SALMON TECHNICAL TEAM REPORT ON TENTATIVE ADOPTION OF 2018 MANAGEMENT MEASURES FOR ANALYSIS

INVESTIGATION OF EXPLOITATION RATES ON ROGUE/KLAMATH COHO IN FISHERIES SOUTH OF CAPE FALCON

Salmon Technical Team, April 2018

Background

At the March 2018 Council meeting, Mr. Marc Gorelnik requested the Salmon Technical Team (STT) investigate the unusually high exploitation rates forecasted for Rogue/Klamath coho salmon in fisheries south of Cape Falcon. Unmarked Rogue/Klamath hatchery coho are used as the indicator of fishery impacts on the Southern Oregon, Northern California Coast Coho (SONCC) Evolutionarily Significant Unit (ESU). The Endangered Species Act (ESA) consultation guidance for SONCC in 2018 is for an ocean exploitation rate of no more than 13%. During development of the three ocean salmon fishing Alternatives at the March Council meeting, exploitation rates exceeded 13%, sometimes substantially, and were much higher than the rates that have occurred in recent years, including several with similar fishing seasons south of Cape Falcon. Between 2010 and 2017, the final ocean salmon seasons adopted by the Council had an average preseason exploitation rate on Rogue/Klamath unmarked coho of 6.9% (range 3.3%-10.0%). Fishing impacts on Rogue/Klamath coho are negligible in fisheries north of Cape Falcon and consequently have little effect on the total exploitation rate.

The current approach to forecasting Rogue/Klamath coho marine exploitation rates relies on two models. The first model forecasts the number of mixed-stock coho mortalities, stratified by time period, area, and fishery. These forecasts are then used as inputs into coho Fishery Regulation Assessment Model (FRAM), where stock-specific exploitation rates are computed. We describe both of these models in more detail below.

Current Method of Estimating Mortality in Fisheries Requiring the Release of Coho (CNR)

The method currently used to estimate the number of mixed-stock "dead coho" resulting from release and drop-off mortality was developed in 2001 by the STT. This method uses projected effort measured in vessel days (troll) and angler-trips (recreational) applied to an average catch per unit effort (CPUE) for each time, area, and fishery stratum in FRAM. The CPUE was calculated from landings and effort data in the late 1980s to early 1990s base period when retention of coho was allowed in these fisheries. Adjustments that reduce the CNR estimates in the troll fisheries are made for targeting Chinook (0.25 reduction) and for a four-spread gear credit (reductions variable by area) in Oregon. Adjustments are not made in the recreational fisheries for Chinook target or gear type.

A key difference in methods exists in this model for fisheries between Cape Falcon and Humbug Mountain and fisheries south of Humbug Mountain. For the area between Cape Falcon and Humbug Mountain, CPUE is adjusted for the current year Oregon Production Index (OPI) coho stock abundance as compared to the base period OPI coho stock abundance, which is the average OPI abundance for the years used to estimate CPUE. Estimates of CNR mortality for fisheries south of Humbug Mountain are not adjusted for current year OPI coho stock abundance. Scaling CPUE for OPI stock abundance south of Humbug Mountain was considered in the past, but a coherent relationship between CPUE and OPI abundance was not found. This may have been because OPI abundance is driven by Columbia River coho, and the contribution of Columbia River coho in these southern fisheries is minimal, thus adjusting

for OPI abundance was not deemed appropriate. The OPI coho abundance is an aggregate of stocks and may not adequately represent the coho stocks that are in these southern fisheries.

How CNR Mortalities are Modeled in FRAM

CNR mortalities are modeled as direct "dead fish" inputs to FRAM by fishery type, time, and area. The coho FRAM base period dataset contains stock abundances and exploitation rates by fishery type, time, and area derived from 1986-92 coded-wire tag data. Estimates of stock-specific mortality can be made using current year stock abundances and applying these base period exploitation rates. Summing up these individual mortality estimates and then comparing the sum to the number of CNR mortality input into the model, provides the adjustment ("effort scalar") that when applied to all coho stocks encountered in the fishery, will produce the target number of dead fish.

