the Federal ESA are complimentary. Management matrices for both incorporate the same marine survival index and a review of historic data indicate that the spawner abundance status for OCN and LCN coho are often the same. Furthermore, even though LCN coho are impacted at a higher rate in freshwater (due to the magnitude of Columbia River fisheries), the allowable cumulative impact rates for LCN are higher than for OCN under the respective management plans. Hence, if marine survival and parental spawner status are the same for both LCN and OCN coho and ocean impacts for both are the same, allowable constraints for LCN coho can still be achieved even with the added impacts from Columbia River fisheries.

In contrast, there may be instances when allowable cumulative fishery impacts for LCN coho (Table 4) may not be achievable if allowable impacts on OCN coho are higher. The latter instance can occur if OCN coho have a higher parental spawner status than lower Columbia River wild coho. In that instance, to balance needs of Columbia River and ocean fisheries, ODFW may request that co-managers in the PFMC process constrain ocean fisheries beyond what is called for to protect OCN coho in Plan Amendment 13. In any case, a strong cooperative effort among co-managers in the PFMC and Columbia River management arenas will be required to successfully integrate conservation needs for OCN coho under Federal ESA standards and LCN coho under conditions stipulated by ODFW's endangered species management plan. A summary of OCN and LCN coho parental spawner status for brood years 1999-2004 (fishery years 2002-2007) is displayed in Table 5.

2002 Integration of Management for OCN and LCN Coho

The management criteria based on parental spawner status for 1999 brood OCN coho differed from that for 1999 brood LCN coho. The parental spawner category for 1999 brood year OCN coho was "Low". On

the other hand, the 1999 brood year parental spawner status for natural coho in the Clackamas River was "Critical" and in the Sandy River was "Very Low". Marine survival for OPI coho resulting from 1999 parental spawners was "Low". Hence, the maximum allowable cumulative impact rate for OCN coho in all 2002 salmon fisheries was 15% (Table 1) whereas the maximum allowable cumulative impact rate for LCN coho, including ocean fisheries, was 14% (average of 11.7% and 16.3%, Table 4). This included an average maximum allowable harvest rate of 5% on LCN in Columbia River fisheries (average of 4% and 6%, Table 3). Therefore, if co-managers in the Columbia River basin needed to craft Columbia River fisheries that utilized the full 5% harvest rate for LCN coho then they had to request that the PFMC constrain overall impacts to OCN coho to less than or equal to approximately 10.5%. This is equivalent to an ocean fishery impact rate on OCN and LCN coho of approximately 9.4% and achieves the cumulative allowable impact rate of 14% for LCN coho (Table 6). Alternatively, co-managers for Columbia River fisheries could agree to constrain in-river fishery impacts to something less than 5%. In that case, constraints on ocean fisheries could be relaxed accordingly. For example, if the harvest rate in the Columbia River fisheries is reduced to 3.5%, then the allowable overall impact rate of 14% on lower Columbia River coho could be achieved if ocean impacts on lower Columbia River coho were constrained to 10.9%. In that case, the overall impact rate on OCN coho would be approximately 12% (i.e. 10.9% in ocean fisheries and about 1.1% in freshwater fisheries, Table 6). In 2002, a strong cooperative effort among co-managers in the PFMC and Columbia River management arenas was made to integrate conservation needs for OCN coho under Federal ESA standards and LCN coho under conditions stipulated by ODFW's endangered species management plan. The ocean fishery impact rate on OCN and LCN was constrained to 11.3%, leaving approximately 2.7% and 3.7% for use in management of LCN and OCN freshwater fisheries, respectively.

