**Cowlitz River Advisory Group**
**Updates for 9/25/18 meeting**

**New CRAG members:** The CRAG member solicitation wrapped up at the end of July. Applications were reviewed in August and two new members have been selected to join the CRAG. They are Paul Ockerman and Cody Clark. Paul operates Ock's Fishing Adventuress, LLC and is on the Board of Directors for the Washington Chapter of Northwest Guides and Anglers Association. Cody is the fishing supply buyer for Bob's Sporting Goods in Longview, Washington. Please welcome them to the group!

**WDFW Budget Talking Points** – we will provide a handout at the 9/25/18 meeting that provides information and talking points regarding WDFW's budget shortfall situation. This information may be valuable in discussions you may have with other members of your groups and/or other hunters and anglers.

**Summer Steelhead** – this year's Cowlitz River summer steelhead return to the hatchery looks like it will come in around 2100 fish. While not a strong year, broodstock numbers have been obtained. Additionally, 565 steelhead were recycled during the recycling window (thru mid-August) and another ~230 fish were returned downstream as controls for the Cowlitz River Hooking Mortality Study.

**Cowlitz Trout Hatchery** – Attached is a summary of the 2018 Cowlitz Trout Hatchery release evaluation that was completed by Tacoma Power and WDFW.

**2019 Juvenile production status** – The table below shows the approximated number of juveniles on hand for the releases scheduled in spring of 2019. Numbers are adjusted and become more accurate as fish are inventoried during marking (adipose clipped)/ and tagging.

| **Cowlitz Trout** | | **Juveniles On Hand** | | **Release Goal** | | **Current % of goal** |
|---|---|---|---|---|---|---|
| Cutthroat | | 130434 | | 90000 | | 145% |
| Su Steelhead | | 677766 | | 650000 | | 104% |
| | | | | | | |
| Tilton - Wi Steelhead | | 59552 | | 48000 | | 124% |
| UCR - Wi Steelhead | | 135877 | | 118000 | | 115% |
| LCR - Wi Steelhead | | 414149 | | 481000 | | 86% |
| Total Wi Steelhead | | 609578 | | 647000 | | 94% |
| | | | | | | |
| **Cowlitz Salmon** | | | | | | |
| Springers 16fpp | | 548816 | | 500000 | | 110% |
| Springers 8fpp | | 874194 | | 800000 | | 109% |
| Springers 5fpp | | 476979 | | 441000 | | 108% |
| Coho Integrated | | 1072406 | | 1100000 | | 97% |
| Coho Segregated | | 1305459 | | 1200000 | | 109% |

- Many programs are currently above release goal targets because additional mortality is anticipated during continued grow-out. This mortality is programmed in to egg take goals.

- An area of concern is LCR Winter Steelhead. Adult broodstock collection goals were met; however, an outbreak of bacterial coldwater disease (combined with soft-shell) has elevated mortality on this stock. A better estimate of fish on hand will occur after marking.

**Lower Cowlitz Fall Chinook Closure –** Fall Chinook returns to the Columbia River were projected to be low this year, and are turning out to be poorer than forecasted. Unfortunately, the Cowlitz River fall Chinook return seems to be following the same pattern. On average, about 30% of the return would be complete by this time. Based on current returns, we are projecting a broodstock shortfall this year and moved quickly last week to implement protection measures, including closing the Cowlitz and tributaries to Chinook retention and contacting NOAA Fisheries regarding collection of NOR Chinook at the separator for incorporation into broodstock. Even with these actions, we may only achieve ~50% of our collection goal.

**Cowlitz River coho** – On a brighter note, coho numbers to date are looking strong with ~ 1000 fish back to the hatchery to date. We will be tracking this run closely as we get further into the return.

**Tilton River Boundary Move** - The closed waters area around the adult fish release site was expanded to approximately 300 feet on 8/21/18. The water conditions at the release site have been very low and warm. The larger closure area is intended to allow fish to recover and disperse in the river after release and help maintain an orderly fishery in this location. This boundary change was announced to the CRAG, posted on the WDFW Facebook page, and included in the Weekender report. The goal for this year is to reduce the expanded boundary just as soon as flow conditions allow for fish released at the site to disperse without harassment and allow for an orderly fishery to occur. Moving the boundary too early can create an “attractive nuisance” which can quickly lead to illegal fishing behavior and a disorderly fishery. WDFW is also working with Tacoma Power to plan for a potential release of a small number of natural-origin Chinook at the mouth of the Tilton River later in the season to help reduce fishery impacts at Gust Backstrom Park by increasing the ratio of hatchery fish in that area. Coho are already being released into the Tilton.

