

Atlantic salmon commercial aquaculture in Washington State

Briefing for WDFW Commission

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*Washington
Department of*
**FISH and
WILDLIFE**

Briefing Outline

- History of Atlantic salmon in Washington State
- WDFW statutory authority
- Atlantic salmon aquaculture in Washington State today (Cooke Aquaculture)
 - Location of net-pens
 - Life-cycle of fish from eggs to market
 - Fish health concerns
 - Disease transmission
 - Antibiotic use
- Cypress Island #2 accident
- Monitoring efforts

Brief Abridged History of Atlantic Salmon in Washington State

- **1951 – 1981:** WA Dept. Fisheries released approximately 76,000 smolts in an effort to establish naturally spawning populations. All attempts failed
- **1972:** First Atlantic salmon farm on the Pacific Coast established by NOAA at Manchester
- **1982:** Atlantic salmon farms in Washington large enough to be economically viable
- **1996:** 107,000 Atlantic salmon escape net-pen
- **1997:** 369,000 Atlantic salmon escape net-pen
- **1999:** 115,000 Atlantic salmon escape net-pen
- **2016:** Cooke Aquaculture purchases Icicle Seafoods and runs existing net-pens as Cooke Aquaculture Pacific
- **August 2017:** 160,000 Atlantic salmon escape Cypress #2 net-pen

WDFW Statutory Authority — Atlantic Salmon Net Pens

- **Washington Dept. of Agriculture**

- **RCW 15.85** – Aquaculture Marketing (WDFW’s role in aquaculture disease monitoring)
- **RCW 16.36** – Animal Health (WDFW is responsible for disease inspection, prevention, and control programs of farm-raised fish)

- **Washington Dept. of Fish & Wildlife**

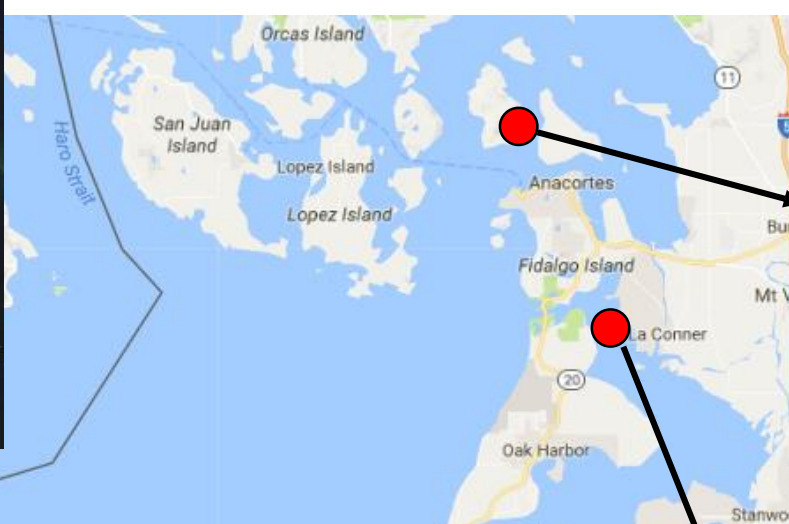
- **RCW 77.12.455** – Inspection and disease control of aquatic farms
- **RCW 77.115** – Aquaculture Disease Control
- **RCW 77.125** – Marine Finfish Aquaculture Programs
- **WAC 220-370** – Aquaculture

WDFW Activities Associated with Regulatory Authority

- **Aquaculture registration** – renewed automatically each year if compliant with reporting requirements (# of fish harvested)
- **Marine aquaculture permit (net-pens)** – issued by WDFW Director for 5-year period. Permit can be conditioned
 - Requires an approved escapement prevention plan (WAC)
 - Requires an approved escapement reporting and recapture plan (WAC)
 - Requires an approved pathogen/disease monitoring plan (no WAC)
- **Aquaculture facility inspection:** prevention and suppression of disease; monitor for escapees
- **If disease outbreak, Director may order actions** to protect fisheries resources of the state
- **Issue transport permits** – contingent on fish health (regulated pathogens)
- **Comprehensive monitoring program:** WDFW and Cooke Aquaculture working with NWIFC and WA Dept. Agriculture to develop monitoring for net-pens

