Willapa Bay Salmon Advisory Group Meeting

Montesano District Office

September 14, 2018

6pm – 8pm

6:00 Willapa Bay Policy Review
- Public Comment/Advisor Input
- Policy Overview
  - Purpose
  - Guiding Principles

7:00 In-Season Data
- Marine Area 2-1 Update – Recreational Fishery
- Commercial Fishery Update
- WB Hatcheries Rack Returns
- Fishery Proposals
- Advisor Input

7:45 Southern Resident Killer Whales
- NOAA & WDFW Priority Stocks
- Available Hatchery Capacity

Willapa Bay Policy Public Workshop
January 23, 2018
Raymond Elks, Raymond WA 6 p.m. – 8 p.m.

(#) = number of additional individuals who supported the comment

Priority

- Priority is opportunity for all within the conservation limits
- Priority means to maintain north bay priority for rec Chinook July – Sept. 15
- Strike the priority from the policy for all groups
- No priorities
- Consequence needed for priorities
- Don't change priorities if you can't hit the goal
- Priorities are in the order listed in the policy. Follow the priorities. There is no conflict for priorities.
- Priority means at least 50% or greater with river goes to the recreational
- At least 50% of Naselle impacts to commercial

Commercial

- Commercial sector feel that they have no say
- Commercial fish in August (some time) below Leadbetter Point
- Get rid of the alternative gear mandate
- No re-institution of commercial dip-in fishery in 2T during august for Columbia River tules
- The commercial fishery is being eliminated by this policy
- Pacific County is the poorest county in WA. No money or jobs. No new fishermen in the commercial fleet. The operating costs are high and the commercial quotas are low.
- Commercial license buyback program. Boats and permits. Take lower bidders first.
- Gillnetters should stay out of the river and stay in the bay.
- Tangle net fishery – policy means more fish are wasted that could go to market
- Converting the commercial fleet to selective gear
- Observer program issues:
    - Liability – hard to maintain equipment and safety when struggling to turn a profit with reduced commercial quotas.
    - Spread observers across the fleet instead of the same boats.
    - Less female observers. Some fishermen's wives are not fans of it.
    - Decks are dangerous.

Recreational Regulations

- Close Naselle River until Oct. 1st above Hwy 4 Bridge to reduce Chinook impacts (1)
- Reduce natural coho bag limit in Marine Area 2.1 to 1-wild (1)
- Shorten season in Marine Area 2.1 and freshwater with an annual season limit (1)
- Close the newly opened sections due to the policy to end the snagging
- If you keep these newly opened sections, make them bobber fisheries
- No retention of natural-origin Chinook in November
- Marine Area recreational season follows Ocean Rules through Labor Day
- Save impacts for our coho; 2 rod endorsement and 4 fish bag
- Put observers on recreational boats and revival boxes

Policy

- Clarify commercial sector did not help create this policy or agree with this policy (1)
- Not fair commercial representation in policy creation process
- Ditch the policy and start fresh (4)
- With the new information we now have that we didn't have prior to the policy, start with a new analysis and policy (1)
- Scrap it all and start over
- Clarify the conservation goal
- Are Columbia River tules going to be a factor affecting this policy?
- Is the 3 million chinook for orcas going to affect how this policy is implemented?
- Achieve 20% goal
- Pay back overage
- If the policy was change by legislative action, why can't other aspects of the policy be changed?
- Change Naselle River to a stabilizing system (2)
- No primary in Willapa Bay. Put the primary in Chehalis with spring Chinook stock (natural)
- No natural origin goals
- Make it a terminal area
- Severe economic impacts to Pacific County economy. Commercial fisheries keep money local
- Manage to hatchery broodstock for all species
- Implement in-season management on the commercial side
- Common sense in-season management
    - Bag limit adjustments
    - Commercial opportunity adjustments
    - Until NOS escapement goals are met, close all terminal commercial fisheries until 9/15
    - Adhering to policy harvest rates creating a buffer for impacts
    - Enforcing commercial payback for over harvest
- Wild WA stocks in Willapa Bay needs to end. End the genetic debate. Refer to UW research.
- Split surplus harvest of hatchery chum between WDFW and commercial fleet
- Stop raising Chinook if the commercial fleet has no season. Save Chinook impacts for the coho season
- Policy designed around nominal ocean conditions. Those are not nominal and change every year.
- Process for change? Phase 1 – then what?
- Front end loading of harvest creates overfishing and overlapping of issues leading to total in-season management of our stocks starting with Chinook.
- In-season management – if recreational fleet fishes, commercial fleet fishes.
- Low returns mean reduced opportunity for everyone.
- Willapa River cannot be a primary designation
- Have Commission change HSRG from wild to hatchery
- Use consistent term and definition ie. wild vs natural-origin

- Premise – WB Chinook DNA is 99.9% hatchery vs wild stock (natural spawners). NOF Chinook and coho returns to WB need to be adjusted upwards because of Canada and Alaska (WA outside ocean fisheries).
- Questionable difference between wild and hatchery fish - DNA
- Not meeting natural spawners – Chinook spawner goals
- Throw out the policy – anti-commercial, anti-gillnet (1984-89 WB hatchery releases)
- All commissioners and Director should all come here for a meeting to hear us with WB
- Who puts more money into the economy? Recreational or commercial?
- Scrap wild salmon policy for WB
- Scrap HSRG recommendations

Hatchery Production
- Make it clear to the public the percent to which salmon are clipped in Willapa Bay
- Change timing of hatchery coho to match commercial priority (move late timed coho)
- Change timing of hatchery chinook to a later run timing
- No backfilling between the hatcheries
- Raise more fish (5)
- Hatchery production needs to be ramped up, particularly chum stocks
- Need more fish to keep burrowing shrimp population in check
- Investigate the idea of producing sturgeon in hatcheries
- NOS is no different than two generations of HOS. Maximize chum production in Willapa Bay.
- Maximize hatchery production at all three hatcheries in WB (12 mi each= 36 mi total)
- Produce more fish to share between all sectors
- Load up the hatcheries. No more native stocks (NOS).
- Operate to hatchery broodstock goals only.

Habitat
- More connection between habitat and the river (ecological system function)
- Include DNR in the meetings due to habitat issues and to explain logging above spawning areas

Marine Mammals
- Predation control of marine mammals (1)
- Eat sea lions
- Seal mortality – population has exploded since 1975. No leadership from our politicians on this issue. Something needs to be done.

Miscellaneous
- Provide communications at the Tokeland and South Bend boat launches
- WDFW do not listen and continually change their minds, not for the betterment of Willapa Bay
- Regional upper management is often temporary. Policy implementation lacks continuity due to personnel changes. Better continuity of policy intent needed.

Willapa Bay Advisor Comments Provided for WB Policy Review

- First and foremost, full implementation of the policy will require the prioritization of the primary conservation objective outlined in the policy, reaffirmed in WBGA v. WDFW, and in the agency's founding legislation in all policy related efforts. Throughout the history of the policy, the secondary objective (to "maintain or enhance the economic well-being and stability of the commercial and recreational fishing industry in the state, provide the public with outdoor recreational experiences, and an appropriate distribution of fishing opportunities throughout the Willapa Bay Basin" has driven the process. The historic allowance of the over harvesting of resources and the mass production of hatchery fish without concern for impacts on natural-origin spawners has perpetuated the decline of the Willapa Bay fishery. Operation under this extraction based mindset is not sustainable. Emphasis on the conservation priority will recalibrate resource extraction to a more sustainable long term equilibrium. Implementation of efforts to achieve the policy's second objective should only occur when they are furthering and not limiting the first objective.

- Despite a history of inadequate implementation, the first objective of the policy to "maintain and rebuild the health of salmon and steelhead populations in the Willapa Bay" is making progress. Although impact rates on wild chinook have largely continued to exceed the conservation limits outlined in the policy, the impact rates are significantly decreased from historic averages that exceeded impact rates of 40%.

- Full implementation of the policy has never been properly funded. Until recently, a lack of in season monitoring to model all exploitation impacts has been lacking, making effective adaptive in season management actions impossible. In-season monitoring must be fully funded. If fisheries participants are unwilling to participate in in-season monitoring efforts, the fishery should be halted or responsible parties prosecuted to the fullest extent of the law. Funding is also required to ensure that all hatchery practices and infrastructure are following the recommendations of the HSRG.

- Fisheries, when implemented, should limit impacts to the fullest extent possible. An unwillingness to explore selective gears that can reduce impact rates should result in a reduced fishery. Adaptation and evolution is a requirement of every industry, and as such, a plan to taper down and then eliminate non-selective gears with high impact rates from the fishery should be developed and implemented.

- A long term self sustaining fishery is only feasible if prioritization of the conservation objective occurs.

- One general comment I'd share is how harvest desires consistently over ride conservation while the policy reads to the opposite.

- The management plan has done exactly what it was intended to do. It was adopted to keep the commercial fleet off the chinook run. Historically about 70% of our chinook harvest was prior to the opening dates for coho management.
  Unless the plan is modified the commercial fleet will not be viable. Depending upon coho harvest will not insure the commercial fleet's economic future.

- Once again, for those that are new, the current policy has yet to allow for a viable commercial fishery since it has started. It has prioritized the Chinook allocation to the recreational fishermen, it has left us short on time to harvest Coho and we no longer fish Chum, even when the runs are healthy. In short without changes to the policy, the state is not providing a viable commercial fishery.

- WDFW in general, and the Fish Department (FD) in particular, should have good policies, ensure they are followed, and update them with the same or greater public involvement originally achieved, as appropriate. They should comply with state and federal statutes such as the Shoreline Management Act and Threatened and Endangered Species act. Examples would be the Willapa Salmon Management Policy, which is mostly adequate and had massive public involvement, the Shoreline Management Act, which prescribes No Net Loss of Ecological Function, and the Forage Fish Policy, which is not being carried out in any meaningful way in Willapa Bay. In the latter case to my knowledge annual surveys and reports are not being written and herring spawning mass has fallen to essentially zero as far as cursory looks can determine. This summary includes specific examples of actions which need be taken by WDFW to achieve the intent of applicable policies and gain public confidence in their implementation.
  1. Forage fish spawning beds must monitored, annual reports written, and restored as necessary to base levels of spawning mass.
  2. Eelgrass must be regularly inventoried and maintained at historical productive levels.
  3. The Public through the Advisory Group must have meaningful input into in-season management and other on the spot decisions as the year progresses.
  4. Drift and anti-set net rules must be clarified as they have been for Gray's Harbor, and must be enforced.

5. A Chinook re-building program must be implemented in-process, before escapement and mortality goals are annually missed each year. Again, timely public/Advisory involvement should not be optional.
6. The Two-Phase Chinook re-building program includes some teeth about payback for overharvest events. With essential provisions such as This, biology, and conservation must take precedence over word-engineering experienced to date. After four years no rebuilding has taken place.
7. Adaptive management must work in both directions, not just for rare better runs to prevent exceeding forecast harvest.
8. Pubic confidence is very low. It can be restored by having not only public input in policy, but by avoiding the treks to the Commission for permission to deviate without equivalent public input when FD wants to deviate.
9. It must be more clear that the policy is designed to protect the resource during down cycles, not just in better times.
10. HSRG has been our guidepost, yet once again FD has stepped back from something, it is supposed to be being studied, as far as my contacts know, without public input. This is a confidence killer for the public that still is involved.
11. Economic Impact of recommendations is required by policy for both commercial and recreational. FD must stop producing such analysis on commercial only. Eliminate the double standard, this is a public confidence killer.
12. We are starting to show that that enhanced Chinook production can be achieved sometimes inexpensively if the Hatchery Dept is so motivated. Do more of this. But for the three year failure of the Nemah hatchery weir, we could be achieving pHOS in two of our three hatchery streams this year. With massive volunteer help, it may still be achievable. Presumably this may be achieved at Forks Creek also, the " old fashioned" way, by just stopping hatchery production. Stopping production is not the public support builder we need.
13. Coho management needs a makeover. A commercial priority must not mean no holds barred procedures. Netting miles of inside narrow river channel will never be compatible with a Willapa River Primary designation for both Chinook and Coho. Stop handing out hatchery coho eggs like candy for nest boxes that simulate NOR returns when they are not. The lack of HOR resiliency that science has shown us is back to bite us now.
14. Fix the wrong-headed, out of date Chum run reconstruction index system. Million dollar "conservation" projects cannot be made useful with no data. I am fan of the PDCA, or Plan Do Check and Adjust role of management. Chum have no check and adjust, and while they flourish elsewhere, they are

permanently down the tubes in Willapa Basin. See Background section for a rehash of what I have been warning about for years. Uncounted streams are stripped of spawners to feed hatchery production and streams where fish ARE counted. This is just fish laundering!