# 2019 Budget Development

## Overview

The Washington Department of Fish and Wildlife (WDFW) is state government's leading fish and wildlife conservation agency. With the state's human population growing at one of the fastest rates in the country, the department's effectiveness is increasingly important to millions of longtime and new state residents.

Unfortunately, WDFW has experienced chronic budget shortfalls – essentially a gap between available funding and required spending. Today, the projected gap for the next two-year budget cycle has grown to about $30 million. This problem is more serious than ever and threatens WDFW's ability to provide the programs and services that Washingtonians expect and deserve.

The shortfall has several causes, but most important are these: (1) state funding from general taxes and the sale of recreational licenses has not kept pace with the cost of managing fish, wildlife, and their habitat, and (2) several one-time funding patches will expire soon. The department still has not fully recovered from the deep cuts imposed during the recession. License fees have not been adjusted since the last increase in 2011. One-time funding of $10 million in the current budget will expire in 2019.

Unless the problem is comprehensively addressed during the 2019 legislative session, the department will not be able to do its job effectively. Ultimately, programs, services, and facilities will have to be reduced and, in some cases, eliminated.

Washington Department of FISH and WILDLIFE

**Contact:**
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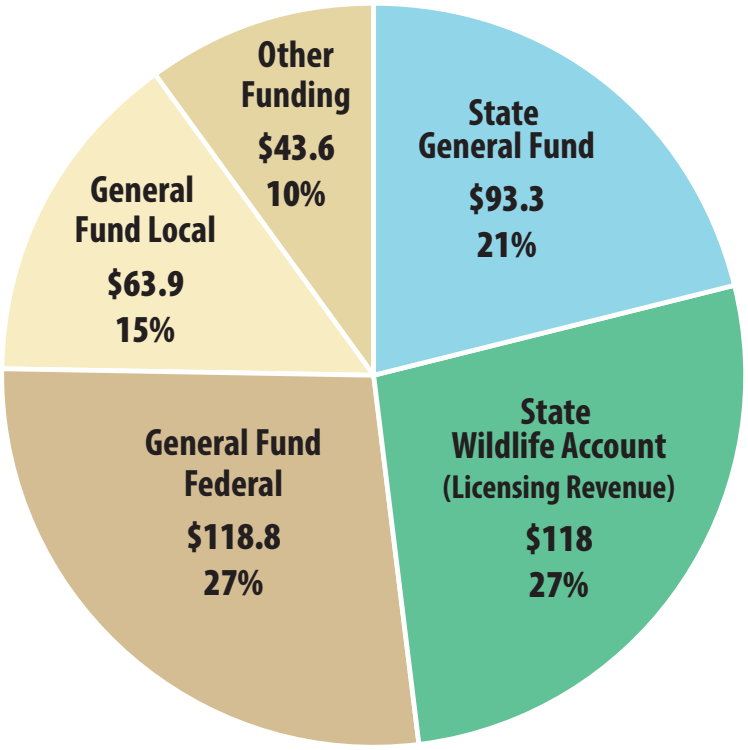
WDFW Policy Director
360-584-7033

Raquel Crosier
Legislative Director
360-902-2226

**wdfw.wa.gov**

## WDFW 2017-19 Operating Budget
### (in millions)




## WDFW has taken several steps to address a chronic problem

Recognizing the seriousness of the problem, the Legislature in 2017 directed WDFW to find efficiencies in current operations, examine the department's management and operation, and develop a long-term funding plan with the help of a broad-based stakeholder advisory group.