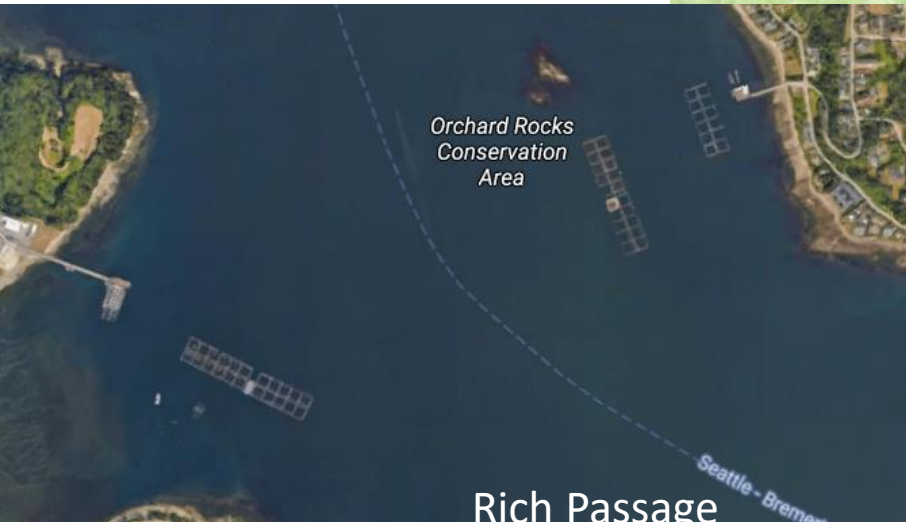
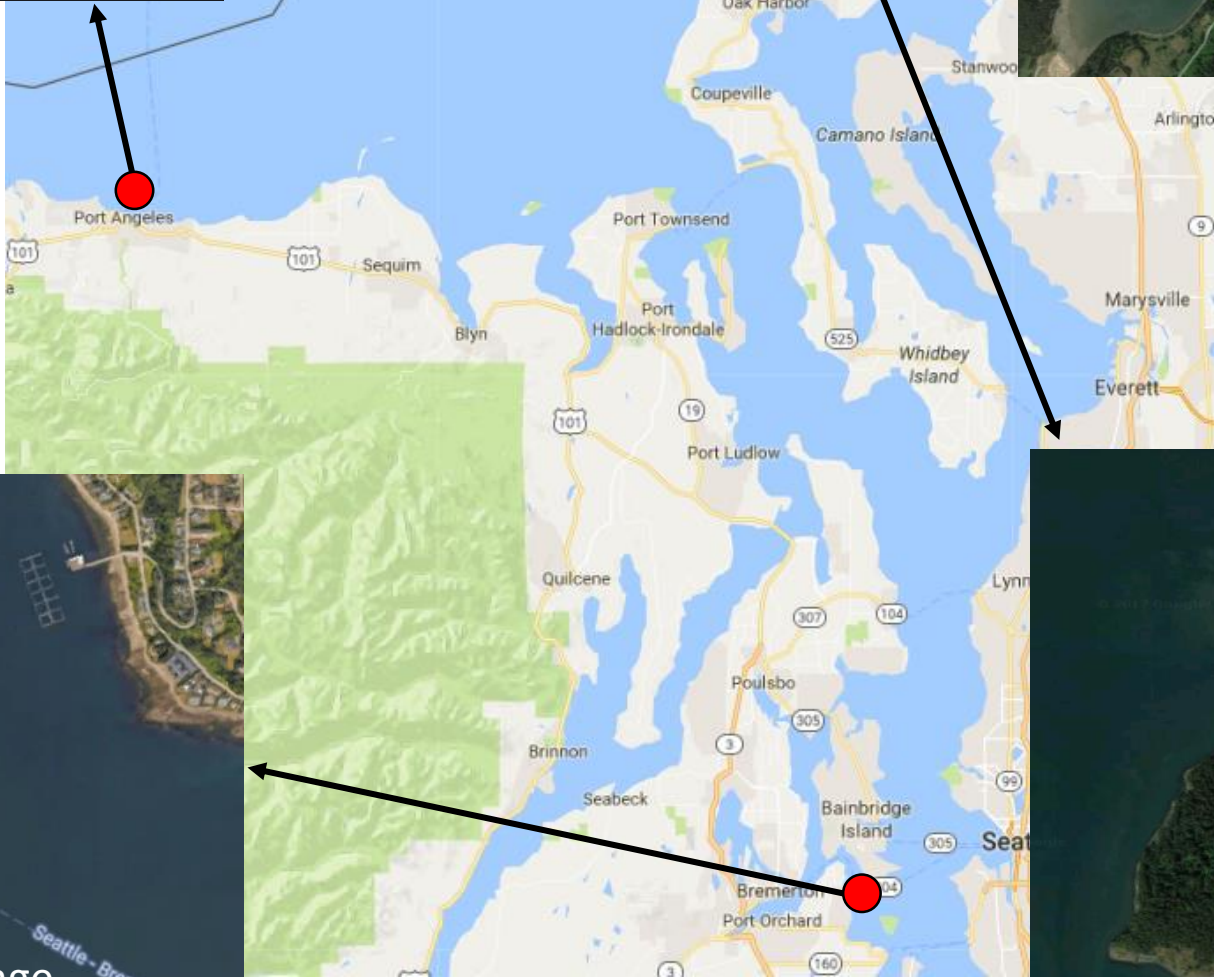


