

Parasitic copepods may be important freshwater population regulatory factors by impairing swimming, stress resistance, and being a vector for pathogens

Crystal L. Herron

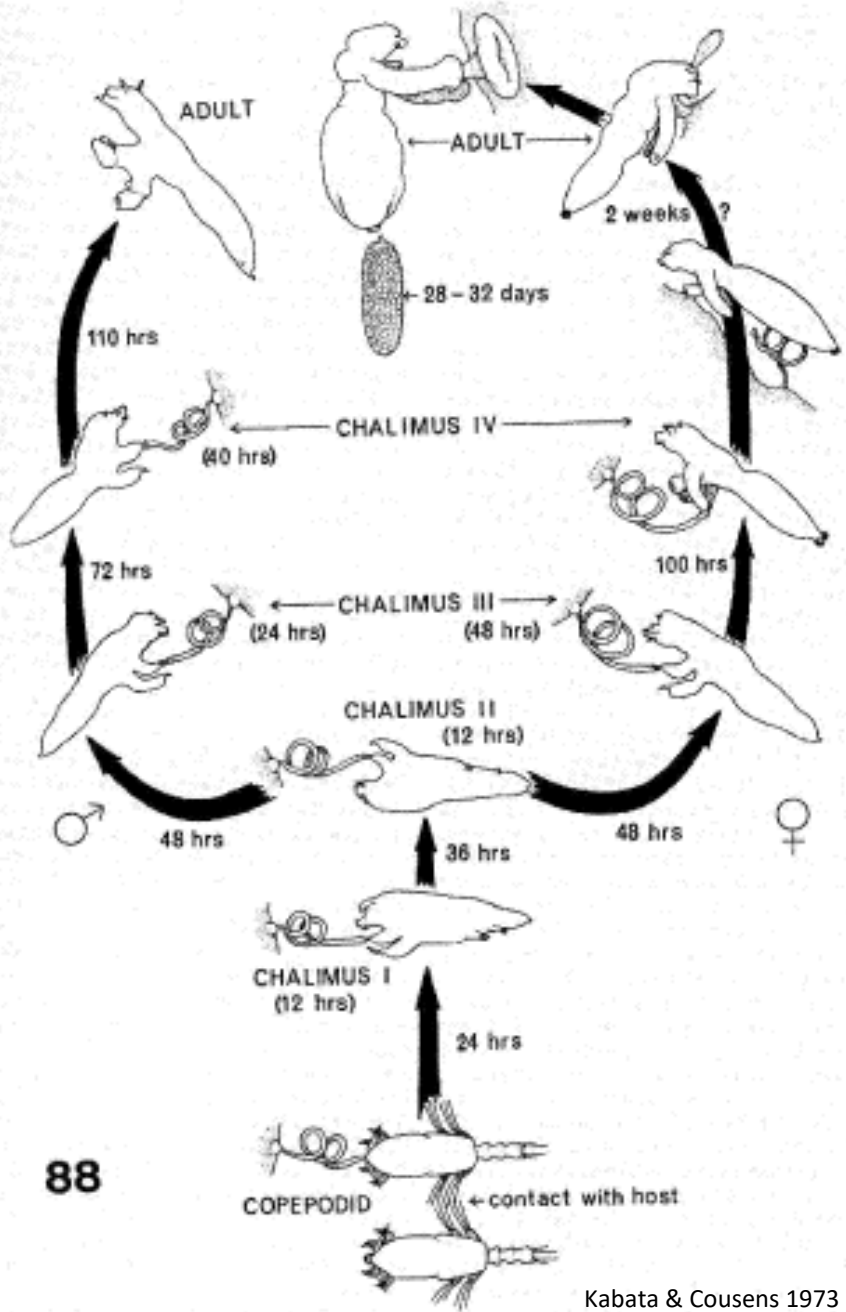
Natassia Ruse, Mike L. Kent, Carl B. Schreck

Presented to WFSR Corvallis, OR.