In response, WDFW:

- **Contracted with an independent consultant** for an extensive management review, which concluded that the department's management practices had not contributed to the funding problem. The consultants did recommend numerous small-scale operational improvements, almost all of which have been or are being made.
- **Identified $3 million in spending cuts** that will be implemented over the next 6-12 months. These include reductions in fish stocking, habitat restoration, and grants to volunteer organizations. By making these cuts soon, the department is reducing the size of the long-term funding problem.
- **Conducted a "zero-based" funding analysis** that connected the dots between WDFW's mission and its day-to-day operation. This exercise underscored the close connection between WDFW's day-to-day business and the goals set by state lawmakers and allowed the Department to examine and ensure that flexible funding goes towards the highest priorities.
- **Developed a long-term funding plan** with help from an advisory group representing outdoor recreation advocates, businesses that depend on WDFW-supported economic activity, and non-profit groups who work with the department on a wide range of projects that benefit their communities and the entire state. The plan describes the current budget situation and provides a vision for securing stable funding.

All of these initiatives are described in detail on the WDFW website at https://wdfw.wa.gov/about/budget/. (Please see graphs on this page and next for a breakdown of WDFW's revenue sources.)

# Now we're developing solutions for the 2019 legislative session

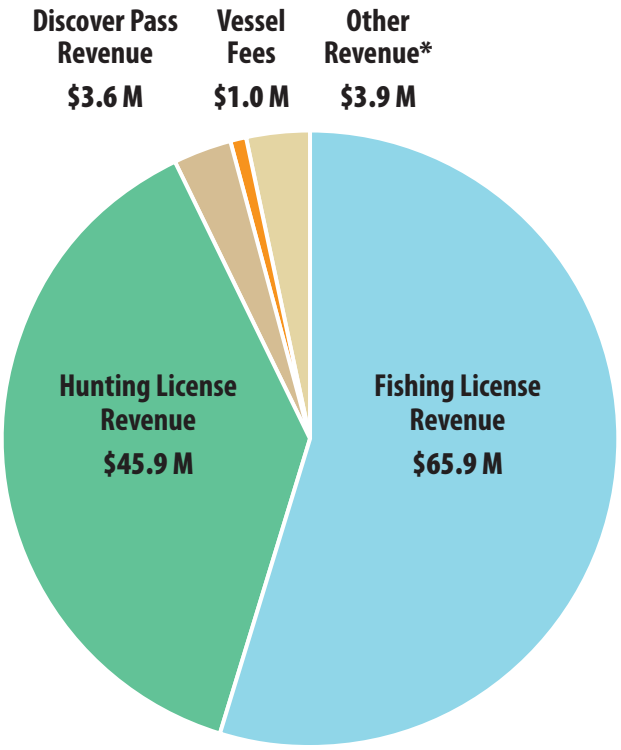
With a long-term funding plan in place, the department is preparing budget and license fee proposals for the Governor and Legislature to (1) eliminate the projected $30 million shortfall, and (2) make strategic, focused investments that will provide long-term benefits.

**Closing the $30 million gap:**

This proposal will avoid cuts and preserve current services in the following programs:

- Wildlife conflict prevention and response ($4.4 million)
- Shellfish enforcement and consumer protection ($2.5 million)
- Land management ($2.7 million)
- Hatchery operations and fisheries management ($9 million)
- Hunting management, including hunter education ($3.2 million)
- Recovery of at-risk species and prevention of invasive species ($3.5 million)
- Columbia River Salmon and Steelhead Endorsement program ($3.3 million)
- Customer service support ($1.9 million)

## WDFW Sources of User Fee Revenue (2015 – 2017)




**Strategic investments for the future:**

Whenever the department talks with conservation and recreation groups and the businesses that depend on Washington's outdoor economy – people who deeply understand the state's fish and wildlife management history – they stress the importance of not just reacting to today's challenges, but anticipating the needs of future Washingtonians.

The department's advisory group was emphatic in this regard, essentially telling WDFW to try to secure the funding needed to implement the mission. The state Fish and Wildlife Commission, which provides policy direction to the department, agreed.