15. Change the policy so that if and when it allows Chum impacts, they are not laid predominately on hens in November.
16. If hatcheries are to produce numbers of chum, design them to allow HOR chum to enter! Do not snag wild chum spawners to feed hatcheries.
17. Keep a weather eye on estuarine habitat. Even hatchery fish must spend weeks with food and cover in our estuary before ocean conversion. This is not being watched now.
18. Institute management goals for estuarine habitat improvement. Require annual inventory of eelgrass, chum recruitment, and waterfowl use days. These are nature's leading indicators of the Willapa Bay food pyramid base. Millions are spent for this in Puget Sound, zero here, except for misleading chum counting.
19. This policy is supposed to apply to steelhead and sturgeon. Management performance measures and public discussion must start reflecting it.
20. If Region Six FD staff cannot support these recommendations, get help from wildlife and habitat folks by bringing them in to meetings and process. If still not enough, explain it, earmark it, budget for it, show willingness to implement policy, and many of your advisors and public will publicly support it.

Background

The policy purpose to achieve or progress with conservation and restoration of our salmon, steelhead, and sturgeon in first four years has not been achieved. The Willapa Basin includes bay habitat and WDFW has turned a blind eye to the latter. Forage fish spawning mass has settled at approximately zero and we can find no plans to change it. Structure for spawning in these beds is eelgrass and every permit request to spray there is approved. No forage fish, no Chinook, no Orcas. Simple equation.

The Policy is supposed to address All Four H's but at least in the public input role it has been one H and had no success at that one (Harvest). If you believe in the need for a balanced Ecology, it is likely not possible to achieve one H by itself. The FD and this advisor group need to address all three, if not four, H's. Turns out we have dams with fish ladders!

A purpose of the policy is to improve public communications, information sharing, and transparency. Great strides have been made in the up front process here, but when the FD institutes things like the chum chuck as an emergency rule, or goes to the Commission asking for major policy deviations without public input, the benefits of all this public interface go down the drain. Recent management changes are a hopeful factor here. " Shall" promote public support cannot be achieved with any continuation of last year's public bypass.

Personal observation by the author and others he talks to have verified an immediate increase in unclipped Chinook at Naselle and Nemah below hatcheries following delays in dip in netting and institution of tangle nets. % in Nemah through experience and informal surveys have verified close to 25% unclipped Chinook when previously I caught none for years. At Naselle hatchery, a proviso by the legislature in budget for increased production, requiring HSRG be followed as a condition, seems to have motivated an innovative staff to produce a fish separating weir as recommended by the author. It works and prevents accumulation of mixed stock below the weir, while allowing transport of NORs upstream to cooler waters. How can FD get money to increase production based on HSRG compliance, then drop HSRG? An attempt is now being made for a similar trap below the Nemah hatchery, and fish are starting to enter it. The ongoing weir failures and slipshod repairs above it, with silting in of the previous holding area, threaten the success here. HORs are being released into skinny waters above the trap and have no weir to accumulate them for later entrance into the hatchery when and if its other duties are finished. They can go up as far as the blocked fish ladder where there is very little water. Four legged predators are already replacing the Senior Citizens who have been sent downstream. They are running down Chinook and wild cutthroat trout which are blocked by the fish ladder and dam as we speak. More permanent weir repair has apparently been delayed until well after the main run arrives in a few weeks. Is this a result of dropping HSRG without public discussion? Volunteers may be able to salvage some of this mess until then if the predators do not beat us to it. The Nemah now has produced over 70% of Chinook returning to Willapa Basin last year and this, and going forward will produce over half. It should have received more priority and again budgets would have had more support if folks could see such things coming.

A citizen has researched enforcement actions over the past several years and found that nine citations were issued for set netting in Willapa. Of these nine, one conviction was the result. Of these nine boardings, five boats had retained wild Chinook on board. We believe new wording like Grays Harbor would provide clarity needed to remedy this unruly situation.

The two phase Chinook recovery program specified in the policy has not, and will not, see any recovery by the end of year four, this year. The author has shown graphs of Chum, Chinook, and Waterfowl Numbers to staff and commission that show negative trends, as well as graphs for herring spawning mass going to zero. All are alarming and none have been refuted to my knowledge.

In an improving organization these would be fuel for management goals and performance ratings. 2017 was a bust for salmon in that now even HOR egg take was missed but for transferring eggs between watersheds. Experience has shown the return rate drops the farther eggs are transferred between rivers. WDFW has backed off HSRG while studying it. We have no knowledge or input into these studies, but we do see evidence of hundreds of qualified scientists disagreeing with it. Our Willapa regimen under HSRG non-compliance has not produced one more fish for people or ORCAs and we are interested to see how more non compliance under a new policy could change this trend. A historical graph shown by staff to the Commission last year showed that even when no Chinook in our basin were clipped, thus every fish on the gravel counted as a NOR, escapement was seldom achieved. The decision to stay away from HSRG, or stay with it, should have had the same public input as the current policy has. Otherwise the FD will be on its own with remaining public support hard to find going forward.

In season management of runs is needed whether short or long. The Columbia would be nowhere without this approach. The annual wishful thinking that " the run is just late" dog won't hunt any more. Region FD will need to get in its sport car and make tight turns and quick starts and stops. I believe the talent now exists in both the Advisor Group and Management to do just that. We now have several lifetimes of experience on this new advisor group, residing in conservation minded people, and a capable Region Manager for Willapa and Grays Harbor.

The calculations for phase one and two of Chinook recovery were supposedly based on nominal ocean conditions. These we do not have. The Pacific Decadal Oscillation got its name for typically lasting for a decade. The FD cannot wait this one out, but must manage what it gets, and avoid double standards between commercial, recreational, and conservation. When will this start?

The Orca situation adds to the urgency of matters. All our experience tells us we do not have a very resilient population of salmon after years of unsigned, then signed, but not followed policies. The current one has been through a lot of scrutiny and it remains to be seen what on earth can do better, other than following this one in a spirit of change. It is my understanding that the current policy was created as an outfall of a lawsuit where the settlement called for the policy to be revisited, the last one never having been approved. Revisiting it, signing it, then dumping it without following it would be a confidence killer of what little is left.

Coho are currently managed as one stock, one run. Everybody I know realizes there are two distinct runs in Willapa Basin, an early and a late one. They would be more appropriately managed as such. Further, the hatcheries now sometimes provide way more HOR eggs for placing in nest boxes, to RFEG, than they actually hatch themselves. These go places where they may overwhelm natural stock, and those that return simulate wild fish when they are not. The Hatchery program thus simulates wild fish and justifies massive commercial retention of NORs where not backed by science. A commercial priority must not justify bypassing conservation standards.

Chum were the main fish in our bay historically. They along with eelgrass and waterfowl were the leading indicators of our system health, and it teemed with all three. Chum are now are counted through a decades old, never updated index stream system where major million dollar habitat restoration programs take place, on the Bear River for example, with no baseline or post mortem run reconstruction, in a river that is called Primary and never counted. Fresh water habitat for tens of thousands of Pintail and thousands of teal was removed for this. Immediately the refuge which historically held 47% of the waterfowl in Willapa dropped to 27% after these dikes were removed. The Chum have not bounced back in total since then and are never counted there. Waterfowl are no longer counted either, after documenting declines associated with the dike busting, followed by eelgrass spraying. Chum early juvenile life is 99% in the bay, nearer shore than Chinook, and they have little cover or food without eelgrass of either species. A Wild Fish Conservancy study documented their preferred habitat in Grays Harbor and eelgrass was number one. Wild Chum are now snagged by the FD out of streams where spawners are not counted and placed into index streams where they are. This is little different from money laundering, just with fish. What we do know is even where they are counted they are not recovering. Again HSRG has the explanation re un- naturalized fish. More naturals are snagged to feed a hatchery program, where hatcheries are designed so they exclude chum from returning on their own. FD should either modify hatcheries to receive chum HORs or get out of the business of degrading natural runs to artificially place them there. A recent modification to the Nemah entrance may have some promise in that. It surely should allow Chinook ingress much improved over the past.

Chum and eelgrass are the historical base of our food pyramid, along with the masses of invertebrates eelgrass harbors. The waterfowl are the visible leading indicator above the surface that tell us how the grass and invertebrates they eat are doing. Forage use days are the bottom line on this one and have looked bad as long as eelgrass has been chemically removed. The current policy has a chum window with no netting unless certain progress is made. This window ends October 30, right when chum hens arrive en masse. If certain criteria are met, 10% mortality can be allowed. This could be put on mostly hens. As constituted the chum policy and management practices are unlikely to succeed and have not to date. Change needed here. Appropriate goals for baseline indicators are again, essential for a learning, improving organization. You cannot achieve that which you do not measure, in a system you actively manage. Time to Check and Adjust, not throw the baby out with the bathwater.

Goals;

1. The Willapa Basin will be doing its part to avoid ESA for all three salmon species. Escapement goals to the gravel are the standard here. Along these lines we hear thoughts from some that if you silt in a river and lose spawning ground, you can lower escapement goals. We think not. Why would we be spending millions for restoration if no need to?
2. Achieve and Maintain a viable, reliable recreational Bay and Fresh water salmon fishery. Our highest historical actuals for Chinook are North Bay for small boats and Nemah for freshwater, year after year. Now in jeopardy in North for the obvious reason; truncated Forks Creek Chinook production. May be in jeopardy in Nemah for failure to make allowances for egg take.
3. Inventory bay and stream habitat carrying capacity. Where is silting a problem, if so? If restoration has worked, is it accounted for in goals? How are estuarine habitat including eelgrass and herring spawning beds/mass faring? Neither done in over ten years. There is an unquantified limit on carrying capacity for both NOR and HOR smolts. This needs to be quantified as and if production in hatcheries is increased.
4. Achieve and Sustain good level of public satisfaction with Fish Department salmon management in the Willapa Basin. The first three goals would help in this regard.
5. An immediate goal will be to incorporate scientific standards in our policy. With the hiatus around HSRG standards, we now need these spelled out. Management told us at last meeting that scientific standards will be used. These need to be called out in a policy designed to support goals above.

<u>Commercial Specific Comments:</u>

- What is the definition of a successful commercial fishery?
  - What does the policy say?
  - What needs to change in the policy?
- Alternative gear is problematic.
  - Only tool is the use of tangle nets, due to the area of Willapa Bay.
  - Tangle nets are limited in where and when they can be effective. Also, the efficiency of the tangle net is less than that of conventional gear, so more

time on the water will be needed to harvest the ramped up hatchery Chinook production in the South Bay. This would mean time in August.
  - During Coho and Chum management, traditional gear will be used as the tangle nets do not work for these fish.
- 50 days of fishing opportunity does not mean anything if there are not any fish available to harvest and the days do not occur when the fish are present.
- 14% harvest rate in 2019 will further reduce commercial and recreational fishing opportunity and make the fishery not economically viable. Also, this will leave thousands of hatchery Chinook unharvested, which is not current with HSRG. They are raised to be harvested not surplused or removed with the weir.
- There are objectives identified in the policy i.e. spawning escapement reviews that have not been accomplished while other objectives put in place right away. Why the discrepancy?
  - Chum escapement methodology is faulty and does not reflect total basin escapement. We have been given a priority on a fish that we are unable to target.
  - Over seeding the spawning grounds, produces reduced natural productivity.
- Fisheries prosecuted on spawning grounds just to meet policy objectives for recreational priority seem contrary to conservation objectives.
- Need additional Chinook impacts to access Coho
- The use of the term "priority" in the policy needs to be stricken or redefined.
  - Time and space
- Segregate the bay.
  - Recreational opportunity in the North end, commercial in the South during the summer months
  - Only until Coho management period.