February 6th, 2018



Salmincola californiensis



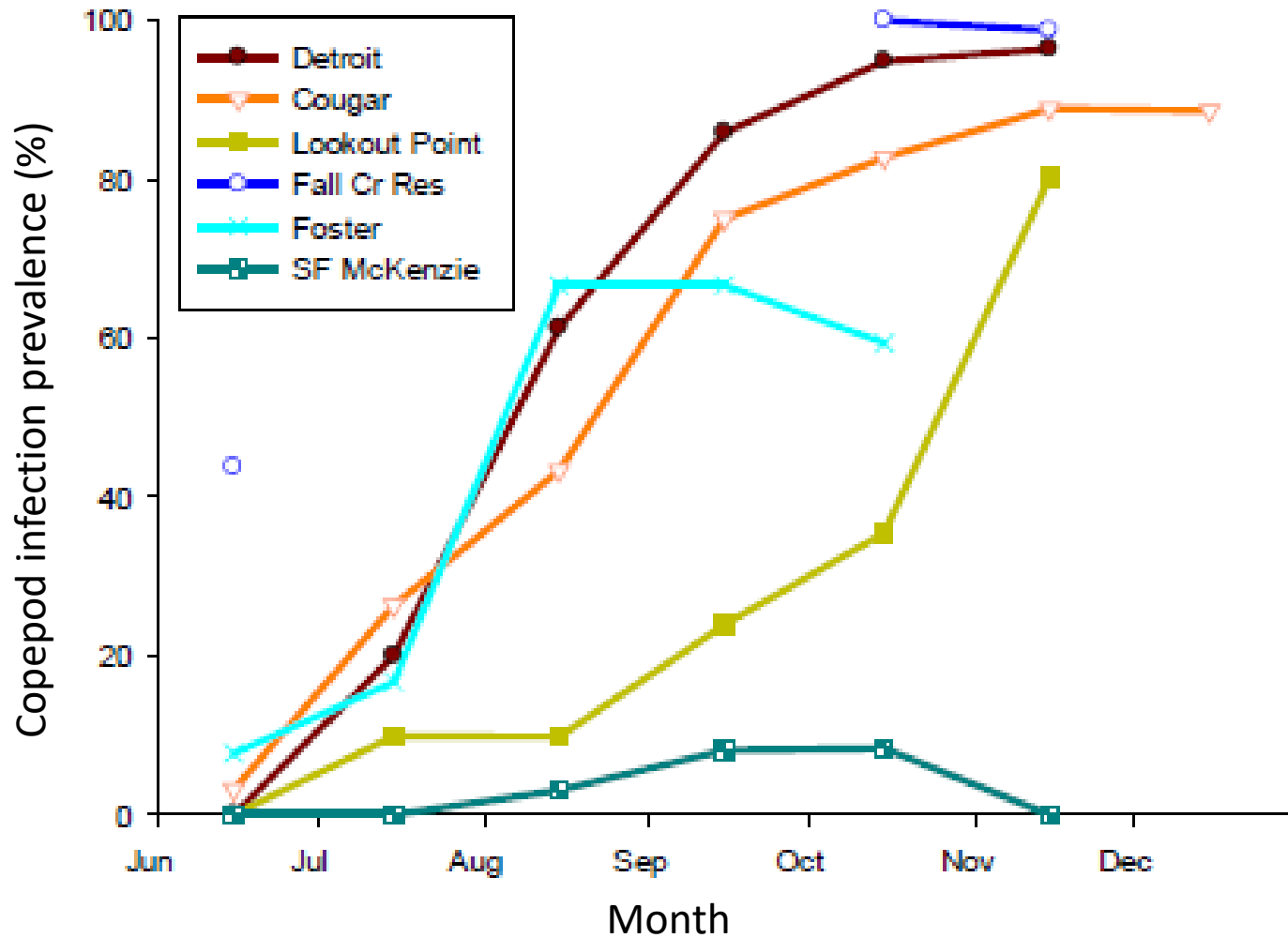
Kabata & Cousens 1973



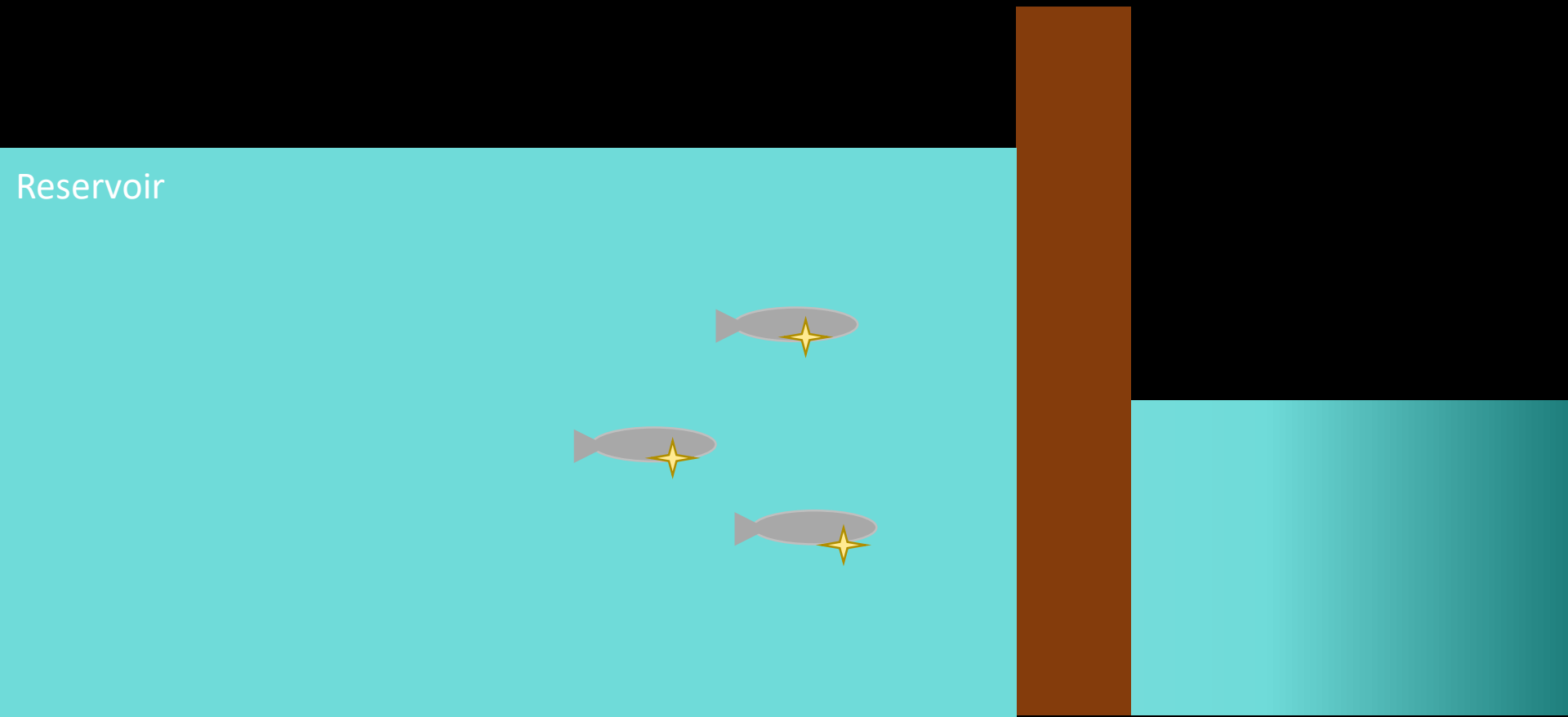
0.50 mm



Ruse



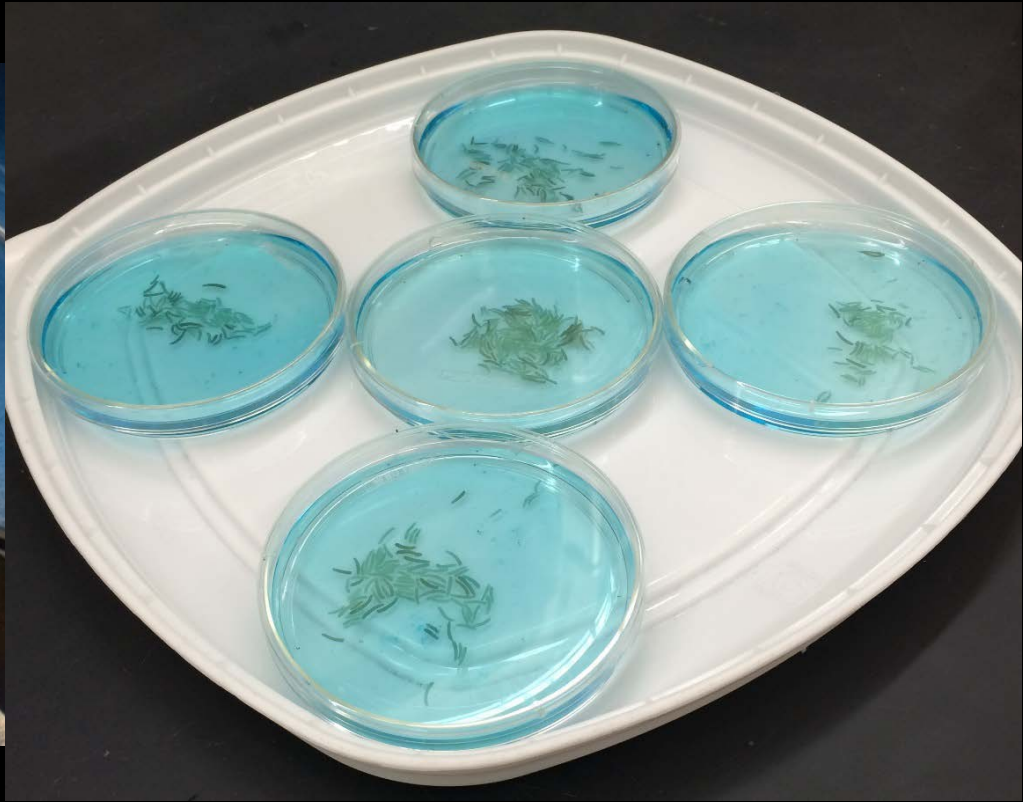
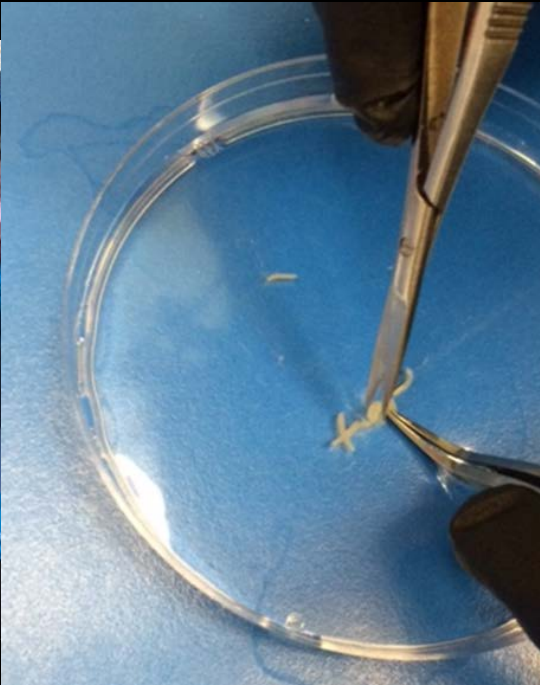
Assess the potential physiologic affect *S. californiensis* could have on juvenile Chinook Salmon



Objectives

1. Create method of copepod infection *
2. Determine if copepod infection impairs fish's physiologic capacity
3. If impairment, is there a tolerable threshold?