With that guidance in mind, WDFW is developing several budget enhancement requests for the 2019-21 budget cycle, which begins in the summer of 2019. Elements include:

- **Conservation investments** in such programs as salmon recovery, watershed health, biodiversity, and conservation enforcement ($14.7 million)
- **Improved land management.** ($3.6 million)
- **Expanded fishing opportunities and hatchery improvements** ($5.6 million)
- **Hunting enhancements,** including improved law enforcement and access ($3.5 million)
- **Orca recovery** (amount TBD)

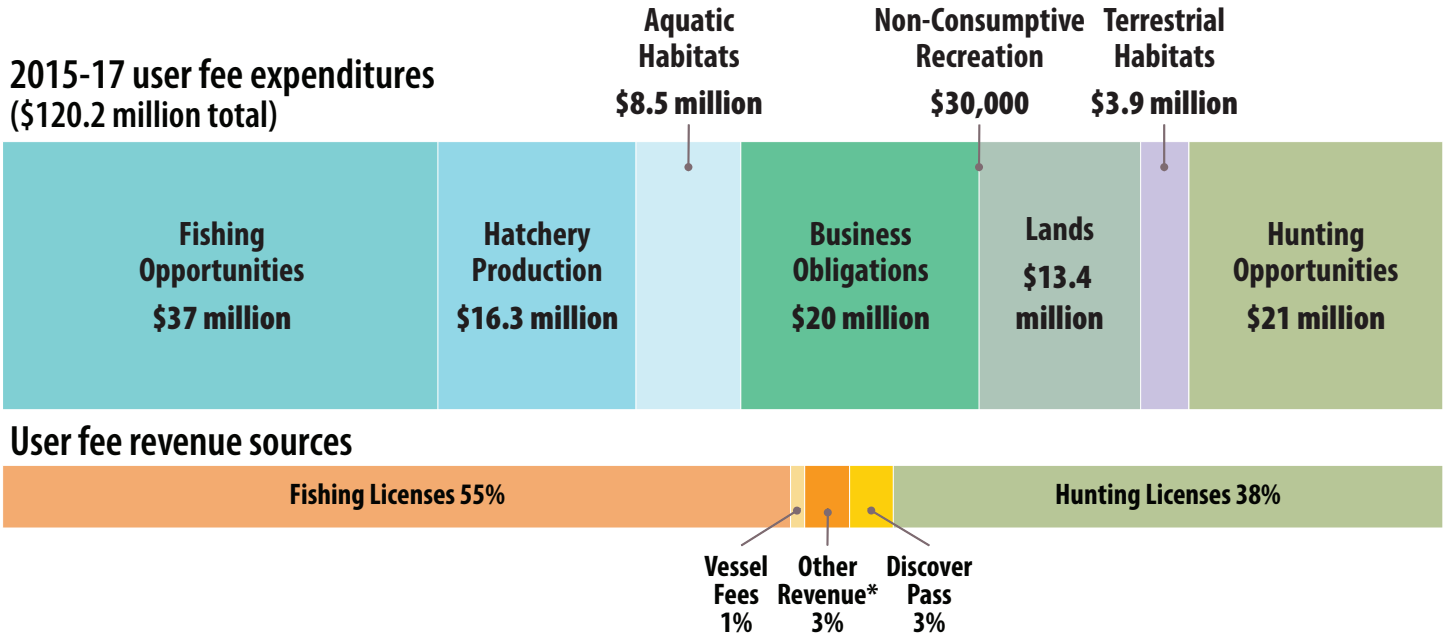
## So, where should new money come from?

The department's proposals to avoid deep budget cuts and make targeted investments will total about $60 million. In the current proposals, about two-thirds of the requests are identified as appropriate to be funded from the state general fund, while license fees would comprise the remaining third.

The department is exploring two concepts for recreational license fee increases: Either a 12-15% across-the-board increase on all license products or a single annual $10 fee charged to each customer (with $3 fee charged for temporary licenses). The final amount depends on the strategic investments and the amount provisioned by the state general fund. (See below for a breakdown on how WDFW spends user fees.)

The department's efforts now will be to refine the budget requests and align the fund sources and amounts based on feedback heard this summer.

## How WDFW spends user fees




* Other revenue includes: non-report penalties, sales of property, income from property, firearm permits, hydraulic permits, and miscellaneous revenue.

# 2018 Cowlitz Trout Hatchery Releases – Summary

The Cowlitz Trout Hatchery is owned by Tacoma Power and operated by the Washington Department of Fish and Wildlife (WDFW). Overall, we estimate that 1,311,000 summer-run steelhead, winter-run steelhead and cutthroat trout were released this year. This is 95% of the release goal of 1,385,000.