Willapa Bay Origin PreSeason Recreational Data

		Willapa Bay Natural Origin Fall Chinook					Willapa Bay Hatchery Origin Fall Chinook				
Stat Wk	Date	Harvest Rate Proportions	Preseason Prediction		In-season Estimate		Harvest Rate Proportions	Preseason Prediction		In-season Estimate	
			NOR	Cumulative Total	WB Origin	Cumulative Total		HOR	Cumulative Total	WB Origin	Cumulative Total
27	7/1 - 7/8	0.0044	1	1	0	0	0.0024	10	10	8	8
28	7/9 - 7/15	0.0013	0	2	1	1	0.0034	13	23	5	13
29	7/16 - 7/22	0.0044	1	3	1	2	0.0106	42	65	3	16
30	7/23 - 7/29	0.0014	0	3	2	5	0.0178	70	135	7	23
31	7/29 - 8/5	0.0100	3	6	2	6	0.0269	106	241	15	38
32	8/6 -8/12	0.0896	26	32	2	9	0.0805	317	558	77	114
33	8/13 - 8/19	0.1528	44	75	6	14	0.1478	583	1,141	185	299
34	8/20 - 8/26	0.2354	67	142	6	20	0.2238	882	2,023	204	503
35	8/27 - 9/2	0.2892	82	225	9	29	0.2834	1,117	3,140	165	668
36	9/3 - 9/9	0.1016	29	254	5	34	0.1013	399	3,540	71	740
37	9/10 - 9/16	0.0806	23	277	0	34	0.0792	312	3,852	3	743
38	9/17 - 9/23	0.0196	6	282			0.0186	73	3,925		
39	9/24 - 9/30	0.0064	2	284			0.0021	8	3,934		
40	10/1 - 10/7	0.0030	1	285			0.0012	5	3,939		
41	10/8 - 10/14	0.0000	0	285			0.0000	0	3,939		
42	10/15 - 10/21	0.0004	0	285			0.0009	3	3,942		
43	10/22 - 10/28	0.0000	0	285			0.0000	0	3,942		
44	10/29 - 11/4	0.0000	0	285			0.0000	0	3,942		
			285					3,942			

2018 Willapa Bay Chinook Landed Catch MSF Preliminary

Stat Week	Dates	Catch Areas																				Basin Total Landed	Basin Willapa Origin NOR Landed	Basin Willapa Origin HOR Landed
		2T				2U				2N				2R				2M						
		Total Landed	UM %	Landed NOR	Landed HOR	Total Landed	UM %	Landed NOR	Landed HOR	Total Landed	UM %	Landed NOR	Landed HOR	Total Landed	UM %	Landed NOR	Landed HOR	Total Landed	UM %	Landed NOR	Landed HOR			
36	Sept. 2 - 8	Closed				Closed				293		N/A	293	Closed				285		N/A	285	578	0	578
37	Sept. 9 - 15	Closed				Closed				274		N/A	274	Closed				240		N/A	240	514	0	514
38	Sept. 16 - 22			N/A	0			N/A	0			N/A	0	Closed						N/A	0	0	0	0
39	Sept. 23 - 29			N/A	0			N/A	0			N/A	0	Closed						N/A	0	0	0	0
40	Sept. 30 - Oct. 6			N/A	0			N/A	0			N/A	0	Closed						N/A	0	0	0	0
41	Oct. 7 - 13			N/A	0			N/A	0	Closed				Closed				Closed				0	0	0
42	Oct. 14 - 20	Closed				Closed				Closed				Closed				Closed				0	0	0
43	Oct. 21 - 27	Closed				Closed				Closed				Closed				Closed				0	0	0
44	Oct 28. - Nov. 3			0	0			0	0			0	0	Closed						0	0	0	0	0
45	Nov. 4 - 10			0	0			0	0			0	0	Closed						0	0	0	0	0
46	Nov. 11 - 17			0	0			0	0			0	0			0	0			0	0	0	0	0
47	Nov. 18 - 24			0	0			0	0			0	0			0	0			0	0	0	0	0
48	Nov. 25 - Dec. 1				0				0				0				0				0	0	0	0
Total Landed		0		0	0	0		0	0	567		0	567	0		0	0	525		0	525	1,092	0	1,092

2018 WB Total Chinook Fishery Impacts Actual Catch + impacts **MSF** ***Preliminary***

Stat Weeks	2T		2U		2N		2R		2M		Basin NOR Impacts	Basin HOR Impacts	Predicted Basin NOR Impacts	Predicted Basin HOR Impacts
	NOR Impacts	HOR Impacts	NOR Impacts	HOR Impacts	NOR Impacts	HOR Impacts	NOR Impacts	HOR Impacts	NOR Impacts	HOR Impacts				
36	0	0	0	0	18	294	0	0	9	288	27	582	80	1,603
37	0	0	0	0	17	279	0	0	18	252	36	530	99	2,026
38	0	0	0	0	0	0	0	0	0	0	0	0	126	1,800
39	0	0	0	0	0	0	0	0	0	0	0	0	64	457
40	0	0	0	0	0	0	0	0	0	0	0	0	39	305
41	0	0	0	0	0	0	0	0	0	0	0	0	10	70
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	1	9
45	0	0	0	0	0	0	0	0	0	0	0	0	4	24
46	0	0	0	0	0	0	0	0	0	0	0	0	0	1
47	0	0	0	0	0	0	0	0	0	0	0	0	0	4
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals	**0**	**0**	**0**	**0**	**36**	**572**	**0**	**0**	**27**	**540**	**63**	**1,112**	**423**	**6,299**

2018 WB Total Chinook NOR Fishery Impacts Summary - Willapa Origin

MSF — Actual Catch + Impacts — *Preliminary*

Stat Weeks	2T			2U			2N			2R			2M			Stat Weeks	Inseason Estimated Natural-Origin Impacts		Preseason Predicted Natural-Origin Impacts	
	Total NOR Impacts	Local NOR Impacts	Predicted NOR Impacts	Total NOR Impacts	Local NOR Impacts	Predicted NOR Impacts	Total NOR Impacts	Local NOR Impacts	Predicted NOR Impacts	Total NOR Impacts	Local NOR Impacts	Predicted NOR Impacts	Total NOR Impacts	Local NOR Impacts	Predicted NOR Impacts		Weekly	Cumulative	Weekly	Cumulative
36	0	0	0	0	0	0	18	13	26	0	0	0	9	8	39	36	20	20	65	65
37	0	0	0	0	0	0	17	12	39	0	0	0	18	17	39	37	29	49	78	143
38	0	0	15	0	0	39	0	0	18	0	0	0	0	0	34	38	0	49	106	249
39	0	0	19	0	0	5	0	0	5	0	0	0	0	0	23	39	0	49	52	301
40	0	0	11	0	0	13	0	0	1	0	0	0	0	0	8	40	0	49	32	333
41	0	0	4	0	0	3	0	0	0	0	0	0	0	0	0	41	0	49	8	341
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	42	0	49	0	341
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	0	49	0	341
44	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	44	0	49	1	342
45	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	45	0	49	3	345
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	49	0	345
47	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	47	0	49	0	345
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	48	0	49	0	345
Totals	**0**	**0**	**50**	**0**	**0**	**63**	**36**	**25**	**89**	**0**	**0**	**0**	**27**	**25**	**143**	**Totals**	**49**	**49**	**345**	**345**

	2T	2U	2N	2R	2M
Tangle Net		0	25	0	25

2018 Willapa Bay Coho Commercial Accounting

Preliminary

Stat Week	2T				2U				2N				2R				2M				WB Actual			WB Predicted		
	Total Landed	UnMarked %	Estimated NOR	Estimated HOR	Total Landed	UnMarked %	Estimated NOR	Estimated HOR	Total Landed	UnMarked %	Estimated NOR	Estimated HOR	Total Landed	UnMarked %	Estimated NOR	Estimated HOR	Total Landed	UnMarked %	Estimated NOR	Estimated HOR	NOR	HOR	Total	NOR	HOR	Total
36	Closed				Closed				83	0.060	5	78	Closed				32	0.083	3	29	8	107	115	25	41	66
37	Closed				Closed				351	0.253	89	262	Closed				117	0.167	20	98	108	360	468	37	234	271
38			0	0			0	0			0	0	Closed						0	0	0	0	0	198	1,114	1,312
39			0	0			0	0			0	0	Closed						0	0	0	0	0	146	783	929
40			0	0			0	0			0	0	Closed						0	0	0	0	0	484	1,588	2,072
41			0	0			0	0	Closed				Closed				Closed				0	0	0	187	131	318
42	Closed																				0	0	0	0	0	0
43	Closed																				0	0	0	0	0	0
44			0	0			0	0			0	0			0	0			0	0	0	0	0	287	79	366
45			0	0			0	0			0	0			0	0			0	0	0	0	0	805	350	1,155
46			0	0			0	0			0	0			0	0			0	0	0	0	0	53	30	83
47			0	0			0	0			0	0			0	0			0	0	0	0	0	220	120	340
48																					0	0	0	27	12	39
Total	**0**		**0**	**0**	**0**		**0**	**0**	**434**		**94**	**340**	**0**		**0**	**0**	**149**		**22**	**127**	**116**	**467**	**583**	**2,469**	**4,482**	**6,951**

Naselle Hatchery Chinook Rack Returns

PRELIMINARY / DRAFT

Year	2015						2016						2017						2018					
Origin	Hatchery			Natural			Hatchery			Natural			Hatchery			Natural			Hatchery			Natural		
Stat Week	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing	Daily Total	Cumulative	% Run Timing
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1		-	-	-
32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	6		-	-	-
33	-	-	-	-	-	-	-	-	-	-	-	-	13	13	0.4%	2	2	0.3%	11	17		2	2	
34	-	-	-	-	-	-	-	-	-	-	-	-	23	36	1.1%	5	7	0.9%	12	29		3	5	
35	-	-	-	-	-	-	-	-	-	-	-	-	26	62	1.9%	6	13	1.6%	44	73		7	12	
36	205	205	4.2%	24	24	2.7%	0	0	0.0%	1	1	0.2%	63	125	3.8%	11	24	3.0%	16	89		5	17	
37	30	235	4.9%	0	24	2.7%	199	199	9.9%	32	33	6.6%	133	258	7.9%	33	57	7.1%	751	840		78	95	
38	2,016	2,251	46.5%	155	179	20.4%	25	224	11.1%	9	42	8.4%	1,179	1,437	43.8%	148	205	25.7%						
39	1,449	3,700	76.4%	134	313	35.7%	801	1,025	50.8%	143	185	36.9%	128	1,565	47.7%	17	222	27.8%						
40	481	4,181	86.3%	269	582	66.4%	229	1,254	62.1%	68	253	50.5%	304	1,869	57.0%	117	339	42.4%						
41	281	4,462	92.1%	217	799	91.2%	665	1,919	95.1%	54	307	61.3%	1,103	2,972	90.6%	321	660	82.6%						
42	278	4,740	97.9%	67	866	98.9%	86	2,005	99.4%	182	489	97.6%	184	3,156	96.2%	113	773	96.7%						
43	25	4,765	98.4%	1	867	99.0%	0	2,005	99.4%	9	498	99.4%	88	3,244	98.9%	21	794	99.4%						
44	37	4,802	99.1%	6	873	99.7%	0	2,005	99.4%	3	501	100.0%	16	3,260	99.4%	2	796	99.6%						
45	20	4,822	99.5%	3	876	100.0%	2	2,007	99.5%	0	501	100.0%	6	3,266	99.5%	0	796	99.6%						
46	11	4,833	99.8%	0	876	100.0%	6	2,013	99.8%	0	501	100.0%	14	3,280	100.0%	2	798	99.9%						
47	8	4,841	99.9%	0	876	100.0%	4	2,017	100.0%	0	501	100.0%	0	3,280	100.0%	1	799	100.0%						
48	-	4,841	99.9%	-	876	100.0%	1	2,018	100.0%	0	501	100.0%	0	3,280	100.0%	0	799	100.0%						
49	-	4,841	99.9%	-	876	100.0%	-	-	-	-			0	3,280	100.0%	0	799	100.0%						
50	3	4,844	100.0%	0	876	100.0%	-	-	-	-			0	3,280	100.0%	0	799	100.0%						
51													1	3,281	100.0%	0	799	100.0%						
Total	**4,844**			**876**			**2,018**			**501**			**3,281**			**799**			**840**			**95**		

SOUTHERN RESIDENT KILLER WHALE PRIORITY CHINOOK STOCKS REPORT

NOAA Fisheries West Coast Region

and

Washington Department of Fish and Wildlife

June 22, 2018

SOUTHERN RESIDENT KILLER WHALE PRIORITY CHINOOK STOCKS

Outline of Prey Prioritization Conceptual Model

NOAA Fisheries and Washington Department of Fish and Wildlife (WDFW) have developed a framework to identify Chinook salmon stocks that are important to Southern Resident killer whales (SRKW) to assist in prioritizing actions to increase critical prey for the whales. The framework currently includes three factors that contribute to the identification of priority Chinook salmon populations. Note, here "population" could mean management unit, stock, ESU, run, etc. Each of the three factors has a range of scores which affects its weight. For each Chinook population ranging from Southeastern Alaska to California, a total score is calculated by adding up the three individual factor scores. The Chinook salmon populations with the highest total scores are considered the highest priority to increase abundance to benefit the whales. Several sensitivity analyses provided initial help in understanding how the weighting/scoring affects the priority list. The conceptual model, factors, and scoring were reviewed at a workshop sponsored by the National Fish and Wildlife Foundation and modifications were made to incorporate feedback from participants. The factors, scoring and priority list can be adapted as new scientific information becomes available.

The three evaluation factors include:

FACTOR 1- Observed Part of SRKW Diet

Description and data sources: Prey tissues/scales and fecal samples have been collected from 2004 – present (Hanson et al. 2010, Ford et al. 2016, Hanson et al. in prep). From the prey tissues/scales collected, Genetic Stock Identification (GSI) were run to identify the Chinook stocks in the diet. The majority of samples have been collected in the summer months in inland waters of WA and British Columbia.

Assumption

- Chinook populations that have been observed in the diet will have higher priority than those that have not.

Caveat: There is currently no spatial correction factor for sample collection (stocks originating from near the sample locations are more likely to be collected), no correction factor for abundance (more abundant stocks are more likely to be identified in the diet), and no correction factor for potential whale selectivity (older, larger fish more likely to be recovered in scale samples).