Port Angeles



Cypress Is.

Cooke Aquaculture
Atlantic Salmon Net Pens

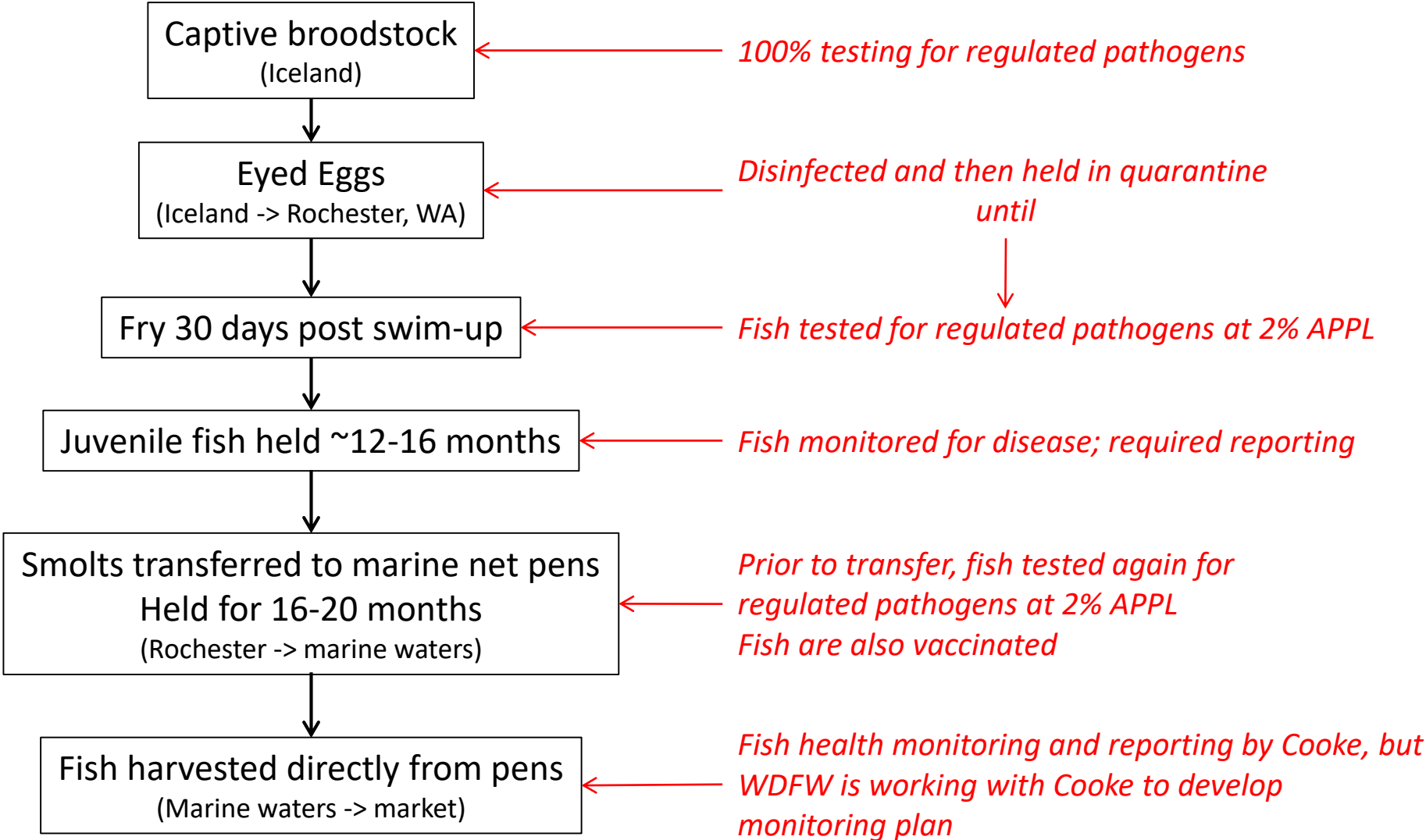


Rich Passage



Hope Is.

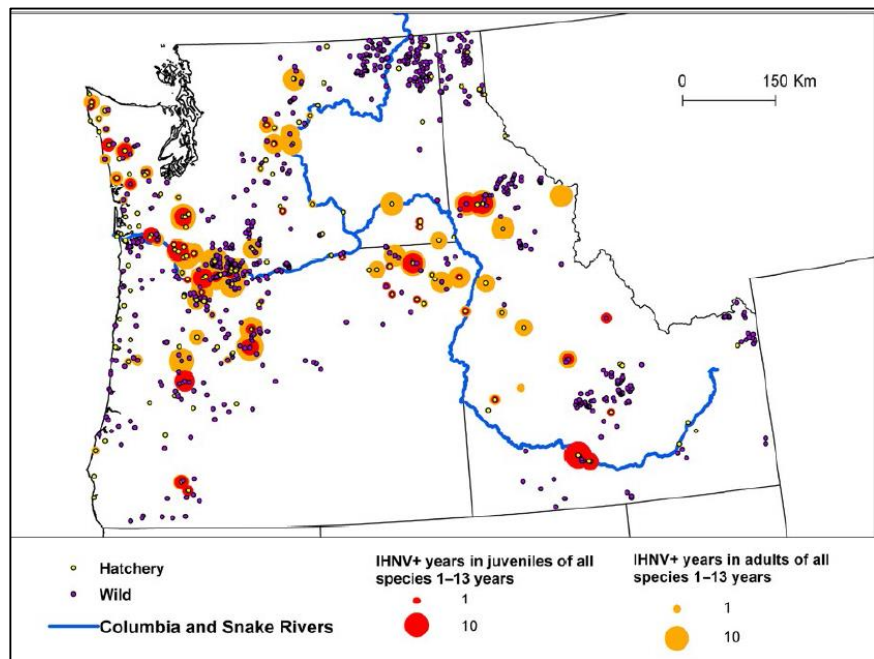