We implemented new techniques this year to improve how we estimated the number of fish released:

1) We previously used only a single method to estimate the number of fish released: a conductance counter. This year, we added another method, a Passive Integrated Transponder (PIT) tag array. We also instituted three new analytical estimation approaches. The conductance counter and PIT tag array systems generated very similar counts; this redundancy gives us greater confidence in the overall results.
2) The conductance counter counts by sensing an electrical current. It does not function well with size variations. When fish of different sizes were allowed to volitionally exit at the same time, it made it difficult to calibrate the counter appropriately. This year, we compartmentalized the stocks and released them separately throughout April and May, which meant that fish of the same size went through the counter at the same time. We also spaced out the releases, which gave more recovery time in between big pulses of fish leaving.
3) We sent the counter in for assessment, repair and laboratory calibration, performed 15 calibration trials, added a camera system for finer chronological control and monitoring, and compared daily results with the PIT tag array results.

Although the success we found with these new techniques is promising, we unfortunately had disease issues at the egg stage with summer-run steelhead and cutthroat trout. However, once ponded, all species had high overall survival rates. The hazing techniques performed by U.S. Department of Agriculture (USDA) personnel resulted in fewer birds observed at the hatchery ponds.

Despite the disease setback this year, we believe the new methodologies and analytic estimation approaches are a huge step in the right direction, but we continue to focus on other ways we can improve, including:

- Adapting these approaches each year as needed
- Exploring increased estimation measures prior to ponding
- Continuing to work on creating more effective communication between our organizations

In addition to operating costs, Tacoma Power has budgeted $8 million for improvements at the Cowlitz Trout Hatchery. The master plan for these improvements is scheduled to be done by October. Engineering design should begin in December and we expect construction to begin in 2019.

## CRAG Member Affliliations

| | |
|---|---|
| **Anthony Crocco** | |
| Primary | Fishermen on the Upper Cowlitz Basin, Scanewa |
| Other | also the Cispus River and upper Tilton River |
| **Bob Reid** | |
| Primary | The Cowlitz Plan for Restoration - Fish |
| Other | |
| **Butch Smith** | |
| Primary | Illwaco Charter Association |
| Other | Illwaco Port Commissioner |
| **Carl Burke** | |
| Primary | Northwest Sportsfishing Industry Association |
| | Northwest Marine Trade Association |
| **Cody Clark** | |
| Primary | Bob's Sporting Goods |
| **Dan Tudor** | |
| Primary | Sports fishermen |
| **David Passmore** | |
| Primary | Outdoors sport fisherman |
| **Don Glaser** | |
| Primary | Friends of the Cowlitz |
| **Gene Tripp** | |
| Primary | Sports fishermen |
| **Greg King** | |
| Primary | Friends of the Cowlitz |

| | |
|---|---|
| **Hank Emond** | |
| Primary | Sports fishermen |
| **Jack Tipping** | |
| Primary | CCA |
| Other | Chapter 57 Muskies, Inc., AFS, National Geographic, AARP |
| **James Shinn** | |
| Primary | CCA |
| Other | Cowlitz River Guides Association |
| **Jon Vigre** | |
| Primary | CCA |
| **Larry Pryor** | |
| Primary | Northwest Fisheries Enhancement |
| Other | CCA, a Cowlitz river Fisherman, NSIA member |
| **Lonnie Goble** | |
| Primary | East Lewis County Fishermen |
| **Paul Ockerman** | |
| Primary | NW Guides and Anglers Association |
| **Randy LeDuc** | |
| Primary | CCA |
| **Rudy Salakory** | |
| Primary | Cowlitz Indian Tribe’s Natural Resources Department |
| **Stan Bartle** | |
| Primary | Fishermen on the Tilton |

**Cowlitz River Hatchery Program Option Assessment**
For CRAG discussion 9/21/18

**Objective:** To evaluate potential options for restructuring and/or increasing hatchery production to optimize programs to meet conservation and harvest goals.