FACTOR 2- Consumed During Reduced Body Condition or Diversified SRKW Diet

Description and data sources: For the second factor, "Consumed During Reduced Body Condition or Diverse Diet", stocks consumed during times of potential reduced body condition and increased diet diversity receive additional weight.

Since 2008, NOAA's SWFSC has used aerial photogrammetry to assess the body condition and health of SRKWs, initially in collaboration with the Center for Whale Research and, more recently, with the Vancouver Aquarium and SR[3]. Photogrammetry data has been collected during seven field efforts in five years, including September 2008, 2013, and 2015, and May and September 2016 and 2017 (Durban et al. 2017; Fearnbach et al. 2018). The proportion of Chinook salmon consumed in whales' diet was estimated by season and region (inland vs coastal waters) using the data from prey tissues/scales and fecal samples (Hanson et al. 2010, Ford et al. 2016, Hanson et al. in prep).

Assumptions

- Reduced body condition and diverse diet occurs from Oct through May.
- Whales switch from preferred prey, Chinook salmon, to other salmonids or prey when Chinook are less available.

FACTOR 3- Degree of Spatial and Temporal Overlap

Description and data sources: Recent prey mapping from Shelton et al. in press (Coded Wire Tag data) was used to assess the overlap in time and space distribution of individual fall Chinook salmon stocks and SRKWs. The distribution/timing of all Chinook salmon stocks across the whales' range from California to Southwest Vancouver Island (and the inland waters of the Salish Sea) was divided into weighted spatial/temporal areas. Currently, Shelton et al. in press includes detailed information on fall runs. Available data for spring Chinook was included, but detailed analyses of data from spring runs are in progress and will be completed in the next two years, incorporating both recoveries in directed Chinook troll fisheries, and Chinook recovered as bycatch in fisheries not targeting Chinook.

For spring run Chinook we relied on reports from the Chinook Technical Committee of the Pacific Salmon Commission (PSC 2018a, 2018b) and published literature (e.g. Satterthwaite et al. 2013, Wahle et al. 1981, Weitkamp 2010) to assign approximate ocean distributions. For stocks with less information, we assumed that the risk to predation was low in seasons and regions that did not correspond to the return timing and origin of each stock (for example, Columbia spring Chinook are assumed to be most available to whales in winter and spring months near the mouth of the Columbia River, but because of their approximate ocean distribution, they are not available in other regions or seasons – particularly mid-summer to fall). Because of limited recoveries, we also assumed that for stocks returning to the Salish Sea (Strait of Georgia, Puget Sound), the distribution was similar in the Salish Sea to Southwest Vancouver Island distributions.

The spatial/temporal Areas currently include: 1) Southwest Vancouver Island (WCVI); 2) Salish Sea; 3) Cape Falcon, Oregon north to British Columbia border; 4) Cape Falcon, OR south to Cape Mendocino (northern California); 5) Cape Mendocino, CA to Point Sur, CA. Seasons are defined as: Spring: April-May; Summer: June-July; Fall: Aug-Oct: Winter: November-March. These areas reflect the division of Chinook run timing (approximately), correspond to periods of coded wire tag recoveries in fisheries, and correspond to predictable patterns of SRKW movement. SRKW distribution data was assessed from multiple sources (e.g. Center for Whale Research, The Whale Museum, NWFSC satellite tagging, NWFSC coastal hydrophones, coastal spring/winter NWFSC cruises, other opportunistic observations).

Assumptions

- Chinook salmon stocks that overlap in space and time are potential prey.
- Chinook salmon stocks that have a higher degree of overlap in space and time have a higher priority than stocks that have a relatively lower degree of overlap.
- Weighted spatial/temporal areas accommodate variation in the distribution of SRKW and Chinook salmon

Caveat- Coded Wire Tag (CWT) model interpolates movement of stocks seasonally to account for gaps in fishing effort. Also, the hatchery releases going into the CWT model are not comprehensive, but rather model the distribution of major stock groupings. Within regions and run type (e.g. fall Puget Sound), the ocean distribution is assumed to be the same for all watersheds. Smaller release groups, such as those from the San Juan Islands (SJUA in RMIS) were not included in Shelton et al. because of the low recovery rates – though the ocean distribution of these fish is assumed to be similar to those populations originating from Puget Sound. In particular, ocean distributions of spring run stocks tend to be less well understood than fall stocks. We use the best information available but acknowledge that advances in estimates of ocean distribution of many stocks will improve with the completion of on-going research over the course of the next 1-3 years.

Weight and Scoring

FACTOR 1

If the Chinook stock was observed >=5% of the whales diet in summer or fall/winter/spring, the stock receives 1 point. If it was not observed in the diet, the stock receives 0 points. This prioritizes stocks observed in the diet compared to those that have not been observed.

FACTOR 2

Current data indicate that both reduced body condition and a diversified diet occur in non-summer months. If a stock is consumed during October through May, it receives 1 point. If it is consumed during June through September, the stock receives 0 points. This prioritizes stocks that are consumed during periods with a higher likelihood of food limitation or stress in the whales' health.

FACTOR 3

For each space/time area described above, if more than 25% of the Chinook stock is distributed in that area, the area receives a sub-score of 2. For areas that contain between 5% and 25% of the Chinook stock, the area receives a sub-score of 1. If an area contains less than 5% of the Chinook stock, it receives a sub-score of 0. The sub-scores for each area are multiplied by an importance weight for each area. The final score for the Chinook stock/population is the sum of the products of the scores and weight for each area normalized such that the highest possible score of a given stock is equal to 3.

Here are the seven space/time combinations included in Factor 3 and their associated weights.

1. WA coast in Winter/Spring; weight = 0.5
2. WA coast in Summer/Fall; weight = 0.5
3. Salish Sea in Winter/Spring; weight = 0.5
4. Salish Sea in Summer/Fall; weight = 0.5
5. OR / N.CA coast in Winter/Spring; weight = 0.25
6. CA coast in Winter/Spring ; weight = 0.25
7. West Coast of Vancouver Island in Winter/Spring; weight = 0.5

The Salish Sea and coastal waters off WA have a 0.5 weight. The areas off British Columbia, OR/North CA and CA have a 0.25 weight. This structure means that the areas of highest SRKW use – the Salish Sea and coastal WA – are treated as twice as important as the other areas.

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Priority Chinook Stocks Using Conceptual Model

ESU / Stock Group	Run Type	Rivers or Stocks in Group	Diet Contribution Score (0,1)	Killer Whale Reduced Body Condition or Diverse Diet Score (0,1)	Spatio-Temporal Overlap Score (0 - 3)	
			Avg. Factor 1 (see note)	Avg. Factor 2 (see note)	Avg. Factor 3	Total Score (sum of factors)
Northern Puget Sound	Fall	Nooksack, Elwha, Dungeness, Skagit, Stillaguamish, Snohomish	1	1	3.00	5.00
Southern Puget Sound	Fall	Nisqually, Puyallup, Green, Duwamish, Deschutes, Hood Canal systems	1	1	3.00	5.00
Lower Columbia	Fall	Fall Tules and Fall Brights (Cowlitz, Kalama, Clackamas, Lewis, others)	1	1	2.63	4.63
Strait of Georgia	Fall	Lower Strait (Cowichan, Nanaimo), Upper Strait (Klinaklini, Wakeman, others), Fraser (Harrison)	1	1	2.63	4.63
Upper Columbia & Snake Fall	Fall	Upriver Brights	1	1	2.25	4.25
Fraser	Spring	Spring 1.3 (upper Pitt, Birkenhead; Mid & Upper Fraser; North and South Thompson) and Spring 1.2 (Lower Thompson, Louis Creek, Bessette Creek)	1	1	2.25	4.25
Lower Columbia	Spring	Lewis, Cowlitz, Kalama, Big White Salmon	1	1	2.25	4.25
Middle Columbia	Fall	Fall Brights	1	1	2.06	4.06
Snake River	Spring-Summer	Snake, Salmon, Clearwater	1	1	1.88	3.88
Northern Puget Sound	Spring	Nooksack, Elwha, Dungeness, Skagit (Stillaguamish, Snohomish)	1	1	1.88	3.88
Washington Coast	Spring	Hoh, Queets, Quillayute, Grays Harbor	1	1	1.69	3.69
Washington Coast	Fall	Hoh, Queets, Quillayute, Grays Harbor	1	1	1.69	3.69
Central Valley	Spring	Sacramento and tributaries	1	1	1.50	3.50
Middle & Upper Columbia Spring	Spring	Columbia, Yakima, Wenatchee, Methow, Okanagan	1	1	1.31	3.31
Middle & Upper Columbia Summers	Summer		1	1	1.31	3.31

Fraser	Summer	Summer 0.3 (South Thompson & lower Fraser; Shuswap, Adams, Little River, S. Thompson mainstem, Maria Slough in Lower Fraser) and Summer 1.3 (Nechako, Chilko, Quesnel; Clearwater River in North Thompson)	1	0	1.88	2.88
Central Valley	Fall and Late Fall	Sacramento, San Joaquin	1	1	0.75	2.75
Klamath River	Fall	Upper Klamath and Trinity	1	1	0.75	2.75
Klamath River	Spring	Upper Klamath and Trinity	1	1	0.75	2.75
Upper Willamette	Spring	Willamette	0	0	2.25	2.25
Southern Puget Sound	Spring	Nisqually, Puyallup, Green, Duwamish, Deschutes, Hood Canal systems	0	0	1.88	1.88
Central Valley	Winter	Sacramento and tributaries	0	0	1.50	1.50
North & Central Oregon Coast	Fall	Northern (Siuslaw, Nehalem, Siletz) and Central (Coos, Elk, Coquille, Umpqua)	0	0	1.41	1.41
West Coast Vancouver Island	Fall	Robsertson Creek, WCVI Wild	1	0	0.38	1.38
Southern Oregon & Northern California Coastal	Fall	Rogue, Chetco, Smith, lower Klamath	0	0	0.75	0.75
Southern Oregon & Northern California Coastal	Spring	Rogue	0	0	0.75	0.75
California Coastal	Fall	Mad, Eel, Russian	0	0	0.75	0.75
California Coastal	Spring	Mad, Eel, Russian	0	0	0.75	0.75
Southeastern Alaska	Spring	Taku, Situk, Chilkat, Chickamin, Unuk, Alsek, Stikine	0	0	0.00	0.00
Northern BC	Spring	Yakoun, Skeena, Nass	0	0	0.00	0.00
Central BC	mostly Summer	Atnarko, Dean River, Rivers Inlet	0	0	0.00	0.00

Note: Factor 1 and 2 are not literal averages. If a major component of the rivers in the ESU / Stock group had 1 then this was scored a 1. If no major component was scored a 1, this was scored a 0

Washington Department of Fish and Wildlife

Decision Support Tool for
Short-term Investments in Chinook Hatchery Production
to Increase Prey for Southern Resident Killer Whales
Draft August 8, 2018

Introduction

The Southern Resident Killer Whale (SRKW) population was listed as an endangered species under the Endangered Species Act (ESA) in 2005 and abundance is now at the lowest level in three decades. Reasons for the decline include legacy effects from the capture of whales for the aquarium trade in the 1960s and 1970s, pollution and contaminants, disturbance from vessels and sound, and prey availability (68 FR 31980; NMFS 2008). Lacy et al. (2017) suggested that a 15% - 30% increase (relative to 1979-2008) in the abundance of Chinook salmon, a preferred prey item, would be needed in conjunction with other actions to achieve the population growth rate associated with delisting.

A Southern Resident Killer Whale Task Force has been established in Washington State to "identify, prioritize, and support the implementation of a longer term action plan needed for the recovery of Southern Residents and necessary to secure a healthy and sustained population for the future." The Task Force is developing and evaluating a broad range of options, including the protection and restoration of habitat, improving the survival rates of juvenile Chinook salmon migrating downstream in the Columbia River, reducing pinniped predation on juvenile Chinook salmon in Puget Sound, and reducing the number of Chinook salmon that are caught in fisheries.

The Task Force is also considering increased hatchery production as an option to increase the number of Chinook salmon available as prey for SRKW. Where existing hatchery capacity exists to increase production, this option is appealing in that it may increase the abundance of Chinook salmon relatively quickly (within 3-5 years). However, poorly chosen or implemented increases in hatchery programs could increase risks to naturally-produced Chinook salmon, some of which are also listed under the federal ESA.

The importance of integrating SRKW and salmon recovery efforts has been recognized by the Washington State Legislature. The 2019 supplemental budget passed by the legislature directed the Washington Department of Fish and Wildlife (WDFW) to increase hatchery releases in 2019 and to work with the governor, federal partners, the hatchery scientific review group, and other interested parties to develop by December 31, 2018 a biennial hatchery production plan that will:

a. identify, within hatchery standards and endangered species act constraints, hatchery programs and specific facilities to contribute to the dietary needs of the orca whales;
b. consider prey species preferences and migratory patterns of orca whales; and
c. include adaptive management provisions to ensure the conservation and enhancement of wild stocks.