Because CNR mortalities are input into FRAM as dead fish, FRAM has to determine the number of dead coho by stock using base exploitation rates and stock abundances that add up to the total dead fish. If coho abundance is low for the stocks that contribute to these fisheries, but a high number of CNR mortalities are input into FRAM due to CPUE not being adjusted, the contact rates may need to be increased significantly to produce the correct number of total dead CNR coho. The forecast abundance of coho stocks that contribute to fisheries south of Humbug Mountain is very low in 2018 relative to past years.

Incorporating Stock Abundance in Estimating CNR Mortalities

As mentioned, the current method adjusts the CNR mortalities in the fisheries from Cape Falcon to Humbug Mountain using a relationship of base period OPI abundance to current year OPI abundance. Fisheries south of Humbug Mountain have no stock abundance adjustment.

The STT investigated three methods that capture the changes in CPUE that would be expected to occur due to variation in coho abundance.

Method One compared changes in CPUE to the changes in stock abundances from year to year. Even though it seems logical that with reduced abundance the CPUE should drop, the regression relationship was weak with similar CPUEs occurring across a wide range of stock abundances. Using CPUE has the additional disadvantage of needing to rely on interview or log book data for recent years where no retention was allowed or very old data where retention occurred. Furthermore, contemporary CPUE data was not available for all fishery sectors. Because of these shortcomings, we did not attempt to predict Rogue/Klamath coho exploitation rates using this method.

Method Two was a variation of the current method used for fisheries north of Humbug Mountain. In this method, instead of using relative abundance of OPI aggregate stocks between base years and current years, the relative abundance of a stock aggregate consisting of Oregon Coast Hatchery, Oregon Coast Natural (OCN), and Rogue/Klamath was used to adjust CNR estimates. These stocks are the main components in the fisheries south of Humbug Mountain and would be a better index of abundance. This system also assumes that this aggregate is distributed in the same way throughout these southern fisheries, just like the assumption for OPI stocks in the northern portion fisheries. Equal distribution north to south is probably not the case for either of these stock aggregate adjustment systems.

Method Three uses FRAM stock abundances as part of the system to scale the CNR estimates. In this method FRAM is run two times. The first run is conducted using the relative proportion of average effort in the base period compared to the projected current effort as a conventional landed catch input scalar to the model. This run produces a "landed catch" for each of the fisheries south of Humbug Mountain, which represents the number of encounters in each of these fisheries. Therefore, the estimate of

encounters are scaled both for the forecast stock abundances that are in the current FRAM run year and the current year fishing effort in vessel days or angler trips. Release mortality rates, drop-off rates, and gear/target adjustments are applied in the same manner as they are in fisheries north of Humbug Mountain to produce the CNR input in the second model run used to estimate stock exploitation rates.

Due to the general lack of high quality recent data on CPUE in non-retention fisheries, Method One was not evaluated further. Method Two was not evaluated further because of the likely violation of the equal distribution assumption for the aggregate in fisheries north and south of Humbug Mountain. As a result, the STT focused on further evaluation of Method Three.

Method Three Using FRAM Stock Abundances for CNR

We ran the March Alternatives using the Method Three two-step system described above. The first pass of FRAM produced the estimated encounters that associate the current stock abundances with the fishing effort projected for each 2018 Alternative. To these encounters we applied the release mortality rates, drop-off mortality, and gear/target reductions as per the current method. Because the 2018 stock abundances for Oregon coast and south stocks are much lower than previous years, and the current system doesn't capture this for fisheries south of Humbug Mountain, the FRAM-based estimates of CNR are much lower and hence the exploitation rates on Rogue/Klamath are greatly reduced (Table 1). The exploitation rates on OCN declined to a lesser extent (Table 2).

As a further test of method, we ran the final preseason FRAM for 2013, a year with similar fisheries south of Cape Falcon but higher coho stock abundances. Rogue/Klamath exploitation rates were lower, as expected, but not to the degree they are in 2018, presumably because the stock abundances weren't as low in 2013. The final 2013 preseason exploitation rate for Rogue/Klamath coho was 7.3% compared to a FRAM-based CNR version of 5.6%.