## Spring Chinook

**Program purpose:** Conservation (Reintroduction/Recovery) and Harvest

**Current Production:** 1.74 Million (500K @16fpp, 800K @ 8fpp, and 440K @ 5fpp)
**ESA maximum:** TBD during consultation (initial modeling suggests this may be up to 2.5 Million)

- ❖ Limiting Factors
    - o Early Rearing constraints – Hatchery at capacity with current program size, suite of release strategies, and other hatchery programs (i.e., coho and fall Chinook).
- ❖ Options

1) Use existing infrastructure differently.
    a. Use Mayfield net pens for a portion of coho instead of fall Chinook
    b. Leave fall Chinook in hatchery instead of moving to net pens
    c. Raise ~165K spring Chinook from 16 fpp group to 5 fpp.

    Benefits:
    - Increased SAR on ~165K group reared to 5 fpp

    Risks:
    - Coho in Mayfield lake net pens is untested (Disease, predation, environmental).
    - Requires coho to be reared for 6 months in net pens vs. 2 months for fall Chinook.
    - Increased security and disease risk.
    - Increased stress due to increased transportation.

    Costs:
    - Additional trucking costs for coho to net pens and back for release
    - Additional security costs
    - Additional feed and therapeutant cost for spring Chinook grow-out (~165K) group
    - Additional operational budget (i.e., increased staffing, vehicles, etc.)
    - Estimated Cost: ~$200K additional operational budget per year.

2) Construct net pens capable of holding entire current coho program.
    a. Construct net pen array at a reservoir location (ideally Mossyrock hatchery site) capable of holding 2.2M coho.
    b. Leave fall Chinook in hatchery instead of moving to net pens
    c. Raise the 500K 16 fpp spring Chinook group to 5 fpp.

Benefits:

- Increased SAR on 500K group reared to 5 fpp

Risks:

- Coho in Mossyrock net pens (or other reservoir location) is untested (Disease, predation, environmental).
- Requires coho to be reared for 6 months in net pens vs. 2 months for fall Chinook.
- Increased security and disease risk.
- Increased stress due to increased transportation.
- No volitional release capability for coho – all trucked releases

Costs:

- Additional trucking costs for coho to net pens and back for release
- Additional security costs
- Additional feed and therapeutant cost for spring Chinook grow-out (500K) group
- Additional operational budget (i.e., increased staffing, vehicles, etc.)
- Estimated: $3.2M capital investment (one-time) and $270K additional operational budget per year.

3) Construct raceway (with reuse water) capable of holding entire current coho program.
    a. Construct additional raceways at Cowlitz Salmon Hatchery and upgrade pollution abatement (PA) pond.
    b. Leave fall Chinook in hatchery instead of moving to net pens
    c. Raise the 500K 16 fpp spring Chinook group to 5 fpp.

Benefits:

- Increased SAR on 500K group reared to 5 fpp

Risks:

- Some additional disease risk to coho production

Costs:

- Additional feed and therapeutant cost for spring Chinook grow-out (500K) group
- Additional operational budget (i.e., increased staffing, vehicles, etc.)
- Estimated: $TBD (one-time) and $TBD additional operational budget per year.

4) Revamp kettles at Cowlitz Salmon Hatchery to increase capacity for Spring Chinook grow-out.
    a. Additional 500K spring Chinook (above current program) released at 16 fpp in November.

Benefits:

- Additional spring Chinook production

Risks:

- Minimal additional operational risk

Costs:

- Additional feed and therapeutant cost for additional spring Chinook (500K @16 fpp)
- Estimated: $8.16M capital investment (one-time) and $294K additional operational budget per year.

5) Construct rearing ponds, PA upgrade and additional intake at Cowlitz Salmon Hatchery to increase capacity for Spring Chinook grow-out.
    a. Additional 500K spring Chinook (above current program) released at 5 fpp in March.

Benefits:

- Additional spring Chinook production

Risks:

- Minimal additional operational risk

Costs:

- Additional feed and therapeutant cost for additional spring Chinook (500K @5 fpp)
- Estimated: $14.2M capital investment (one-time) and $390K additional operational budget per year.