A third forum where increases in Chinook hatchery production are under consideration is associated with the U.S.-Canada negotiations to update the Pacific Salmon Treaty (PST). The updated Chinook chapter is expected to include measures that will reduce fishery exploitation rates on Chinook salmon. Within the U.S. section, discussions are occurring regarding additional measures, such as an increase in hatchery production, which may further reduce risks to SRKW.

Providing a consistent evaluation framework may help promote the development of an integrated and complementary package of increases in hatchery production. Building on previous decision support tools, WDFW developed a SRKW-Chinook assessment procedure (SCAP) to systematically assess the benefits and risks of options to increase the hatchery production of Chinook salmon. While the analysis focuses on facilities where capacity currently exist to increase hatchery production, the decision support tool may also be helpful in identifying locations where investments in new infrastructure would be warranted. This draft paper describes the decision support tool and provides preliminary results for some analyses. Complete analyses will be provided in the final document.

Increasing the number of juvenile Chinook salmon released is not the only hatchery action that could increase prey for SRKW. Other hatchery actions that may be beneficial include increasing the production of other species, selective breeding to increase the size of adult Chinook salmon, and a broadening of release timing to reduce inter-annual variation in survival rates. Although these actions may have merit, they are beyond the scope of this document.

SRKW-Chinook Assessment Procedure

The Task Force was established with the recognition that the future health of SRKW and Chinook salmon are intertwined, and that swift near-term actions and effective long-term actions are necessary to recover these iconic and endangered animals. Consistent with this broad vision, SCAP considers both benefits and risks to SRKW and Chinook salmon through a four-step process:

Step 1. Identification of Candidate Programs. Which hatchery facilities have existing capacity to increase production of Chinook salmon? What would be the broodstock source? At what life stage would release occur? How many juvenile Chinook salmon would be released?

Step 2. Assessment of Benefits to SRKW. Of the candidate programs, which have the greatest likelihood of increasing prey to SRKW in the most cost-effective manner?

Step 3. Risks and Benefits to Chinook Salmon. What are the relative risks and benefits of the candidate programs to Chinook salmon populations?

Step 4. Integration of SRKW and Chinook Salmon Assessment. Of the candidate program, which are most likely to provide benefits to SRKW in a manner consistent with achieving our Chinook salmon objectives?

The candidate programs are scored relative to benefits to SRKW and risks and benefits to Chinook salmon. A candidate program could score up to +50 points for benefits to SRKW, and from -110 to +50 points relative to Chinook salmon. A candidate program with the greatest potential benefits to SRKW and Chinook salmon would score +100 points.

The following sections describe the methods and results of the application of SCAP to Chinook salmon hatchery programs operating in tributaries to Puget Sound, the Washington Coast, and the Columbia River.

Step 1. Identification of Candidate Chinook Programs

Methods

We assessed the infrastructure and existing production at hatcheries throughout the state to identify where capacity existed to increase the production of Chinook salmon. Where capacity existed, we evaluated options for broodstock, release location, and the preferred life stage to release the juvenile Chinook salmon. The resulting candidate programs reflect the availability of hatchery capacity, broodstock, and the preferred release strategy. Potential effects to natural populations or existing ESA-limits to production were not considered in this step.

Results

The assessment identified 18 candidate hatchery programs with the collective potential to increase production by approximately 16 million juvenile Chinook salmon (Table 1). Eight candidates were identified in the Puget Sound region, seven candidates in the Washington Coast region, and three candidates in the Columbia River region.

Table 1. Hatchery facilities with the capacity to increase Chinook salmon production. Run timing abbreviations: SP – spring; S – summer; F fall. Release stage abbreviations: SY – subyearling; Y – yearling.

Region	Facility (Run Timing)	Release Location	Release Stage	Potential Production Increase	SAR	Cost/ Adult Fish
Puget Sound	Hupp (SP)	Hupp	SY	500,000	0.32%	$63
	Kendall Creek (SP)	Lummi Seaponds	SY	1,000,000	0.39%	$18
	Marblemount (SP)	Marblemount	Y	400,000	1.09%	$40
	Minter (SP)	Minter	SY	400,000	0.32%	$10
	Minter(F) [1/]	Minter	SY	400,000	0.61%	$10
	Wallace (S)	Wallace Tulalip Bay	SY	500,000 500,000	0.30%	$16
	Samish (F)	Samish Whatcom Cr.	SY	1,000,000 500,000	0.77%	$9
	Soos Creek (F)	Palmer Ponds	SY	2,000,000	0.44%	$23
Washington Coast	Aberdeen (F)	Aberdeen	SY	100,000	0.22%	$25
	Bingham Creek (F)	Bingham Cr.	SY	500,000	0.31%	$29
	Forks Creek (SP)	Forks Creek	SY	1,000,000	0.33% [2/]	$29
	Humptulips (F)	Humptulips	SY	1,250,000	0.53%	$15
	Naselle (F)	Naselle	SY	2,500,000	0.49%	$13
	Sol Duc (S)	Sol Duc	SY	1,000,000	0.34%	$23
	Sol Duc (S)	Sol Duc	Y	150,000	0.42%	$40
Columbia River	Beaver Creek (F)	Deep River	SY	1,000,000	0.23%	$35
	Ringold (Sp)	Ringold	Y	350,000	0.49%	$37
	Ringold (F)	Ringold	SY	1,000,000	0.37%	$28

[1/] Additional space not available at Minter Creek for fall Chinook until brood year 2019. Space currently being used to replace capacity lost while Puyallup Hatchery is rebuilt.

[2/] Kalama spring SAR used as no estimate currently available for spring Chinook salmon in Willapa Bay.

Step 2. Assessment of Benefits to SRKW

Methods

We scored candidate programs based on the likely importance of the program as prey to SRKW and cost effectiveness. The following approach was used to select and rank the candidate programs.

1) **Importance as Prey** (maximum potential of 35 points). The scoring system is designed to prioritize candidate programs that have the greatest likelihood of providing Chinook salmon to SRKW. The prey index (NMFS and WDFW 2018) ranges from 0 to 5 and is derived from information on the presence of the Chinook stock in the diet of SRKW, consumption of the stock

during the period from October through May, and spatial and temporal overlap of the salmon stock and SRKW. Values of the index were multiplied by a factor of 7 to ensure that this factor was given at least twice the weight of the most cost effective candidate program.

Uncertainty exists in many of the factors used to assess the importance of different stocks of Chinook salmon as prey. Given this uncertainty, candidate programs were ranked within regions to inform the selection of a portfolio of production increases in Puget Sound, the Washington Coast, and the Columbia River.

2) **Cost Effectiveness** (maximum potential 15 points). Given two candidate programs with an equal prey index, it would be advantageous to invest in the program that provides the greatest number of age 3-5 Chinook salmon per dollar invested. The cost per age 3-5 Chinook salmon produced was computed by dividing the cost per smolt by the SAR. Programs were scored as follows: <$20/fish, 15 points; $21 - $40/fish, 10 points; $41 - $60/fish, 5 points; > $60/ fish, 0 points.

Results

The candidate programs scored and ranked relative to likely importance as prey for SRKW and cost effectiveness are presented in Table 2. Candidate programs in Puget Sound generally scored higher than those in the Columbia River or Washington Coast, and candidate programs with fall production scored higher than spring Chinook programs. These results primarily reflect the SRKW prey index score as cost effectiveness, in general, varied little between the programs.

Table 2. Assessment of benefits of candidate programs to SRKW.

Region	Facility (Run Timing)	Release Stage	Potential Increase	SRKW Score	SRKW Regional Rank
Puget Sound	Hupp (SP)	SY	500,000	18	4
	Kendall Creek (SP)	SY	1,000,000	42	3
	Marblemount (SP)	Y	400,000	42	3
	Minter (SP)	SY	400,000	50	1
	Minter(F)	SY	400,000	50	1
	Wallace (S)	SY	1,000,000	50	1
	Samish (F)	SY	1,500,000	50	1
	Soos Creek (F)	SY	2,000,000	45	2
Washington Coast	Aberdeen (F)	SY	100,000	36	2
	Bingham Creek (F)	SY	500,000	36	2
	Forks Creek (Sp)	SY	1,000,000	36	2
	Humptulips (F)	SY	1,250,000	41	1
	Naselle (F)	SY	2,500,000	41	1
	Sol Duc (S)	SY	1,000,000	36	2
	Sol Duc (S)	Y	150,000	41	1
Columbia R.	Beaver Creek (F)	SY	1,000,000	42	1
	Ringold (Sp)	Y	350,000	33	3
	Ringold (F)	SY	1,000,000	40	2

Step 3. Assessment of Risks and Benefits to Chinook Salmon

Methods

Conceptual Framework. The foundation for the assessment of the risks and benefits to Chinook salmon is a recognition that: i) habitat productivity has been substantially degraded throughout much of Washington; ii) the status of Chinook salmon populations differs; iii) the potential contribution of each population to conservation and recovery differs; and iv) all of these factors (and others) must be incorporated in watershed-specific strategies. Decision support tools that build on this foundation have been developed for a number of planning processes, including the Snohomish integrated adaptive management strategy (Rawson and Crewson 2017), the co-managers' Puget Sound Chinook hatchery resource management plan (WDFW and PSIT 2004), and hatchery reviews conducted by the Hatchery Scientific Review Group (HSRG 2014).

The integrated framework for the Snohomish River basin (Rawson and Crewson 2017) linked recovery phases to habitat status and to population viability, and proposed habitat and hatchery management strategies for each recovery phase (tables 2 and 3). The recovery phases (preservation, recolonization, local adaptation, and full restoration) were previously proposed by the HSRG (2014) to categorize the types of hatchery programs that might be appropriate under varying levels of population viability. We applied a similar approach as Rawson and Crewson, but differentiated Poor and Fair habitat. The specific metrics for assessing population viability and habitat status are provided in Appendix A.

Table 2. Phases of recovery depending on both population viability status and habitat condition. Modified from Rawson and Crewson (2017).

Habitat Status	*Population Viability Status*		
	Low	*Moderate*	*High*
Very Good	Recolonization	Local Adaptation	Full Restoration
Good			
Fair	Preservation	Local Adaptation - Recolonization	Local Adaptation
Poor	Preservation	Preservation	Not Applicable

Table 3. Appropriate management linked to both population viability status and habitat status. Modified from Rawson and Crewson (2017).

Habitat Status	*Population Viability Status*		
	Low	*Moderate*	*High*
Very Good	Maintain Habitat, Improve VSP	Maintain Habitat, Improve VSP	Maintain Habitat, Maintain VSP
Good			
Fair	Restore Habitat, Preserve Population	Restore Habitat, Improve VSP	Restore Habitat, Maintain VSP
Poor	Restore Habitat, Preserve Population	Restore Habitat, Preserve Population	Not Applicable

In developing appropriate management strategies, the co-managers have also recognized the importance of the origin and composition of the natural spawners (WDFW and PSIT 2004). The co-managers' Comprehensive Management Plan for Puget Sound Chinook salmon (PSIT and WDFW 2010) categorizes populations according to the origin of naturally reproducing adults, presence of indigenous populations, the proportional contribution of artificial production, and the origin of hatchery broodstock:

> Category 1 - natural production is predominantly of natural origin, by native / indigenous stock(s), or enhanced to a greater or lesser extent by hatchery programs that utilize indigenous broodstock.
>
> Category 2 – natural production by a non-native stock, introduced for use in local hatchery production, and influenced by ongoing hatchery contribution. The indigenous population is functionally extinct. Habitat conditions may not currently support self-sustaining natural production.
>
> Category 3 – an independent natural population was not historically present; natural production may occur, involving adults returning to a local hatchery program, or straying from adjacent natural populations or hatchery programs.

We used the comanager approach to categorize Puget Sound Chinook salmon populations but relied on recovery plans, other NMFS documents, Fish and Wildlife Commission guidance, or co-manager discussions for the remainder of Washington. Recovery plans for ESA-listed Chinook salmon outside of Puget Sound have often categorized populations relative to their role in conservation and recovery. For example, the Lower Columbia Recovery Plan (LCFRB 2010) categorizes populations as Primary, Contributing, or Stabilizing. For consistency across these forums, we used a common categorization, with "A" indicating the highest significance for conservation and recovery planning.

Together, the categorization of populations, habitat status, and population viability provides a framework, or context, for evaluating All-H management actions.

Assessment of Benefits and Risks. The benefits and risks of candidate hatchery programs were evaluated in a manner similar to the Benefit-Risk Assessment Procedure (BRAP)(WDFW 2001; WDFW and PSIT 2004). In the first step, we qualitatively assessed each candidate program relative to guidelines that describe the preferred conditions for hatchery operations. The probability that the candidate program was consistent with the guidelines was categorized as High, Moderate, or Low. The guidelines were derived from Appendix A of the co-manager hatchery plan (WDFW and PSIT 2004), BRAP, and updated based on any new analyses conducted since that time.