Life cycle of commercial net pen Atlantic salmon (Cooke Aquaculture in Puget Sound)



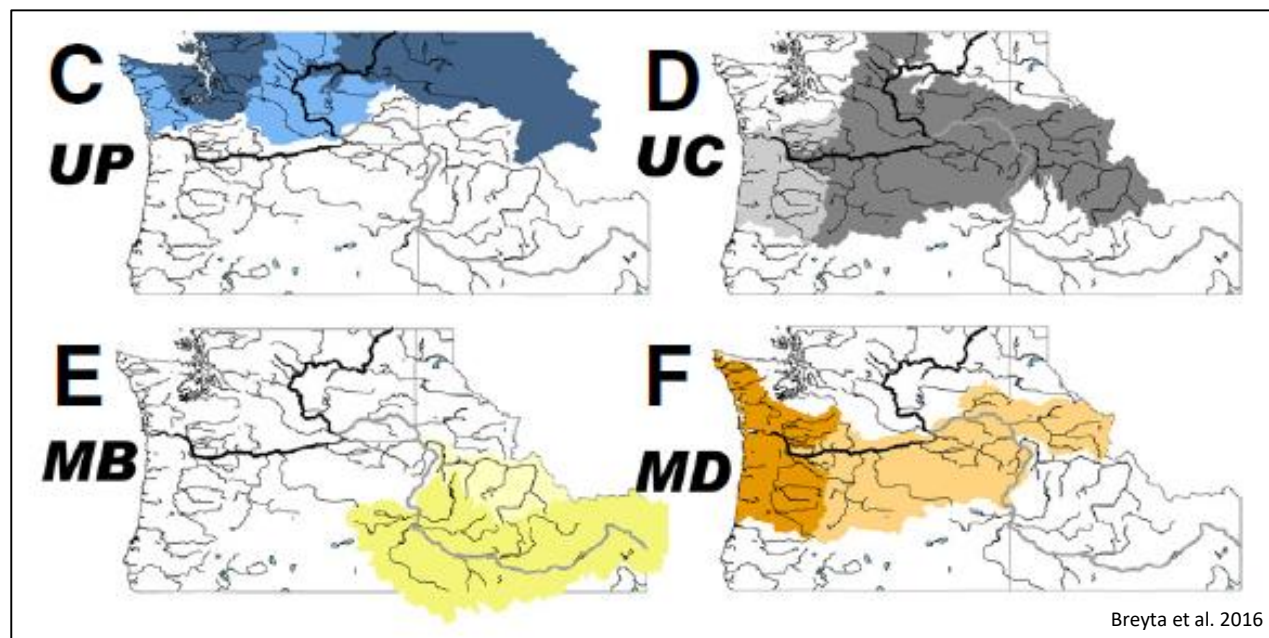
Current Fish Health Concerns Related to Atlantic Salmon Aquaculture in Puget Sound