Collect & Raise



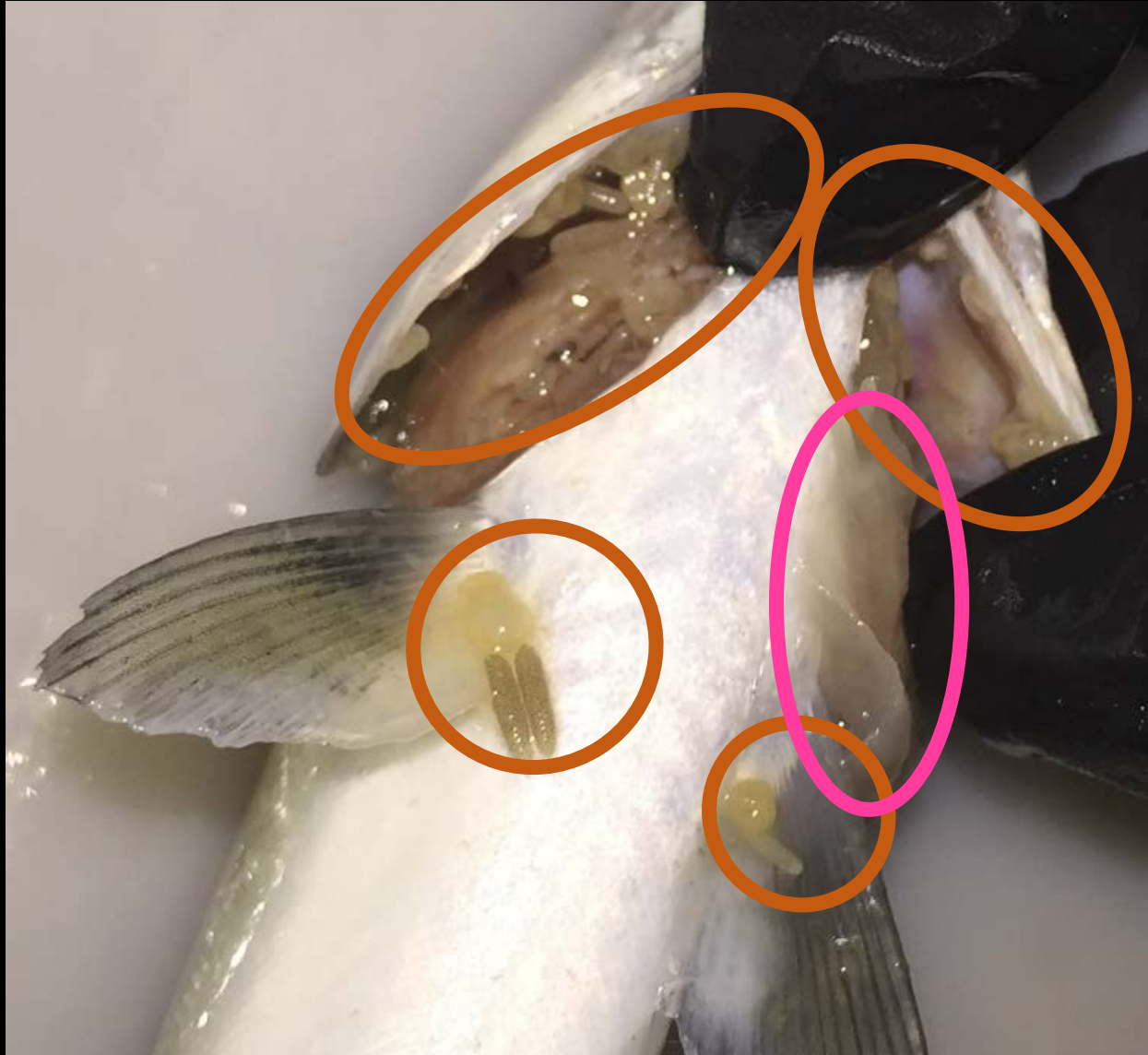
Hatchery infection



Reservoir infection



Reservoir infection



Endurance challenge

Exhaustion?

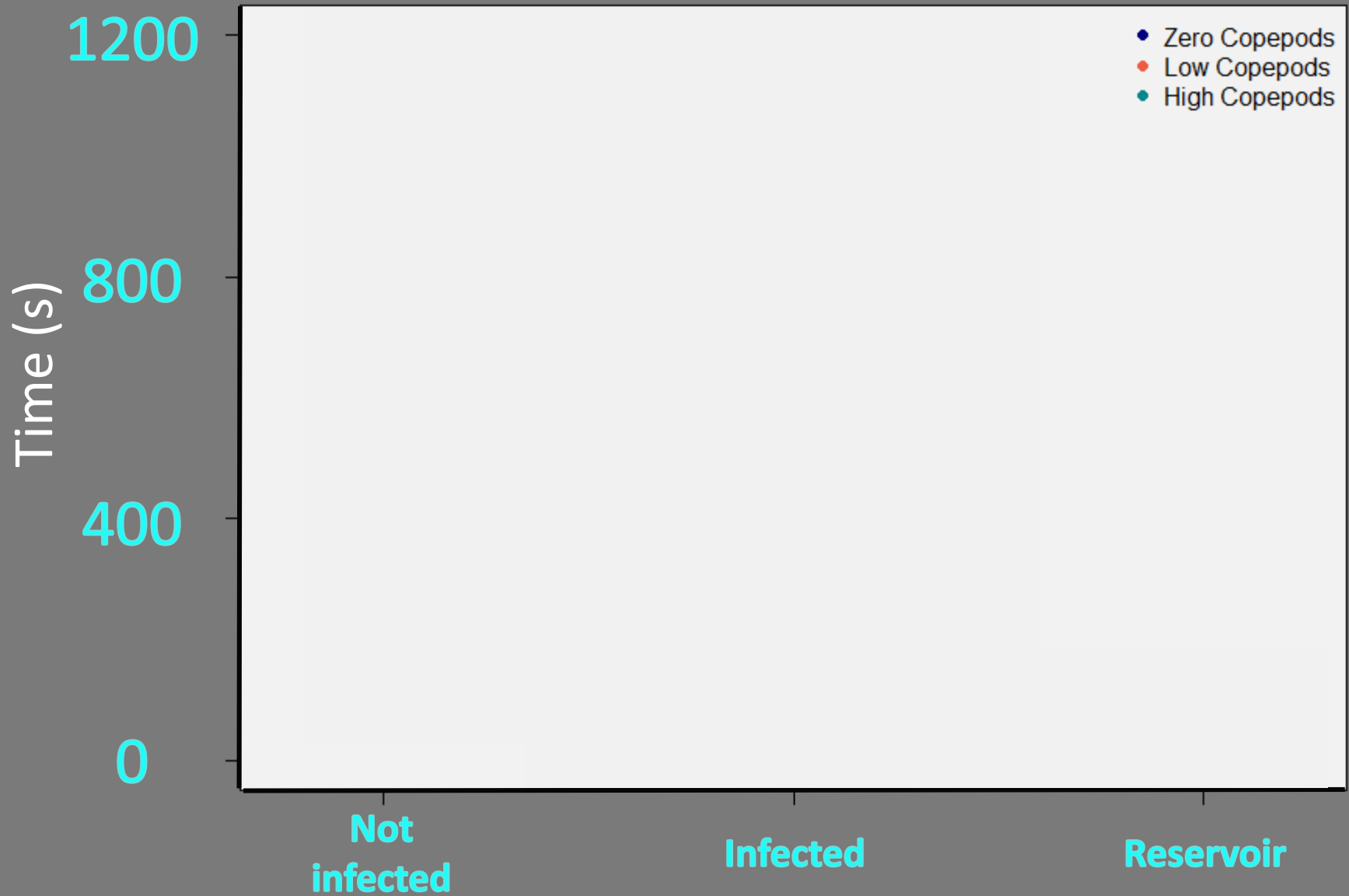
Adjustment period
 $t=15$ min
 $v=10.16$ cm/s