In the second step, we assessed the hatchery programs within the broader context of the status of the habitat, the viability of the population, and the category of the population. This is necessary because one or more of these factors may preclude the implementation of a "Preferred" program, or flexibility may exist due to the status and conservation role of the population. For example, a hatchery conservation program may be initiated to prevent the extirpation of a population. The Preferred hatchery program would likely be designed to primarily use natural-origin broodstock in order to limit some of the genetic risks associated with hatchery programs. However, the productivity of the habitat may be so poor, or interception rates in Canadian fisheries so high, that insufficient numbers of natural-origin adults may return to provide the number of broodstock necessary to operate the "Preferred" hatchery program. Under these circumstances, variation from the "Preferred" may occur to achieve, in the best possible manner, the objectives of the program.

The concept of variation from the "Preferred" program was developed by the co-managers and termed a tolerance profile (WDFW 2001). The tolerance profiles levels were established to account for the broader context in which the hatchery program operates. Greater deviations from the "Preferred" characteristics were tolerated when the indigenous population was extirpated, population viability was low, and/or habitat status was poor.

We focused on four attributes in our evaluation of the potential risks and benefits of the candidate populations: 1) abundance; 2) among-population diversity; 3) within population diversity; and 4) productivity. These four attributes are similar to the characteristics of viable salmonid populations identified by McElhany et al. (2000) with the exception that we did not consider the effects of a candidate program on spatial structure. Although we agree that spatial structure is an important consideration in recovery planning, the added discrimination it would provide between candidate hatchery programs seemed likely to be small relative to the complexities of spatial analyses.

The range of potential scores for the four attributes qualitatively reflect our assessment of their relative importance for salmon conservation and recovery. We gave the greatest weight (up to 50 points) to abundance and among-population diversity since population are commonly considered the basic unit for conservation and recovery of salmon (McElhany et al. 2000), and abundance and among-population diversity are prerequisites to maintain these building blocks. Within-population diversity is also of long-term evolutionary importance, but it is unlikely to be maintained in the absence of among-population diversity. Therefore, we defined it as a second tier attribute with a maximum weight of 30 points. Reduced reproductive success of hatchery fish spawning in the natural environment and competition are two hazards potentially affecting the productivity of the population. Reductions in productivity associated with the reduced reproductive success of hatchery-origin Chinook salmon may also have a genetic basis, although environmental and hatchery cultural practices may be equally important in some cases. We categorized reproductive success as a tier 3 factor with a maximum weight of 20 points. Competitive effects were given a weight of up to 10 points because of the likely lack of a long-term genetic consequence.

We briefly describe below the scoring method for each of these attributes and provide additional information in Appendix A.

Abundance. A hatchery program can be an effective tool to maintain a population which, absent the hatchery program, would have a high risk of extirpation or loss of genetic diversity. Integrated hatchery programs benefitting populations in the Preservation or Recolonizing recovery phases could score up to +50 points for a program that was implemented in a manner consistent with the hatchery practices appropriate for the watershed.

Among-Population Diversity. Maintaining and increasing diversity among populations is an important factor in evaluating the candidate hatchery programs. A program that maintains among-population diversity facilitates natural processes of adaptation to conditions encountered by the population in the watershed, estuary, and ocean. A candidate program could lose 25 or 50 points if the program was implemented in a manner inconsistent with population-specific hatchery practices appropriate for maintaining among-population diversity.

Within Population Diversity. Maintaining and increasing the diversity within a population is also important for facilitating local adaptation and long-term viability. A candidate program could lose 15 or 30 points if the program was implemented in a manner inconsistent with population-specific hatchery practices appropriate for maintaining population diversity.

Productivity. Productivity is an important factor determining population resilience. A candidate program could reduce the productivity of natural spawners through competition between hatchery- and natural-origin fish, or if a candidate program results in adults spawning in a river and those spawners have lower reproductive success than natural-origin spawners. A candidate program that was likely to reduce productivity could lose up to 30 points if the program was implemented in a manner inconsistent with hatchery practices appropriate for the watershed.

Results

{This section will be completed after broader review of the methods described in Appendix A.}

Table 3. Assessment of benefits and risks of candidate programs to Chinook salmon. Run timing abbreviations: SP – spring; S – summer; F fall.

Region	Facility (Run Timing)	Chinook Score	Abundance	Among Population Diversity	Within Population Diversity	Productivity
Puget Sound	Hupp (SP)					
	Kendall Creek (SP)					
	Marblemount (SP)					
	Minter (SP)					
	Minter(F)					
	Wallace (S)					
	Samish (F)					
	Soos Creek (F)					
Washington Coast	Aberdeen (F)					
	Bingham Creek (F)					
	Forks Creek (SP)					
	Humptulips (F)					
	Naselle (F)					
	Sol Duc (S)					
	Sol Duc (S)					
Columbia R.	Beaver Creek (F)					
	Ringold (Sp)					
	Ringold (F)					

Step 4. SCAP Results

Methods

We integrated the SRKW and Chinook salmon scores in two ways. Method 1 was to simply add the SRKW and Chinook salmon scores. The resultant combined score resulting can be used to add programs until a funding limit is reached, or the desired adult production is achieved. Method 2 accepted a candidate program for further consideration only if the program was at least moderately consistent with watershed objectives. Candidate programs that do not meet this criterion are shaded grey in Table 4.

Table 4. Hatchery facilities with the capacity to increase Chinook salmon production. Release stages abbreviations: SY – subyearling; Y – yearling.

Region	Facility	Run Timing	Release Stage	Potential Increase	SCAP Score	SRKW Score	Salmon Score
Puget Sound	Hupp	Spring	SY	500,000		18	
	Kendall Creek	Spring	SY	1,000,000		42	
	Marblemount	Spring	Y	400,000		42	
	Minter	Spring	SY	400,000		50	
	Minter	Fall [1/]	SY	400,000		50	
	Wallace	Summer	SY	1,000,000		50	
	Samish	Fall	SY	1,500,000		50	
	Soos Creek	Fall	SY	2,000,000		45	
Washington Coast	Aberdeen	Fall	SY	100,000		36	
	Bingham Creek	Fall	SY	500,000		36	
	Forks Creek	Spring	SY	1,000,000		36	
	Humptulips	Fall	SY	1,250,000		41	
	Naselle	Fall	SY	2,500,000		41	
	Sol Duc	Summer	SY	1,000,000		36	
	Sol Duc	Summer	Y	150,000		41	
Columbia R.	Beaver Creek	Fall	SY	1,000,000		42	
	Ringold	Spring	Y	350,000		33	
	Ringold	Fall	SY	1,000,000		40	

[1/] Additional space not available at Minter Creek for fall Chinook until brood year 2019. Space currently being used to replace capacity lost while Puyallup Hatchery is rebuilt.as additional Chinook salmon are being cultured at this facility while Puyallup Hatchery is rebuilt.

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Appendix A. Methods for Assessing Candidate Programs Relative to Chinook Salmon

Categorizing Habitat Status

Similar to previous work (WDFW and PSIT 2004; Rawson and Crewson 2017), habitat status was categorized as Poor, Fair, Good, or Very Good based upon the estimates of productivity relative to Properly Functioning Conditions (PFC). NMFS (1996) identified the status of key habitat attributes consistent with viable salmonid populations (PFC), at risk, and non-PFC. The Puget Sound Technical Recovery Team subsequently used an analysis of the demographics of each Chinook salmon population with PFC habitat conditions as one basis for establishing recovery goals. For this assessment, we categorized habitat status based upon the estimated intrinsic productivity of the population:

Poor:	Productivity < non-PFC level, where non-PFC was estimated as 20% of historical productivity
Fair:	non-PFC level ≤ Productivity < PFC Level
Good:	PFC Level ≤ Productivity < Historical Level
Very Good:	Historical Level ≤ Productivity

Categorizing Population Viability

We assessed population viability by using the most risk averse result of three analyses.

Population Viability Analysis. A population viability analysis provides an estimated probability of extinction during a defined time period. Following Rawson and Crewson (2017), a population was characterized as High viability if the probability of extinction was at least 95% for a period of 100 years. Low viability was defined as a less than 95% probability of persisting for 40 years. Moderate viability is intermediate between these two categories.

Projected Fishery Exploitation Rates Relative to Rebuilding Exploitation Rates (RERs). NOAA Fisheries has estimated RERs for many Chinook salmon populations as a metric to assess the risk of alternative fishery exploitation rates. Fisheries in Canada and Southeast Alaska (northern fisheries) exploit many Chinook salmon stocks originating from Washington during their ocean migration. This may result in total fishery exploitation rates that exceed a population RER, even when fisheries in the southern U.S. are severely constrained. A population was characterized as Low viability if the RER was less than or equal to the projected total fishery exploitation rate under the Pacific Salmon Treaty obligations. High viability was defined as a population where the RER exceeded the projected total fishery exploitation rate by at least 30%. Moderate viability is intermediate between these two categories.

NOS Abundance. Per generation abundance in terms of NOS was calculated as the geometric mean value for the period 2010-2014 for consistency with the most 5-year status reviews completed by NOAA Fisheries. Scoring levels were based on extinction risk levels taken from Allendorf et al. (1997), below 250 considered a very high risk of extinction, and 250-2500 a high risk of extinction.

Abundance – Preservation & Recolonization
Is the population in a Preservation or Recolonization phase and, if so, is the program scaled consistent with biological guidelines?

Consistency with Guidelines
For populations in the Preservation or Recolonization phase, an upper natural spawner guideline (UNSG) was defined as the greater of the estimated capacity (for a Ricker or Hockey-Stick function), the equilibrium point (for a Beverton-Holt function), or the Upper Management Threshold (Puget Sound stock). A lower natural spawner guideline (LNSG) was defined as the greater of 250 spawners or, for Puget Sound stocks, the Point of Instability. The probability of consistency (P{Consistency}) with preferred management practices is dependent on the projected number of natural spawners under poor survival conditions relative to the natural spawner guideline:

P{Consistency}	Projected Natural Spawners Relative to Natural Spawner Guideline	
	Preservation Phase	Recolonization Phase
High	LNSG < Spawners ≤ UNSG	LNSG < Spawners ≤ UNSG
Moderate	75% LNSG < Spawners ≤ 125% UNSG%	75% LNSG < Spawners ≤ 125% UNSG%
Low	Spawner < 75% LNSG or Spawners > 125% UNSG	Spawner < 75% LNSG or Spawners > 125% UNSG

Scoring:
Reducing the likelihood of extirpation is critically important and hatcheries are often one of the few tools available to achieve this objective in the short-term. Given the importance of maintaining or increasing abundance for populations in the Preservation or Recolonization phases, a candidate program may score 0, 25, or 50 points for this attribute.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	High	+25	+50	+50
A	Low	Fair	Moderate	0	+25	+50
A	Low	Good – V. Good	Moderate	0	+25	+50
A	Moderate	Poor	Moderate	0	+25	+50
A	Moderate	Fair	Low	0	0	+25
A	Moderate	Good – V. Good	Population not in Preservation or Recolonization			
A	High	Poor	Combination Unlikely			
A	High	Fair	Low	0	0	+50
A	High	Good – V. Good	Population not in Preservation or Recolonization			
B	Low	Poor	High	+25	+50	+50
B	Low	Fair	Moderate	0	+25	+50
B	Low	Good – V. Good	Moderate	0	+25	+50
B	Moderate	Poor	Moderate	0	+25	+50
B	Moderate	Fair	Low	0	0	+25
B	Moderate	Good – V. Good	Population not in Preservation or Recolonization			
B	High	Poor	Combination Unlikely			
B	High	Fair	Low	0	0	+25
B	High	Good – V. Good	Population Moves to Category A			

Among-Population Diversity
Is the program consistent with Best Management Practices to maintain or increase among-population diversity?

Consistency with Guidelines:
This factor is concerned solely with hatchery-origin spawners that are not derived from the population where spawning is occurring (includes all segregated programs). The probability of consistency with preferred management practices (P{Consistency}) is dependent upon the source of the hatchery-origin spawners and gene flow to the natural population. In turn, the weight given this factor depends on the category of the population (A or B), population viability, and habitat status.