## Coho

**Program purpose:** Conservation (Reintroduction/Recovery) and Harvest

**Current Production:** 2.178 Million (@ 15fpp)
**ESA maximum:** TBD during consultation (initial modeling suggests this may be up to 2.978 Million)

- ❖ Limiting Factors
    - o Early Rearing constraints – Hatchery at capacity with current program size and other hatchery programs (i.e., spring and fall Chinook).
- ❖ Options

1) Construct rearing ponds, PA upgrade and additional intake at Cowlitz Salmon Hatchery plus net pen array in reservoir or re-use raceways.

    a. Additional 800K coho (above current program) released at 15 fpp in April

Benefits:

- Increased coho production

Risks:

- Minimal additional operational risk if production remains on-site in re-use raceways.
- Coho in Mossyrock net pens (or other reservoir location) is untested (Disease, predation, environmental).

- Requires coho to be reared for 6 months in net pens vs. 2 months for fall Chinook.
- Increased security and disease risk.
- Increased stress due to increased transportation.
- No volitional release capability for coho – all trucked releases

Costs:

- Additional feed and therapeutant cost for additional coho
- Estimated: $7.1M capital investment (one-time) and $320K additional operational budget per year.

## Winter Steelhead

**Program purpose:** Conservation (Reintroduction/Recovery) and Harvest

**Current Production:** 647K (Lower Cowlitz 481K, Upper Cowlitz 118K and Tilton48K)
**ESA maximum:** TBD during consultation (winter and summer program sizes are co-dependent). Re-implementation of an early-timed program will likely reduce the overall allowable steelhead production under ESA.

❖ Options

1) Current path – expansion of integrated late winter steelhead program run-timing.
2) Implement segregated early-timed winter steelhead program using Big Creek stock.
3) Development of segregated early-timed winter steelhead program from local broodstock (within strata)
    a. Sources: Cowlitz stock or Kalama stock
    b. Use Big Creek stock in the interim during development

## New Facility and/or Remodel of Existing Facilities

An alternative to the above options is to construct a new facility or an expansive remodel of an existing facility.

Benefits:

- Ability to increase hatchery production up to ESA constraints to provide fish for reintroduction/recovery and harvest opportunity
- More flexibility to meet conservation and harvest goals.
- Reduce reliance on off-site rearing and the associated risk and cost.

Risks:

- Lowest risk option from a fish production standpoint

Costs:

- Estimated: $40M capital investment (one-time) and $1.2M additional operational budget per year.

September 14, 2018

To: Cowlitz River Advisory Group Members
From: Jack Tipping
Subject: Cowlitz River Hatchery Spring Chinook status update

As you may recall, a few years ago I expressed grave concern about changes in the Cowlitz Hatchery Spring Chinook program (Table 1). These changes were contrary to agency recommendations, based on extensive program analysis, of releasing fish at 5/lb in March (WDF, 1991). Numbers wise, only 28% of the current program complies with the 1991 recommendation.

Alarmingly, the March @ 8/lb release was made despite the WDFW 2002-2006 size at release study at the Cowlitz Hatchery by John Morrison (WDFW fish health specialist) which showed about 25% greater survival for 5/lb fish compared to 10/lb fish (Table 2). When I asked Keith Underwood why the change to 8/lb, he told me that he didn't believe Morrison's results because he had not reviewed the experimental design beforehand.

I recently queried the coded-wire tag database to ascertain survivals of the 2013-2015 releases to compare March @ 5/lb survivals to the November @16/lb and March @ 8/lb releases (mini-jacks excluded from all groups). Results show that the March @ 5/lb had 733% greater survival than the November @16/lb group and 76% greater survival than the March @ 8/lb group (Table 3). Based on observed survivals, the current program produced 9,000 adult fish. If all fish had been released in March @ 5/lb, production would have been 15,840 adult fish, a 76% improvement.

In hopes of gaining insight to future returns, I queried the CWT database to see if there was a relationship between spring Chinook mini-jack returns versus jack returns and adult survivals. As you know, mini-jacks are sexually mature males that return 10-12 inches in length a few months after release. There are two major influences to mini-jack returns, hatchery and ocean. Hatchery influences include body size, feeding regimes, genetics, etc. Ocean influences are food and predator abundance; if there is an abundance of food and few predators, more mini-jacks will return than with sparse food and high predator abundance.