Increase speed
 $t=9$ min

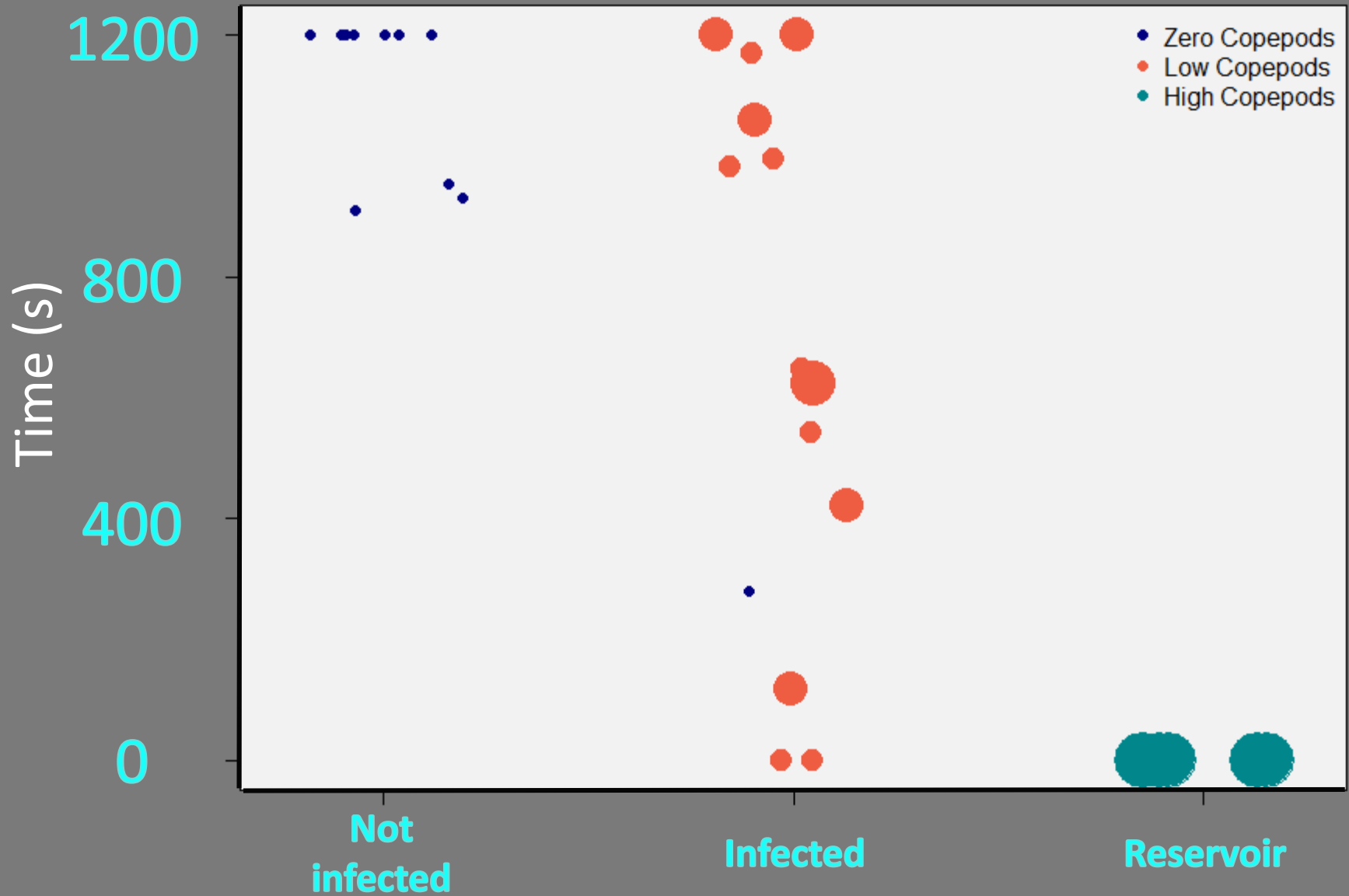
Experimental trial
 $t=20$ min max, 30 sec exhaustion
 $v=23.11$ cm/s