- Disease transmission
 - Infectious Hematopoietic Necrosis Virus – IHNV
 - Piscine Orthoreovirus (PRV) and “Heart and Skeletal Muscle Inflammation” (HSMI)
 - Sea Lice
- Use of antibiotics in feed

Infectious Hematopoietic Necrosis Virus - IHNV



Breyta et al. 2017



Breyta et al. 2016

Host Species	MB	MD	UC	UP
Sockeye	0	1%	6%	87%
Rainbow	82%	15%	2%	2%
Steelhead	13%	71%	30%	5%
Chinook	5%	13%	62%	7%
	High Mortality	High Mortality	Low Pathogenicity (Low Mortality)	High Mortality

Adapted from Breyta et al. 2016 & Kurath (Pers. Com 2017)

IHNV – Risks to Pacific Salmonids from Atlantic Salmon

- **Concern** (expressed by public):

- Atlantic salmon amplify, make more virulent, and shed virus particles putting at risk native salmon as they swim past net-pens
- 2012 outbreak of IHNV at Rich Passage facilities

- **Discussion:**

- IHNV is a regulated pathogen and fish are tested prior to transport
- Highly unlikely Atlantic salmon will introduce an exotic strain of IHNV
- IHNV in Puget Sound = UP clade; UP clade = low virulence in Chinook, Steelhead, Chum; high virulence in sockeye (confirmed UP clade in 2012 outbreak)
- In 2012 highly likely IHNV was transmitted from free-ranging sockeye to Atlantic salmon
- Dose of shed viral particles from 2012 outbreak lower than that required to infect Chinook, Steelhead, or Chum

- **Conclusion:**

- **Low risk that Chinook, Steelhead, or Chum populations will be negatively affected by the occurrence of IHNV in Atlantic salmon net pens**

Piscine Orthoreovirus (PRV) and “Heart and Skeletal Muscle Inflammation” (HSMI)

- **Concern (expressed by public):**

- PRV is the causal agent of HSMI. HSMI is deadly disease. Atlantic salmon will amplify and shed virus particles putting at risk native salmon as they swim past net-pens.

- **Discussion:**

- WDFW and co-managers do not test for PRV at our facilities; not a regulated pathogen
- PRV is the casual agent of HSMI in farmed Norwegian Atlantic salmon. HSMI is a syndrome or condition recognized from histopathology. It can lead to death of the fish.
- HSMI has not been reported in any wild populations of salmonids in Norway or in North America
- PRV present in Pacific Northwest since at least 1977, before Atlantic salmon were imported for commercial aquaculture
- High levels of PRV genetic material have been detected in wild and cultured salmonids with no evidence of HSMI, including Chinook, Coho, Pink, and Steelhead in Washington
- HSMI recently described as statistically associated with PRV at an Atlantic salmon farm in BC; laboratory studies in BC on Atlantic salmon indicated no association with presence and transmissibility of PRV and HSMI
- Association between PRV and HSMI is complicated and may be a function of viral strains, host immune system, and environmental stressors; combination of such factors are not present or active in native salmonids in the Pacific Northwest