P{Consistency}	Source of Hatchery-Origin Spawners		
	Within MPG	Outside MPG, Within ESU	Outside ESU
High	GF ≤ 2%	GF ≤ 1%	Not Applicable
Moderate	2% < GF ≤ 10%	1% < GF ≤ 5%	GF ≤ 2%
Low	GF > 10%	GF > 5%	GF > 2%

Scoring:
Maintaining and increasing the diversity among populations is important for facilitating the ability of a population to adapt to the conditions encountered in the watershed, estuary, and ocean. However, among population diversity is considered less of a concern when population viability is low and habitat status is fair-poor, or when the locally adapted population has been extirpated. Given the importance of maintaining or increasing among population diversity, a candidate program may lose 25 or 50 points points for this attribute.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	Moderate	-25	0	0
A	Low	Fair	Low	-50	-25	0
A	Low	Good – V. Good	Low	-50	-25	0
A	Moderate	Poor	Low	-50	-25	0
A	Moderate	Fair	Low	-50	-25	0
A	Moderate	Good – V. Good	Low	-50	-25	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Moderate	-50	-25	0
A	High	Good – V. Good	Low	-50	-25	0
B	Low	Poor	High	0	0	0
B	Low	Fair	Moderate	-25	0	0
B	Low	Good – V. Good	Moderate	-25	0	0
B	Moderate	Poor	Moderate	-25	0	0
B	Moderate	Fair	Moderate	-25	0	0
B	Moderate	Good – V. Good	Low	-50	-25	0
B	High	Poor	Combination Unlikely			
B	High	Fair	Moderate	-25	0	0
B	High	Good – V. Good	Population Moves to Category A			

Within Population Diversity – Integrated Programs

Is the proposed program consistent with Best Management Practices to maintain or increase within population diversity?

Consistency with Guidelines:
Effective population size determines the rate at which genetic diversity may be lost from a population, and the rate at which diversity is lost. Effective size is strongly affected by variability in reproductive success, spawner sex ratio, and variability in census size of the composite population. The probability that effective size is consistent with preferred management practices depends on the proportion of the hatchery and natural spawners used as broodstock, the census size of the composite population, the relative reproductive success of hatchery fish spawning in the wild, and spawner sex ratio.

P{Consistency}	Census Size of Composite Population		
	<1000/mean age	1000-1500/mean age	> 1500/mean age
High			ESD ≤ 25%
Moderate	ESD ≤ 10%	ESD ≤ 25%	25% < ESD ≤ 40%
Low	ESD >10%	ESD > 25%	ESD > 40%

Scoring:
Maintaining within population diversity facilitates long-term evolutionary. However, when population viability is poor, in particular, reductions in within population diversity are a smaller concern than maintaining the population. A candidate program may lose 10 or 20 points for this attribute.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	High	0	0	0
A	Low	Fair	High	0	0	0
A	Low	Good – V. Good	Moderate	-15	0	0
A	Moderate	Poor	High	0	0	0
A	Moderate	Fair	Moderate	-15	0	0
A	Moderate	Good – V. Good	Low	-30	-15	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Moderate	-30	-15	0
A	High	Good – V. Good	Low	-30	-15	0
B	Low	Poor	High	0	0	0
B	Low	Fair	High	0	0	0
B	Low	Good – V. Good	Moderate	-15	0	0
B	Moderate	Poor	High	0	0	0
B	Moderate	Fair	Moderate	-15	0	0
B	Moderate	Good – V. Good	Low	-30	-15	0
B	High	Poor	Combination Unlikely			
B	High	Fair	Low	-30	-15	0
B	High	Good – V. Good	Population Moves to Category A			

Productivity – Integrated Programs
Is the proposed program consistent with Best Management Practices to maintain or increase population productivity? We considered both a potential reduction in the reproductive success resulting from the

presence of hatchery-origin Chinook salmon spawning in a river, and competition between hatchery- and natural-origin Chinook salmon.

Reproductive Success - Consistency with Guidelines:
The productivity of a naturally-spawning population of Chinook salmon can be affected by domestication. Domestication, or hatchery-influenced selection, occurs when selection pressures imposed by hatchery spawning and rearing differ greatly from those imposed by the natural environment and cause genetic change that is passed on to natural populations through interbreeding with hatchery-origin fish. The extent of domestication depends upon the differences in selective pressure in the hatchery and natural environment (which includes the amount of time the fish spend in the hatchery environment), the proportion of natural-origin fish in the hatchery broodstock, and the proportion of natural spawners consisting of hatchery-origin fish (which are both encapsulated in the proportionate natural influence (PNI) metric).

The methods used to score reproductive success are summarized below. Additional details may be found in WDFW (2001).

Selective Pressure - Hatchery Culture Practices and Release Stage. Hatchery culture practices were categorized as Naturalized, Standard, or Selective using the approach described in BRAP. In general, a Naturalized program will be characterized by a lack of intentional selection spawners, eggs, or juveniles, spawners have the ability to select mates, a naturalized rearing environment, and the size and time of release are consistent with naturally-produced juvenile Chinook salmon. To account for the effect of the time in the hatchery, the hatchery culture score was multiplied by 0.87 for fry releases and 0.935 for subyearling releases of juvenile Chinook salmon. These adjustment factors were derived from Theriault et al. (2011).

Release Stage	Hatchery Culture Practices		
	Naturalized	Standard	Selective
Fry	0	12	21
Subyearling	0	13	22
Yearling	0	14	24

Broodstock Origin & Composition of Natural Spawners. In order to factor in natural-origin broodstock and hatchery-origin spawners, the PNI was scaled to give this index approximately an equal weight as selective hatchery culture practices at PNI = 0.50. The resulting linear relationship had a slope and intercept of 50.

Domestication Score. The selective pressure and the scaled PNI were summed as a "domestication score".

Following a similar approach to BRAP, a hatchery program was categorized as highly probable to be consistent with preferred hatchery practices for a DS less than 25, and unlikely to be consistent with ideal management practices if DS was equal to or greater than 40.

P{Consistency}	Domestication Score
High	DS < 25
Moderate	25 ≤ DS < 40
Low	DS ≥ 40

Reproductive Success Scoring:
The productivity of a population typically is an important factor determining allowable fishery exploitation rates and population viability. Populations with low productivity are less resilient to

reductions in abundance associated with poor environmental conditions. As with other factors, potential losses in productivity associated with domestication must be considered in the broader context of the population viability, habitat status, and the category of the population. A candidate program may score lose 10 or 20 points for this attribute.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	High	0	0	0
A	Low	Fair	High	-10	0	0
A	Low	Good – V. Good	Moderate	-10	0	0
A	Moderate	Poor	High	0	0	0
A	Moderate	Fair	Moderate	-10	0	0
A	Moderate	Good – V. Good	Low	-20	-10	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Low	-20	-10	0
A	High	Good – V. Good	Low	-20	-10	0
B	Low	Poor	High	0	0	0
B	Low	Fair	High	0	0	0
B	Low	Good – V. Good	Moderate	-10	0	0
B	Moderate	Poor	High	0	0	0
B	Moderate	Fair	Moderate	-10	0	0
B	Moderate	Good – V. Good	Low	-20	-10	0
B	High	Poor	Combination Unlikely			
B	High	Fair	Low	-20	-10	0
B	High	Good – V. Good	Population Moves to Category A			

Competition - Consistency with Guidelines:
For an integrated program, the key characteristics of a candidate program are that: 1) the size of the program is scaled properly for the watershed and 2) the juveniles are volitionally released at a life stage (typically subyearlings or yearlings) and in a physiological condition (smolting) that will minimize residence time in the freshwater (FW) and in the natal estuarine environment.

We recognize that competition may occur outside of the natal freshwater and estuarine environments. However, we are not aware of any analytical tools that would differentiate the potential risks of the candidate programs in these environments.

P{Consistency}	Release Strategy Minimizes FW & Estuarine Residence Time	Release Strategy Doesn't Minimize FW & Estuarine Residence Time
High	Spawners ≤ UNSG	-
Moderate	UNSG < Spawners ≤ 125% UNSG%	Spawners ≤ 25% UNSG
Low	Spawners > 125% UNSG	25% UNSG < Spawners

Competition Scoring:
We used similar concepts to score competition as discussed above for reduced reproductive success, except that the maximum negative score was 10 points. The potential loss of 10 points, rather than the 20 points associated with reduced reproductive success, reflects that competition is unlikely to have long-term genetic effects on a population.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	High	0	0	0
A	Low	Fair	High	-5	0	0
A	Low	Good – V. Good	Moderate	-5	0	0
A	Moderate	Poor	High	0	0	0
A	Moderate	Fair	Moderate	-5	0	0
A	Moderate	Good – V. Good	Low	-10	-5	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Low	-10	-5	
A	High	Good – V. Good	Low	-10	-5	0
B	Low	Poor	High	0	0	0
B	Low	Fair	High	0	0	0
B	Low	Good – V. Good	Moderate	-5	0	0
B	Moderate	Poor	High	0	0	0
B	Moderate	Fair	Moderate	-5	0	0
B	Moderate	Good – V. Good	Low	-10	-5	0
B	High	Poor	Combination Unlikely			
B	High	Fair	Low	-10	-5	0
B	High	Good – V. Good	Population Moves to Category A			

Productivity Score – Integrated Program
The productivity score for an integrated program is the sum of the scores for the reproductive success and competition scores identified above.

Productivity – Segregated Programs
Is the proposed program consistent with Best Management Practices to maintain or increase population productivity? We considered both a potential reduction in the reproductive success resulting from the presence of hatchery-origin Chinook salmon spawning in a river, and competition between hatchery- and natural-origin Chinook salmon.

Reproductive Success - Consistency with Guidelines:
For a segregated hatchery program, hatchery-origin Chinook salmon are likely to have low productivity in the natural environment due to little (or no) use of natural-origin broodstock and hatchery practices are likely intended to maximize the survival of the fish in the hatchery environment. Therefore, the consistency with preferred management practices (P{Consistency}) is a dependent only upon the rate of gene flow to natural populations.

P{Consistency}	Gene Flow
High	GF ≤ 5%
Moderate	5% < GF ≤ 10%
Low	10% < GF

Reproductive Success - Scoring:
The productivity of a population typically is an important factor determining allowable fishery exploitation rates and population viability. Populations with low productivity are less resilient to reductions in abundance associated with poor environmental conditions. Unlike an integrated program, a segregated program is not intended to have direct benefits to a natural population, and has the

potential to significantly reduce productivity of the natural population. Therefore, the allowable risk profile is more restrictive as population viability and habitat status decline. A candidate program may lose 10 or 20 points for this attribute.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	Low	-20	-10	0
A	Low	Fair	Low	-20	-10	0
A	Low	Good – V. Good	Low	-20	-10	0
A	Moderate	Poor	Low	-20	-10	0
A	Moderate	Fair	Moderate	-10	0	0
A	Moderate	Good – V. Good	Moderate	-10	0	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Moderate	-10	0	0
A	High	Good – V. Good	Moderate	-10	0	0
B	Low	Poor	Moderate	0	0	0
B	Low	Fair	Moderate	0	0	0
B	Low	Good – V. Good	Moderate	-10	0	0
B	Moderate	Poor	Moderate	-10	0	0
B	Moderate	Fair	Moderate	-10	0	
B	Moderate	Good – V. Good	Moderate	-10	0	0
B	High	Poor	Combination Unlikely			
B	High	Fair	High	0	0	0
B	High	Good – V. Good	Population Moves to Category A			

Competition – Consistency with Guidelines
The preferred characteristics of a segregated program are: 1) that it is located in a watershed without a historical Chinook population; and 2) the juveniles are volitionally released at a life stage (typically subyearlings or yearlings) and a size, time, and physiological condition (smolting) that will minimize interactions with natural-origin juvenile Chinook salmon in the freshwater and natal estuarine environment.

We recognize that competition may occur outside of the natal freshwater and estuarine environments. However, we are not aware of any analytical tools that would differentiate the potential risks of the candidate programs in these environments.

P{Consistency}	Condition
High	No Historical Chinook Population
Moderate	Historical Chinook Population, Release Strategy Minimizes Interactions
Low	Historical Chinook Population, Release Strategy Doesn't Minimize Interactions

Competition - Scoring:
Competition was scored in an analogous manner to reproductive success, except that a maximum of 10 points could be lost. The potential loss of 10 points, rather than the 20 points associated with reduced reproductive success, reflects that competition is unlikely to have long-term genetic effects on a population.

Population Category	Population Viability	Habitat Status	Tolerance Profile	Consistency with Ideal Management Practices		
				Low	Moderate	High
A	Low	Poor	Low	-10	-5	0
A	Low	Fair	Low	-10	-5	0
A	Low	Good – V. Good	Low	-10	-5	0
A	Moderate	Poor	Low	-10	-5	0
A	Moderate	Fair	Moderate	-5	0	0
A	Moderate	Good – V. Good	Moderate	-5	0	0
A	High	Poor	Combination Unlikely			
A	High	Fair	Moderate	-5	0	0
A	High	Good – V. Good	Moderate	-5	0	0
B	Low	Poor	Moderate	0	0	0
B	Low	Fair	Moderate	0	0	0
B	Low	Good – V. Good	Moderate	-5	0	0
B	Moderate	Poor	Moderate	-5	0	0
B	Moderate	Fair	Moderate	-5	0	
B	Moderate	Good – V. Good	Moderate	-5	0	0
B	High	Poor	Combination Unlikely			
B	High	Fair	High	0	0	0
B	High	Good – V. Good	Population Moves to Category A			

Productivity Score – Segregated Program
The productivity score for a segregated program is the sum of the scores for the reproductive success and competition scores identified above.