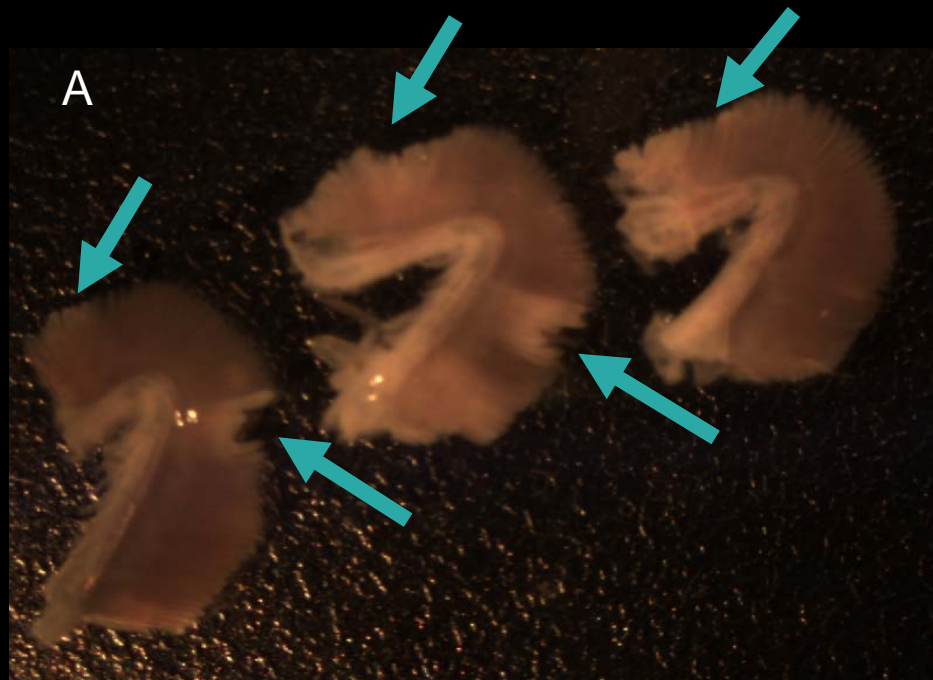
- Swim time
- Gill damage

Swimming



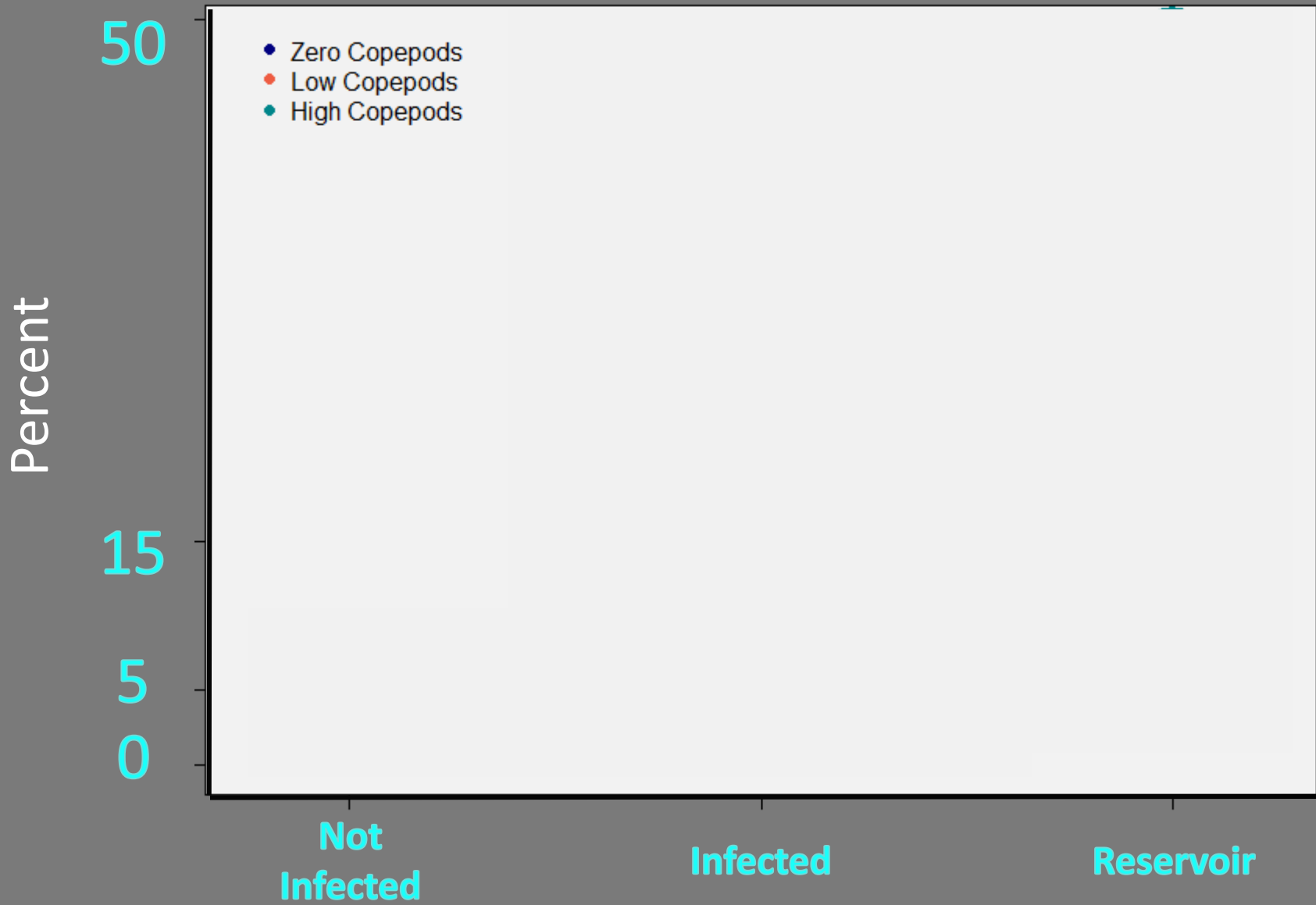
Swimming



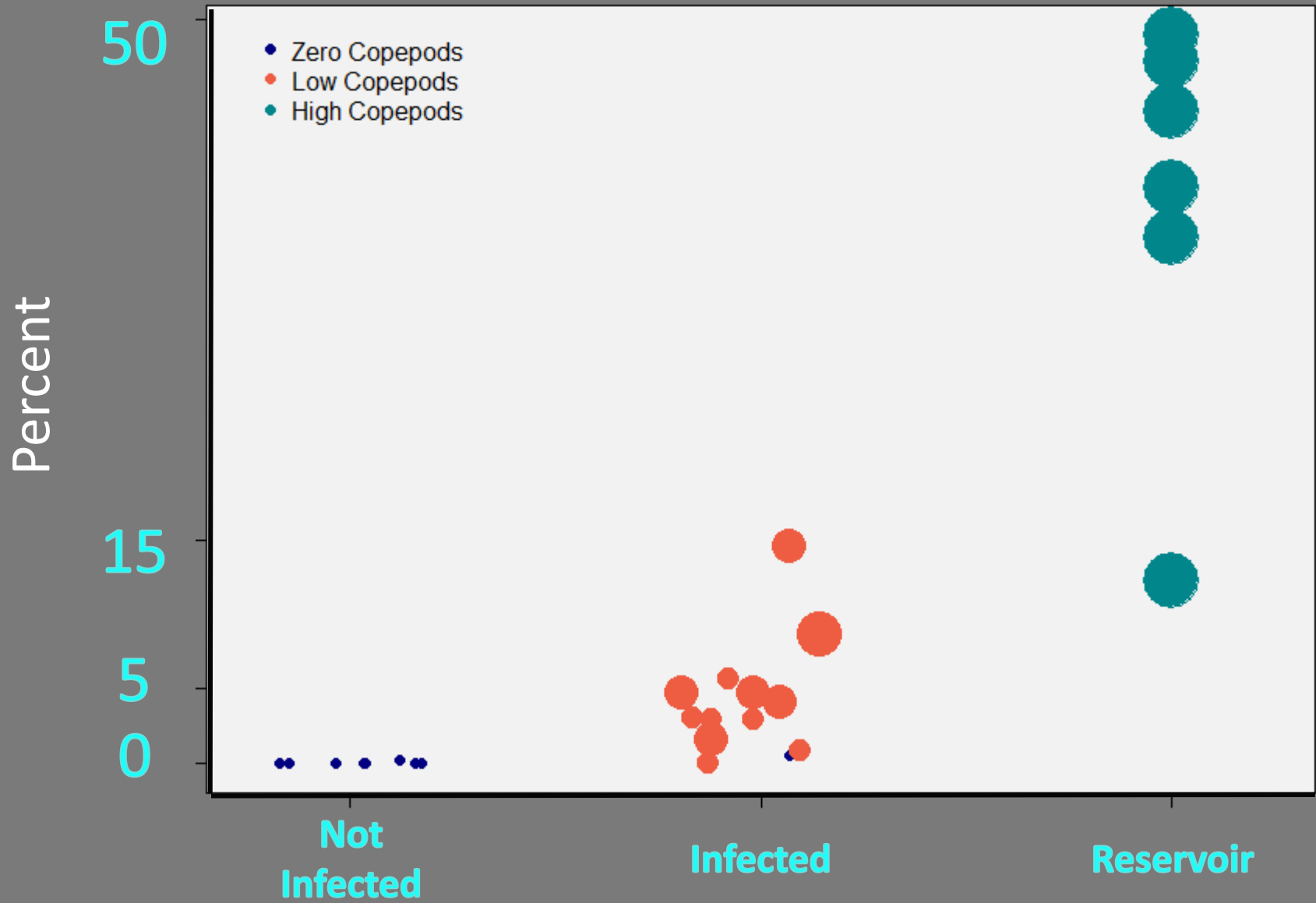




Gill Damage



Gill Damage



Objectives

1. Create method of copepod infection



2. Determine if copepod infection impairs fish's physiologic capacity.

Yes- impaired swimming performance

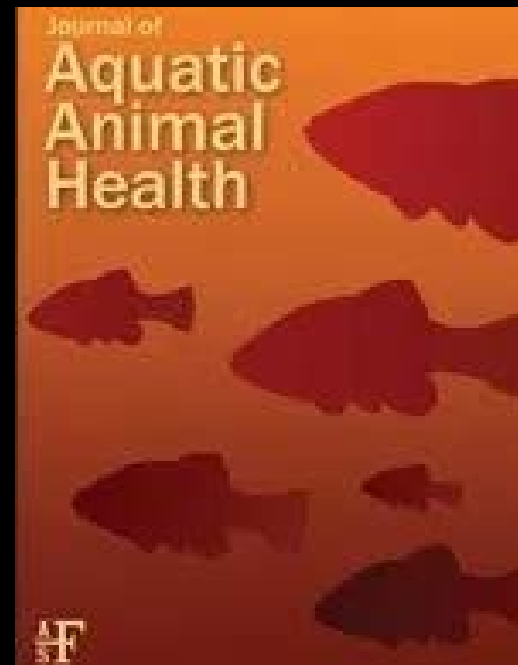


3. If impairment, is there a tolerable threshold?

Some fish affected by 1-2. Damage may be better predictor



Herron, C.L., M.L. Kent, C.B. Schreck. In Press. Swimming Endurance in Juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) infected with *Salmincola californiensis*. Journal of Aquatic Animal Health.





Vectors for disease?



Aeromonas salmonicida

Validate *S. californiensis*' capacity to act as vectors for disease



*Aeromonas
salmonicida*

Objectives

1. Detect *A. salmonicida* in copepod egg sacs from infected hosts.
 - Juveniles
 - Adults
2. Infect disease naïve fish with *A. salmonicida* using copepods as the vehicle.

Juvenile fish injected with *A. salmonicida*

Fish ID	Pathogen Presence	Egg Sacs Tested	Egg Sacs +
1	+	5	4
2	-	5	0
3	+	11	6
4	-	2	0
5	+	3	3
6	+	4	3

Adults


Mortalities already infected with *A. salmonicida*



Adult fish *A. salmonicida* detection

Fish ID	Pathogen Presence	Copepods	Culture +	PCR+
3*	+	9	4	5
4	+	2	0	0
5	+	2	2	1
6	+	2	1	--
7	+	2	0	0
8	+	1	1	0
10	+	1	1	--
13	+	2	1	1
15	-	1	0	0

Objectives

1. Detect *A. salmonicida* in copepod egg sacs from infected hosts. 
 - Juveniles
 - Adults
2. Infect disease naïve fish with *A. salmonicida* using copepods as the vehicle.
 - To be continued... full time master's student needed.

Where are the copepods coming from?