- **Conclusion:**

- **The presence of PRV genetic material in Pacific salmon tissues is not sufficient evidence for HSMI disease**

Prevalence of PRV in Washington Pacific Salmonids

(from Purcell et al. 2017)

Species	Region	# Pops Tested	# Pops Positive	# Individ. Tested	# Individ. Positive	% Individ. Tested
Chinook	Col. R	6	4	64	7	11%
	PS & SJF	10	2	153	10	7%
	WA Coast	5	0	90	0	0%
Chum	Col. R	0	0	0	0	na
	PS & SJF	7	0	115	0	0%
	WA Coast	3	0	65	0	0%
Coho	Col. R	5	3	75	4	5%
	PS & SJF	5	2	70	5	7%
	WA Coast	8	6	135	13	10%
Pink	Col. R	0	0	0	0	na
	PS & SJF	7	1	115	1	<1%
	WA Coast	0	0	0	0	na
Sockeye	Col. R	2	0	60	0	0%
	PS & SJF	4	0	95	0	0%
	WA Coast	5	0	110	0	0%
Steelhead	Col. R	9	1	145	1	<1%
	PS & SJF	3	0	100	0	0%
	WA Coast	8	0	130	0	0%
TOTALS		87	19 (22%)	1522	41	2.6%

Sea Lice

- **Concern (expressed by public):**

- Atlantic salmon in net-pens will amplify and transmit sea lice putting at risk native salmon populations

- **Discussion:**

- Sea lice are marine ectoparasitic copepods
 - *Lepeophtheirus salmoni* and *Caligus clemensi*
- Problem for Atlantic salmon farms in Norway, Canada, and elsewhere
 - Affects production, and pest management control problems are implemented
 - Implicated in the transmission of ISAV – now part of USDA Pathogen Control Program in Maine
- Empirical studies and models: transmissibility of sea lice from farmed to wild populations, and with potential declines in wild populations
 - Pink and chum populations in BC
 - Atlantic salmon populations in Norway
- Sea lice in the Puget Sound Atlantic salmon net pens
 - Occur in low numbers, if at all
 - No treatment needed for sea lice in over 10 years



- **Conclusion**

- **Low risk that native salmonid populations in Puget Sound will be negatively affected by sea lice associated with Atlantic salmon net-pens in Puget Sound**

Antibiotics in Feed – Veterinary Feed Directive (VFD)

Facility	Jan-2017	Feb-2017	Mar-2017	Apr-2017	May-2017	Jun-2017	Total
Cypress #1							0
Cypress #2							0
Cypress #3							0
Hope Is		1					1
Clam Bay							0
Fort Ward							0
Orchard Rks							0
Port Angeles				1	1	2	4
WDFW – East		1	1	1	6	3	12 (8)
WDFW - West		2	1	7	5	2	17 (8)

Accidental Release of Atlantic Salmon at Cypress Island #2 (Year 2017)