2003 Integration of Management for OCN and LCN Coho

The management criteria based on parental spawner status for 2000 brood OCN coho differed slightly from that for 2000 brood LCN coho. The parental spawner category for 2000 brood year OCN coho was "High" for two sub-aggregates and "Low" for one sub-aggregate. On the other hand, the 2000 brood year parental spawner status for natural coho in the Clackamas and Sandy rivers was "Medium" for both. Marine survival for OPI coho resulting from 2000 parental spawners was "Medium". Hence, the maximum allowable cumulative impact rate for OCN coho in all 2003 salmon fisheries was 15% (Table 1) whereas the maximum allowable cumulative impact rate for LCN coho, including ocean fisheries, was 29.2% (Table 4). This included a maximum allowable harvest rate of 20% on LCN in ocean fisheries and 11.5% on LCN in Columbia River fisheries (Tables 2 and 3). Therefore, co-managers in the Columbia River basin had the ability to utilize the full 11.5% harvest rate for LCN coho and did not have to request that the PFMC constrain overall impacts to OCN coho to less than what is allowed under the federal ESA.

2004 Integration of Management for OCN and LCN Coho

The management criteria based on parental spawner status for 2001 brood OCN coho again differed slightly from that for 2001 brood LCN coho. The parental spawner category for 2001 brood year OCN coho was "High" for two sub-aggregates and "Low" for one sub-aggregate. On the other hand, the 2001 brood year parental spawner status for natural coho in the Clackamas and Sandy rivers was "High" for both. Marine survival for OPI coho resulting from 2001 parental spawners was "Medium". Hence, the maximum allowable cumulative impact rate for OCN coho in all 2004 salmon fisheries is 15% (Table 1) whereas the maximum allowable cumulative impact rate for LCN coho, including ocean fisheries, is 40.5% (Table 4). This includes a maximum allowable harvest rate of 30% on LCN in ocean fisheries and 15% on LCN in Columbia River fisheries (Tables 2 and 3). Therefore, co-managers in the Columbia River basin could utilize the full 15% harvest rate for LCN coho and not have to request that the PFMC constrain overall impacts to OCN coho to less than what is allowed under the federal ESA.

2005 Integration of Management for OCN and LCN Coho

The management criteria based on parental spawner status for 2002 brood OCN coho again differed from that for 2002 brood LCN coho. The parental spawner category for 2002 brood year OCN coho was "High" for all three sub-aggregates. On the other hand, the 2002 brood year parental spawner status for natural

coho in the Clackamas and Sandy rivers was "Low" for both. Marine survival for OPI coho resulting from 2002 parental spawners was "Low". Hence, the maximum allowable cumulative impact rate for OCN coho in all 2005 salmon fisheries is 15% (Table 1) whereas the maximum allowable cumulative impact rate for LCN coho, including ocean fisheries, is 21.4% (Table 4). This includes a maximum allowable harvest rate of 15% on LCN in ocean fisheries and 7.5% on LCN in Columbia River fisheries (Tables 2 and 3). Therefore, co-managers in the Columbia River basin could utilize the full 7.5% harvest rate for LCN coho and not have to request that the PFMC constrain overall impacts to OCN coho to less than what is allowed under the federal ESA.

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Table 1. OCN work group revisions to the harvest management matrix in Plan Amendment 13 showing allowable fishery impacts and ranges of resulting recruitment for each combination of parental spawner abundance and marine survival.

Parent Spawner Status ^{1/}	Marine Survival Index (based on return of jacks per hatchery smolt)			
	Extremely Low (<0.0008)	Low (0.0008 to 0.0014)	Medium (>0.0014 to 0.0040)	High (>0.0040)
	High Parent Spawners > 75% of full seeding	E ≤ 8%	J ≤ 15%	O ≤ 30%
Medium Parent Spawners > 50% & ≤ 75% of full seeding	D ≤ 8%	I ≤ 15%	N ≤ 20%	S ≤ 38%
Low Parent Spawners > 19% & ≤ 50% of full seeding	C ≤ 8%	H ≤ 15%	M ≤ 15%	R ≤ 25%
Very Low Parent Spawners > 4 fish per mile & ≤ 19% of full seeding	B ≤ 8%	G ≤ 11%	L ≤ 11%	Q ≤ 11%
Critical ^{2/} Parental Spawners ≤ 4 fish per mile	A 0 - 8%	F 0 - 8%	K 0 - 8%	P 0 - 8%