I queried 256 CWT groups of Cowlitz Hatchery spring Chinook releases going back to 1973. The results showed a strong relationship between mini-jack returns and jack returns the following year and with subsequent adult survivals (Table 4). Broodyears with a large abundance of mini-jacks had high adult survivals and broodyears with low abundance of mini-jacks had poor adult survival. There was no group that had a high abundance of mini-jacks and low adult survival and conversely, no group with a low number of mini-jacks had high adult survival. According to the model, to obtain 1% adult survival (about 10,000 adults to the hatchery), a broodyear would need to return about 1,800 mini-jacks.

In looking at hatchery returns of mini-jacks and adult returns since 2009 (Table 5), the 2013 return of 3,422 mini-jacks corresponds to relatively large adult return numbers in 2015 and 2016. The lower mini-jack returns in 2015 and 2016 corresponds to the modest adult returns in 2018. What is extremely alarming is the mini-jack returns in 2016, 2017 and 2018. If the model continues to hold true, Cowlitz spring Chinook returns will be abysmal for the next several years and we can expect limited sport fishing. If we can shift the releases to 5/lb in March, at least the adult survivals will increase by 76%, even though that won't help for several years.

Table 1. Current Cowlitz Spring Chinook hatchery program.

| Month | Number | Size |
|---|---|---|
| Nov | 500,000 | 16/lb |
| Mar | 800,000 | 8/lb |
| Mar | 500,000 | 5/lb |

Table 2. John Morrison's Cowlitz Hatchery Spring Chinook size at release study (survival, excludes minijacks).

| Release yr | 15/lb | 10/lb | 5/lb |
|---|---|---|---|
| 2002 | 1.10 | 1.64 | 2.49 |
| 2003 | 0.99 | 1.12 | 1.16 |
| 2004 | 0.14 | 0.55 | 0.78 |
| 2005 | 0.04 | 0.19 | 0.39 |
| 2006 | 0.13 | 0.31 | 0.40 |
| AVG | 0.48(%) | 0.76(%) | 1.04(%) |

Table 3. Survivals from current Cowlitz Hatchery Spring Chinook program.

| Release | Code | size(mm) | Smolts | Jacks(%) | Adults(%) |
|---|---|---|---|---|---|
| Nov 2013 | 5673 | 139 | 99,986 | 36 (0.04) | 175 (0.18) |
| Mar 2014 | 6267 | 170 | 98,393 | 174 (0.18) | 836 (0.85) |
| Mar 2014 | 6266 | 191 | 95,994 | 170 (0.18) | 1,349 (1.41) |
| | | | | | |
| Nov 2014 | 6641 | 131 | 92,840 | 12 (0.01) | 44 (0.05) |
| Mar 2015 | 6642 | 164 | 94,949 | 137 (0.14) | 146 (0.15) |
| Mar 2015 | 6643 | 185 | 95,258 | 204 (0.21) | 334 (0.35) |

| AVG | | Jacks(%) | Adults(%) |
|---|---|---|---|
| Nov | 16/lb | 0.03 | 0.12 |
| Mar | 8/lb | 0.16 | 0.50 |
| Mar | 5/lb | 0.20 | 0.88 |

Table 4. Mini-jack returns to the hatchery, jack returns to the hatchery and adult survival of coded-wire tagged groups of spring Chinook from the Cowlitz Salmon Hatchery.

| Minijacks (% of release) | Jack returns (%) 1 yr later | Adult survival (%) | Number of tagged groups |
|---|---|---|---|
| >0.50% | 0.22 | 5.84 | 25 |
| 0.10-0.49% | 0.09 | 1.51 | 74 |
| 0.05-0.10% | 0.10 | 1.14 | 40 |
| 0.00-0.05% | 0.04 | 0.55 | 117 |

Table 5. Mini-jacks and adult spring Chinook returns to the hatchery.

| Year | Mini-jacks | Adult returns |
|---|---|---|
| 2009 | 1,892 | |
| 2010 | 1,167 | |
| 2011 | 406 | 2,210 |
| 2012 | 342 | 5,838 |
| 2013 | 3,422 | 4,015 |
| 2014 | 1,338 | 4,768 |
| 2015 | 1,024 | 17,602 |
| 2016 | 410 | 14,930 |
| 2017 | 92 | 8,784 |
| 2018 | 46 | 2,700 |

References

Washington Department of Fisheries, 1991. Analysis of the Cowlitz Spring Chinook Program. Salmon Culture Division, Assessment and Development Section.