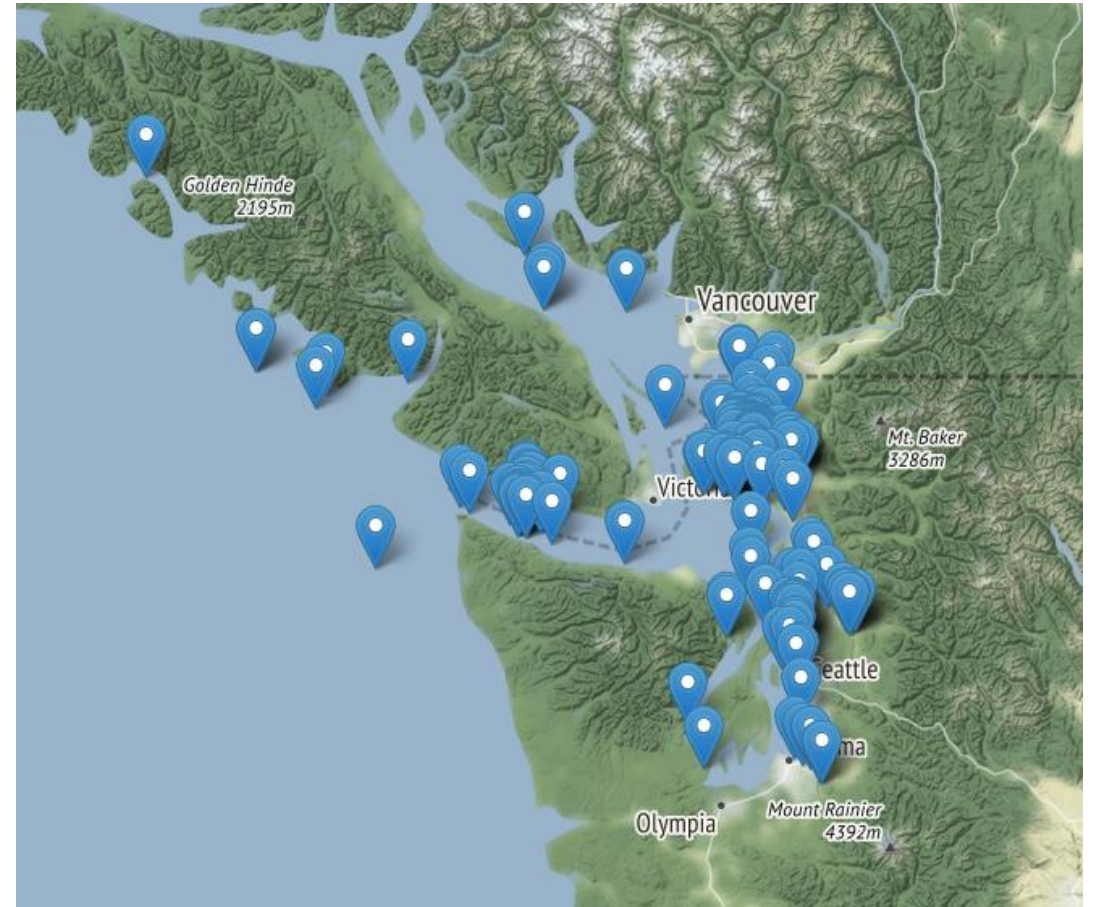
Timeline

- August 19: Accident begins
- August 20: WDFW notified
- August 22: Fisheries begins
- August 23: Daily monitoring
- August 25: Gov. Inslee: no new permits
- August 26: Structure stabilized
- November 9: Formal end of response



Recovery of Escaped Atlantic Salmon

- Total # fish in raft prior to accident = **305,000**
- Total # fish accounted for after accident = **200,927**
 - 145,851 extracted from net pen
 - 55,076 various fisheries
 - Biological data taken
- Total # fish currently unaccounted = **104,073**



Escaped Atlantic Salmon Samples in WDFW Records

(data to help understand potential effects to native salmonids)

Stomach Contents	Sex			Total
	F	M	U	
Empty	9	10	10	29
Pellet	0	1	0	1
Yes	1	0	0	1
No data	3	2	2	7
Total	13	13	12	38

Gonad Development	Sex			Total
	F	M	U	
No	6	11	8	25
Slight	2	0	0	2
Yes	0	1	0	1
No data	5	1	4	10
Total	13	13	12	38

• Fish Health

- Not all fish examined
- Testing not yet completed
- Preliminary Results
 - Tests results from fish caught immediately after accident: Healthy
 - Tests results from fish caught weeks after accident: Many were unhealthy, contracting disease from local pathogens

Ongoing Monitoring Efforts for Escaped Fish

- **Recovery** Atlantic salmon from existing fisheries, if present
- **Monitor** for Atlantic salmon during normal agency operations
 - Spawning grounds
 - Traps, weirs
 - Hatcheries
- **Implement new eDNA** monitoring efforts
 - Test assay in lab ✓
 - Field-test collection methods and assay ✓
 - Develop sampling design ✓
 - Implement

Development of Comprehensive Disease/Pathogen Monitoring Program from Atlantic Salmon Net-pens in Puget Sound

- Funding from USDA-APHIS-VS to WDFW
- 1-year project, ending February 2018
- Cooperative project
 - WDFW, NWIFC, WA Dept. Agriculture
 - Cooke Aquaculture Pacific
 - With technical assistance from NOAA, USGS, USFWS
- Establishes minimum health monitoring, inspection/surveillance, communication/notification/reporting requirements
- Determines which pathogens will be monitored and procedures for testing
- Requirements for biosecurity and disease containment
- Public review of plan (January 2018)