Summary

The STT's examination of the models used to forecast Rogue/Klamath coho exploitation rates indicated that the unusually high forecasts produced for the March Alternatives resulted from a lack of scaling base period CPUE to current coho stock abundances south of Humbug Mountain. The effect was particularly notable this year because coho stocks distributed south of Humbug Mountain have very low 2018 abundance forecasts. Three methods were proposed to address this issue and to make the modeling framework consistent with the other approaches used by the STT that account for annual variation in abundance when predicting CPUE. Based on our evaluation, the STT recommends the use of Method Three for forecasting coho CNR mortalities south of Humbug Mountain during the April Council meeting and into the future. If this modification were to be implemented in 2018, the predicted marine fishery exploitation rates for Rogue/Klamath coho would be reduced substantially relative to the exploitation rate forecasts presented in Preseason Report II (Table 1). The exploitation rates on OCN coho also declined, but to a lesser extent (Table 2). The STT believes this modification is warranted and is an improvement over the existing method that does not capture annual differences in stock abundances. Finally, Method Three is an application of an existing, approved model (coho FRAM), and the proposed changes are to model inputs and not model structure.

TABLE 1. RK coho exploitation rates from March Alternatives compared to Method Three FRAM based CNR.

	RK Coho --March			RK Coho --FRAM CNR		
Fishery	I	II	III	I	II	III
SOUTH OF CAPE FALCON						
Recreational:						
Cape Falcon to Humbug Mt.	0.5%	0.5%	0.4%	0.5%	0.5%	0.4%
Humbug Mt. to OR/CA border (KMZ)	1.1%	0.6%	0.2%	0.3%	0.2%	0.0%
OR/CA border to Horse Mt. (KMZ)	3.5%	4.5%	4.9%	0.6%	0.6%	0.8%
Fort Bragg	2.0%	2.6%	1.7%	0.3%	0.4%	0.3%
South of Pt. Arena	1.7%	1.1%	0.7%	0.2%	0.2%	0.1%
Troll:						
Cape Falcon to Humbug Mt.	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Humbug Mt. to OR/CA border (KMZ)	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%
OR/CA border to Horse Mt. (KMZ)	3.0%	2.5%	4.0%	1.5%	1.3%	2.0%
Fort Bragg	0.5%	0.5%	0.5%	0.0%	0.1%	0.1%
South of Pt. Arena	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%
BUOY 10	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ESTUARY/FRESHWATER	NA	NA	NA	NA	NA	NA
TOTAL	12.9%	12.9%	12.7%	4.0%	3.6%	4.0%

TABLE 2. OCN coho exploitation rates from March Alternatives compared to Method Three FRAM based CNR.

	OCN Coho --March			OCN Coho --FRAM CNR		
Fishery	I	II	III	I	II	III
SOUTH OF CAPE FALCON						
Recreational:						
Cape Falcon to Humbug Mt.	6.8%	5.5%	8.2%	6.9%	5.6%	8.3%
Humbug Mt. to OR/CA border (KMZ)	0.5%	0.2%	0.1%	0.1%	0.1%	0.0%
OR/CA border to Horse Mt. (KMZ)	0.7%	0.8%	1.0%	0.1%	0.1%	0.2%
Fort Bragg	0.5%	0.7%	0.3%	0.1%	0.1%	0.0%
South of Pt. Arena	0.6%	0.4%	0.2%	0.1%	0.1%	0.0%
Troll:						
Cape Falcon to Humbug Mt.	0.6%	0.6%	0.5%	0.6%	0.6%	0.5%
Humbug Mt. to OR/CA border (KMZ)	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%
OR/CA border to Horse Mt. (KMZ)	0.9%	0.9%	1.6%	0.4%	0.5%	0.7%
Fort Bragg	0.2%	0.2%	0.3%	0.0%	0.0%	0.0%
South of Pt. Arena	0.4%	0.3%	0.1%	0.1%	0.1%	0.0%
BUOY 10	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
ESTUARY/FRESHWATER	1.5%	1.6%	1.5%	1.6%	1.6%	1.6%
TOTAL	14.8%	12.7%	14.9%	12.1%	10.1%	12.5%

PFMC
04/06/18