Sub-aggregate and Basin Specific Spawner Criteria Data							
Sub-aggregate	Miles of Available Spawning Habitat	100% of Full Seeding	"Critical"		Very Low, Low, Medium & High		
			4 Fish per Mile	12% of Full Seeding	19% of Full Seeding	50% of Full Seeding	75% of full Seeding
Northern	899	21,700	3,596	NA	4,123	10,850	16,275
North - Central	1,163	55,000	4,652	NA	10,450	27,500	41,250
South - Central	1,685	50,000	6,740	NA	9,500	25,000	37,500
Southern	450	5,400	NA	648	1,026	2,700	4,050
Coastwide Total	4,197	132,100	15,636		25,099	66,050	99,075

1/ Parental spawner abundance status for the OCN aggregate assumes the status of the weakest sub-aggregate.

2/ "Critical" parental spawner status is defined as 4 fish per mile for the Northern, North-Central, and South-Central sub-aggregates. Because the ratio of high quality spawning habitat to total spawning habitat in the Rogue River Basin differs significantly from the rest of the basins on the coast, the spawner density of 4 fish per mile does not represent "Critical" status for that basin. Instead, "Critical" status for the Rogue Basin (Southern Sub-aggregate) is estimated as 12% of full seeding of high quality habitat.

Table 2. Harvest management matrix for LCN coho salmon showing maximum allowable **OCEAN** fishery mortality rates.

Parental Escapement ^{1/}		Marine Survival Index (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (< 0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	> 0.75 full seeding	< 8.0%	< 15.0%	< 30.0%	< 45.0%
Medium	0.75 to 0.50 full seeding	< 8.0%	< 15.0%	< 20.0%	< 38.0%
Low	0.50 to 0.20 full seeding	< 8.0%	< 15.0%	< 15.0%	< 25.0%
Very Low	0.20 to 0.10 of full seeding	< 8.0%	< 11.0%	< 11.0%	< 11.0%
Critical	< 0.10 of full seeding	0 – 8.0%	0 – 8.0%	0 – 8.0%	0 – 8.0%

^{1/} Full Seeding: Clackamas River = 3,800
Sandy River = 1,340

Table 3. Harvest management matrix for LCN coho salmon showing maximum allowable **FRESHWATER** fishery mortality rates.

Parental Escapement ^{1/}		Marine Survival Index (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (< 0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	> 0.75 full seeding	< 4.0%	< 7.5%	< 15.0%	< 22.5%
Medium	0.75 to 0.50 full seeding	< 4.0%	< 7.5%	< 11.5%	< 19.0%
Low	0.50 to 0.20 full seeding	< 4.0%	< 7.5%	< 9.0%	< 12.5%
Very Low	0.20 to 0.10 of full seeding	< 4.0%	< 6.0%	< 8.0%	< 10.0%
Critical	< 0.10 of full seeding	0.0 – 4.0%	0.0 – 4.0%	0.0 – 4.0%	0.0 – 4.0%

^{1/} Full Seeding: Clackamas River = 3,800
Sandy River = 1,340

Table 4. Likely cumulative exploitation rates for LCN coho under the combined management protocols proposed for setting ocean and in-river fishery harvest rates.

Parental Escapement ^{1/}		Marine Survival Index (based on return of jacks per hatchery smolt)			
		Critical (<0.0008)	Low (< 0.0015)	Medium (< 0.0040)	High (> 0.0040)
High	> 0.75 full seeding	< 11.7%	< 21.4%	< 40.5 %	< 57.4%
Medium	0.75 to 0.50 full seeding	< 11.7%	< 21.4%	< 29.2%	< 49.8%
Low	0.50 to 0.20 full seeding	< 11.7%	< 21.4%	< 22.7%	< 34.4%
Very Low	0.20 to 0.10 of full seeding	< 11.7%	< 16.3%	< 18.1%	< 19.9%
Critical	< 0.10 of full seeding	0.0 – 11.7%	0.0 – 11.7%	0.0 – 11.7%	0.0 – 11.7%

^{1/} Full Seeding: Clackamas River = 3,800
Sandy River = 1,340

Table 5. Parental spawner status for OCN and LCN coho for brood years 1999-2002 which translates into fishery years 2002-2006.