2018 Willapa Bay Marine Area Recreational Catch Estimate

PRELIMINARY/DRAFT

CHK = Chinook
AD = Adipose clipped (hatchery origin)
UM = Unmarked

CPUE = Catch per unit effort
Effort = An individual angler trip

July (Ocean 2 Rules

Stat Week	Anglers	Estimated Total Chinook Kept	Total Chinook CPUE	Estimated Total AD Chinook Kept	**Willapa Origin Chinook AD Impacts**	Estimated Total UM Chinook Kept	**Willapa Origin Chinook UM Impacts**	Estimated Total Coho Kept	Estimated Total AD Coho Kept	Estimated Total UM Coho Kept	Coho CPUE
26	72	1	0.014	1	**0**	0	**0**	0	0	0	0.000
27	206	27	0.130	26	**8**	1	**0**	1	1	0	0.005
28	202	19	0.096	16	**5**	3	**1**	0	0	0	0.000
29	202	14	0.071	10	**3**	4	**1**	0	0	0	0.000
30	255	31	0.123	24	**7**	7	**2**	1	1	0	0.004
31	102	8	0.078	6	**2**	2	**1**	0	0	0	0.000
Season Total	1,038	101	0.097	83	**25**	18	**5**	2	2	0	0.002

August

Stat Week	Dates	Strata	Strata Description	# Boats Sampled	# Boats Not Sampled	# Total Boats	Expanded # Total Boats	Sample Rate	# Anglers Sampled	# Anglers per boat	Expanded # Total Anglers	# CHK AD Kept	# CHK UM Kept	CHK AD CPUE	Expanded # CHK AD Kept	**# WB Origin CHK AD Impacts**	# CHK UM Released	CHK UM CPUE	Estimated CHK UM Encounters	Estimated Total CHK UM Impacts	**# WB Origin CHK UM Impacts**	# Coho AD Kept	# Coho UM Kept	Total Coho CPUE (AD+UM)
31	8/1 - 8/2	1	Wed-Thur	11	0	11	25	45%	23	2.09	51	0	0	0.000	0	**0**	0	0.000	0	0	**0**	0	0	0.000
31	8/3 - 8/5	2	Fri-Sun	150	10	160	178	84%	362	2.41	430	17	0	0.047	20	**13**	12	0.033	14	2	**1**	2	0	0.006
32	8/6 - 8/9	1	Mon-Thur	84	2	86	192	44%	174	2.07	397	18	0	0.103	41	**27**	6	0.034	14	2	**1**	3	0	0.017
32	8/10 - 8/12	2	Fri-Sun	120	2	122	204	59%	271	2.26	460	45	0	0.166	76	**50**	5	0.018	8	1	**1**	2	1	0.011
33	8/13 - 8/16	1	Mon-Thur	110	9	119	265	41%	245	2.23	591	36	0	0.147	87	**56**	8	0.033	19	3	**2**	2	1	0.012
33	8/17 - 8/19	2	Fri-Sun	249	16	265	443	56%	662	2.66	1,177	111	0	0.168	197	**129**	25	0.038	44	6	**4**	11	6	0.026
34	8/20 - 8/23	1	Mon-Thur	187	3	190	423	44%	415	2.22	940	91	0	0.219	206	**134**	16	0.039	36	5	**3**	9	2	0.027
34	8/24 - 8/26	2	Fri-Sun	222	9	231	386	58%	543	2.45	944	62	3	0.114	108	**70**	18	0.033	31	4	**3**	20	10	0.055
35	8/27 - 8/30	1	Mon-Thur	143	4	147	328	44%	315	2.20	722	35	0	0.111	80	**52**	16	0.051	37	5	**3**	13	6	0.060
35	8/31 - 9/2	2	Fri-Sun	348	27	375	418	83%	860	2.47	1,033	144	0	0.167	173	**113**	50	0.058	60	8	**5**	78	29	0.124
36	9/3 - 9/6	1	Mon-Thur	133	6	139	310	43%	263	1.98	612	41	1	0.156	95	**62**	16	0.061	37	5	**3**	24	13	0.141
36	9/7 - 9/9	2	Fri-Sun	82	6	88	147	56%	198	2.41	355	8	0	0.040	14	**9**	7	0.035	13	2	**1**	25	11	0.182
37	9/10 - 9/13	1	Mon-Thur	41	5	46	103	40%	76	1.85	190	2	0	0.026	5	**3**	2	0.026	5	1	**0**	18	6	0.316
37	9/14 - 9/16	2	Fri-Sun																					
				1,880	99	1,979	3,420	55%	4,407	2.34	7,902	610	4	0.138	1,104	**718**	181	0.041	319	45	**29**	207	85	0.066

2018 Willapa Bay Salmon Fishery Planning Model

Updatec 2018 North of Falcon

PFMC # coho FRAM # 1830 Final

Name of model: Commercial Proposal

Marine Area Rec: Chinook MSF Aug 1, 3 fish bag,1 coho
Freshwater: 4 fish bag, 1 wild coho
Commercial:

Commercial Chinook Drop out	0.03
Commercial Coho Drop out	0.02
Small mesh gear mortality	0.56
Tangle net mortality	0.31
Sport hook & line drop off	0.05
Marine Hooking Mortality	0.14
Freshwater Hooking Mortality	0.10
0.75	25% Savings for 12 hr fishery using 24 hr rate
	Based on 12-Hr rates

	Chinook								Coho								Chum
	Total Hatchery	Willapa North	Nemah Palix	Naselle Bear	Total Natural	Willapa North	Nemah Palix	Naselle Bear	Total Hatchery	Willapa North	Nemah Palix	Naselle Bear	Total Natural	Willapa North	Nemah Palix	Naselle Bear	Total
Pre-Season Runsize	40,257	16,055	19,580	4,622	3,838	2,195	490	1,153	34,993	6,893	0	28,100	18,994	10,691	2,734	5,568	39,932
Escapement Goal	3,525	200	1,950	1,375	4,353	2,172	328	1,853	2,500	1,000	0	1,500	13,600	9,679	1,294	2,628	35,400
Harvestable	36,732	15,855	17,630	3,247	-515	23	162	-700	32,493	5,893	0	26,600	5,394	1,012	1,441	2,940	4,532

Stat Week	2017 Dates	Days Fished T	U	N	R	M	MSF T	U	N	R	M	Chinook Catch Natural T	U	N	R	M
32	Aug 5 - Aug 11	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
33	Aug 12 - 18	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
34	Aug 19 - 25	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
35	Aug. 26 - Sept 1	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
36	Sept. 2 - 8	0.0	0.0	2.0	0.0	1.0	1.00	1.00	0.31	1.00	0.31	0	0	26	0	39
37	Sept. 9 - 15	0.0	0.0	3.0	0.0	1.0	1.00	1.00	0.31	1.00	0.31	0	0	39	0	39
38	Sept 16 - 22	3.0	3.0	6.0	0.0	5.0	0.56	0.31	0.56	1.00	0.56	15	39	22	0	34
39	Sept. 23 - 29	5.0	3.0	6.0	0.0	5.0	0.56	0.31	0.56	1.00	0.56	31	5	6	0	28
40	Sept 30 - Oct 6	4.0	3.0	6.0	0.0	5.0	0.56	0.31	0.56	1.00	0.56	11	13	2	0	9
41	Oct. 7 - 13	1.0	4.0	0.0	0.0	0.0	0.56	0.31	1.00	1.00	1.00	4	3	0	0	0
42	Oct. 14 - 20	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
43	Oct. 21 - 27	0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
44	Oct. 28 - Nov 3	0.0	2.0	0.0	0.0	0.0	1.00	0.56	1.00	1.00	1.00	0	1	0	0	0
45	Nov. 4 - 10	5.0	5.0	5.0	0.0	5.0	0.56	0.56	0.56	1.00	0.56	2	2	0	0	0
46	Nov. 11 - 17	5.0	5.0	5.0	5.0	5.0	0.56	0.56	0.56	0.56	0.56	0	0	0	0	0
47	Nov. 18 - 24	5.0	5.0	5.0	5.0	5.0	0.56	0.56	0.56	0.56	0.56	0	0	0	0	0
48	Nov. 25 - Dec 1	5.0	5.0	5.0	5.0	5.0	0.56	0.56	0.56	0.56	0.56	0	0	0	0	0
49		0.0	0.0	0.0	0.0	0.0	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0
Commercial Catch Totals		33	35	43	15	37						62	63	95	0	150
Commercial Harvest Rate																

Stat Week	Hatchery Chinook Total Hatchery	Total WB Origin	Willapa North	Nemah Palix	Naselle Bear	Natural Chinook Total Natural	Total WB Origin	Willapa North	Nemah Palix	Naselle Bear
32	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0
36	1,603	1,603	225	1,083	295	80	65	11	15	39
37	2,026	2,026	327	1,331	368	99	78	16	17	45
38	1,873	1873	1,157	526	189	131	110	59	13	38
39	606	606	325	208	73	89	71	35	9	27
40	323	323	230	66	27	42	35	22	3	10
41	70	70	63	3	4	10	8	7	0	1
42	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0
44	9	9	9	0	0	1	1	1	0	0
45	24	24	18	4	2	4	3	3	0	1
46	1	1	1	0	0	0	0	0	0	0
47	4	4	4	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0	0
Commercial Catch Totals	6,539	6,539	2,359	3,222	958	456	371	154	57	160
Commercial Harvest Rate		0.162	0.147	0.165	0.207		0.097	0.070	0.116	0.139

Stat Week	Hatchery Coho Total Hatchery	Willapa North	Nemah Palix	Naselle Bear	Natural Coho Total Natural	Willapa North	Nemah Palix	Naselle Bear	CHUM MSF	Chum Catch T	U	N	R	M	Total Chum
32	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
36	41	0	0	41	25	4	14	7	1.00	0	0	1	0	1	3
37	234	1	0	233	37	6	21	11	1.00	0	0	2	0	1	3
38	1,140	356	0	784	200	150	36	14	1.00	2	4	3	0	5	14
39	1,065	170	0	895	203	114	63	26	1.00	31	4	2	0	37	73
40	1,834	274	0	1560	515	327	138	51	1.00	172	4	55	0	224	456
41	131	58	0	73	187	163	16	8	1.00	265	47	0	0	0	312
42	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
44	79	51	0	27	287	273	13	0	0.56	0	116	0	0	0	116
45	350	201	0	149	805	737	61	7	0.56	158	386	151	0	950	1,645
46	30	19	0	10	53	50	2	0	0.56	15	111	57	42	244	469
47	120	76	0	44	220	203	15	1	0.56	2	20	57	42	13	134
48	12	7	0	4	27	25	2	0	0.56	2	1	57	0	13	72
49	0	0	0	0	0	0	0	0	1.00	0	0	0	0	0	0
Commercial Catch Totals	5,036	1,215	0	3,822	2,559	2,053	381	125	16	647	692	386	85	1,487	3,297
Commercial Harvest Rate	0.144	0.176		0.136	0.135	0.192	0.139	0.022							0.083

	Willapa R Natural Chinook Mortality Rate Projected	Cap	Naselle Natural Chinook Mortality Rate Projected	Cap	Chum Mortality Rate Projected	Cap
Harvest Rate	19.4%	20%	17.6%	20%	9.2%	###

2018 Chinook Policy Guidance: Natural Chinook HR for Willapa Bay		
Commercial	9.65%	9%
Rec Marine	7.4%	
Rec Freshwater	1.4%	

Coho Natural Escapement	Projected	Goal
	15,153	13,600

	Hatchery Chinook Total	Willapa North	Nemah Palix	Naselle Bear	Natural Chinook Total	Willapa North	Nemah Palix	Naselle Bear	Hatchery Coho Total	Willapa North	Naselle Bear	Natural Coho Total	Willapa North	Nemah Palix	Naselle Bear	Chum Total
Recreational Marine Catch	3,942	3,550	171	221	285	254	2	29	1,879	400	1,479	959	767	118	73	148
Harvest Rate	0.098	0.221	0.009	0.048	0.074	0.116	0.005	0.025	0.054	0.058	0.053	0.050	0.072	0.043	0.013	0.004
Recreational Freshwater Catch	7,979	896	6,599	484	55	19	21	14	1,873	280	1,593	323	177	2	144	218
Harvest Rate	0.198	0.056	0.337	0.105	0.014	0.009	0.044	0.012	0.054	0.041	0.057	0.017	0.017	0.001	0.026	0.005
Total Recreational Catch	11,921	4,446	6,770	705	339	273	24	43	3,752	680	3,072	1,282	944	120	217	366
Harvest Rate	0.296	0.277	0.346	0.153	0.088	0.124	0.048	0.037	0.107	0.099	0.109	0.067	0.088	0.044	0.039	0.009
Expected Escapement	21,797	9,250	9,588	2,959	3,128	1,768	409	950	26,205			15,153				36,269
Goal												13,600				35,400
Total Harvest Rates	0.459	0.424	0.510	0.360	0.185	19.4%	0.164	17.6%	0.251			0.202				9.2%

2018 WB Planning Model TAMM1830 04.12.18 (8).xlsx