Fishery Year	Parent Spawner Year	Parental Spawner Category		
		OCN ^{1/}	LCN Clackamas	LCN Sandy
2002	1999	Low	Critical	Very Low
2003	2000	Low	Medium	Medium
2004	2001	Low	High	High
2005	2002	High	Low	Low
2006	2003	High	Medium	High
2007	2004	Medium	Low ^{2/}	High

^{1/} Category represents the status of the lowest sub-aggregate.

^{2/} Incomplete

Table 6. Maximum allowable cumulative exploitation rates on LCN coho and how they relate to maximum allowable harvest rates on LCN coho in freshwater fisheries, harvest rates on LCN coho in ocean fisheries, and cumulative exploitation rates on OCN coho. Shaded cells depict in-river harvest rates or overall exploitation rates for LCN coho that exceed the maximum allowable in 2002 given the status of the parental spawners and the marine survival for the 1999 brood year production.

IMPACT RATES ON SURROGATE OCN COHO		FISHERY HARVEST RATES ON LOWER COLUMBIA RIVER NATURAL COHO											
		OCEAN	INRIVER										
OVERALL	FRESHWATER		1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%
OVERALL EXPLOITATION RATES ON LOWER COLUMBIA NATURAL COHO													
7.0%	1.13%	5.9%	6.8%	7.3%	7.8%	8.2%	8.7%	9.2%	9.6%	10.1%	10.6%	11.0%	11.5%
7.5%	1.13%	6.4%	7.3%	7.8%	8.2%	8.7%	9.2%	9.6%	10.1%	10.6%	11.1%	11.5%	12.0%
8.0%	1.13%	6.9%	7.8%	8.3%	8.7%	9.2%	9.7%	10.1%	10.6%	11.1%	11.5%	12.0%	12.5%
8.5%	1.13%	7.4%	8.3%	8.8%	9.2%	9.7%	10.1%	10.6%	11.1%	11.5%	12.0%	12.5%	12.9%
9.0%	1.13%	7.9%	8.8%	9.3%	9.7%	10.2%	10.6%	11.1%	11.6%	12.0%	12.5%	12.9%	13.4%
9.5%	1.13%	8.4%	9.3%	9.7%	10.2%	10.7%	11.1%	11.6%	12.0%	12.5%	13.0%	13.4%	13.9%
10.0%	1.13%	8.9%	9.8%	10.2%	10.7%	11.1%	11.6%	12.1%	12.5%	13.0%	13.4%	13.9%	14.3%
10.5%	1.13%	9.4%	10.3%	10.7%	11.2%	11.6%	12.1%	12.5%	13.0%	13.4%	13.9%	14.4%	14.8%
11.0%	1.13%	9.9%	10.8%	11.2%	11.7%	12.1%	12.6%	13.0%	13.5%	13.9%	14.4%	14.8%	15.3%
11.5%	1.13%	10.4%	11.3%	11.7%	12.2%	12.6%	13.1%	13.5%	14.0%	14.4%	14.9%	15.3%	15.7%
12.0%	1.13%	10.9%	11.8%	12.2%	12.7%	13.1%	13.5%	14.0%	14.4%	14.9%	15.3%	15.8%	16.2%
12.5%	1.13%	11.4%	12.3%	12.7%	13.1%	13.6%	14.0%	14.5%	14.9%	15.4%	15.8%	16.2%	16.7%
13.0%	1.13%	11.9%	12.8%	13.2%	13.6%	14.1%	14.5%	15.0%	15.4%	15.8%	16.3%	16.7%	17.2%