We found

Copepods reduce
swimming endurance

Copepods carry
infectious bacteria

Acknowledgements

- Schreck lab
- Fish Performance and Genetics Laboratory
- Kent lab
- Rockey lab
- Todd Pierce

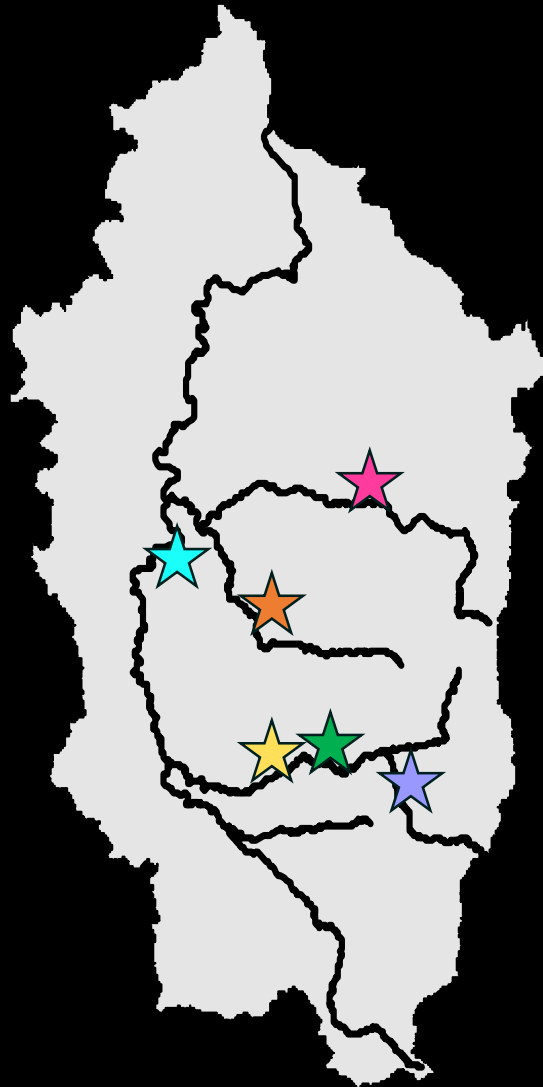


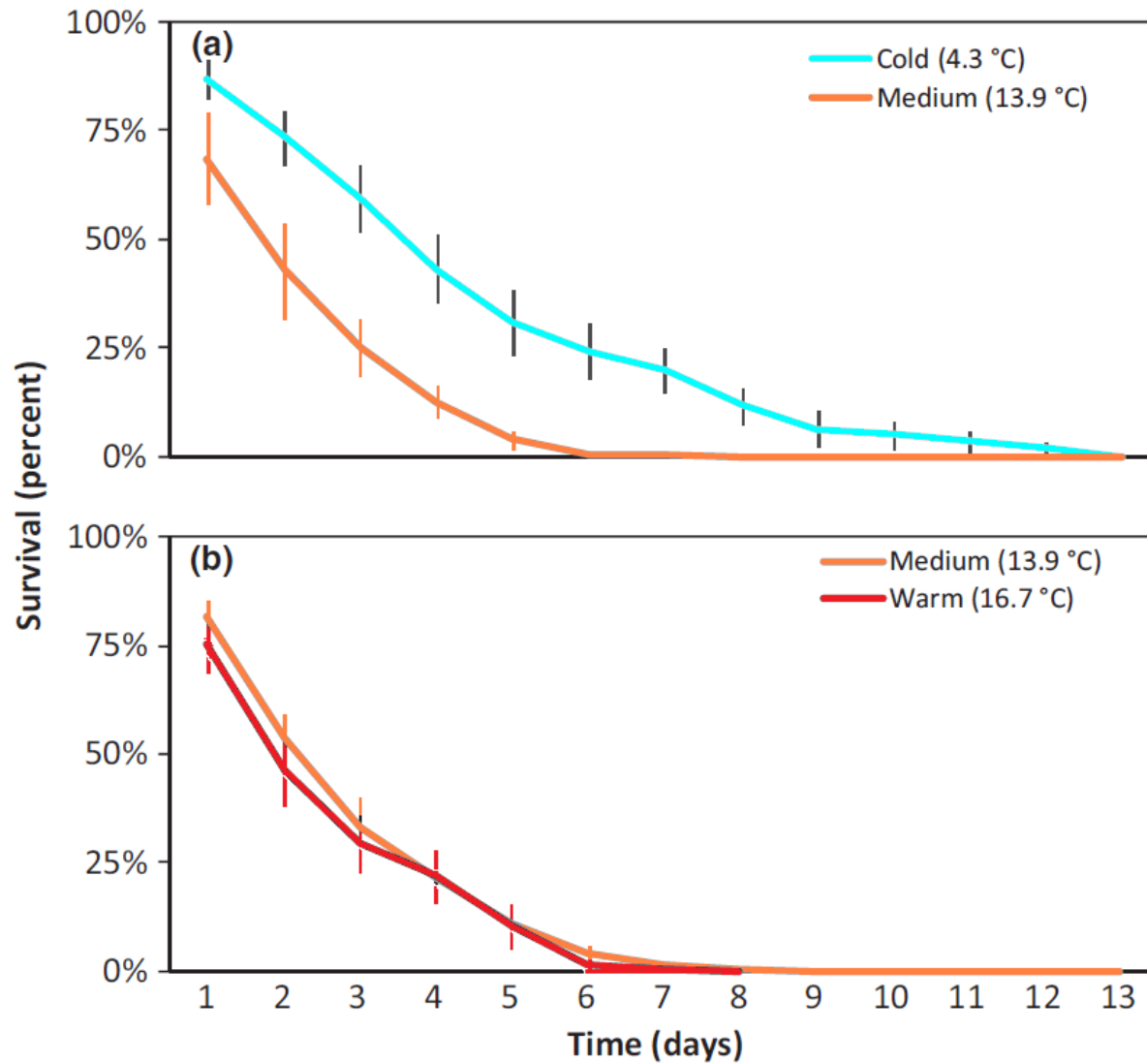
Questions?



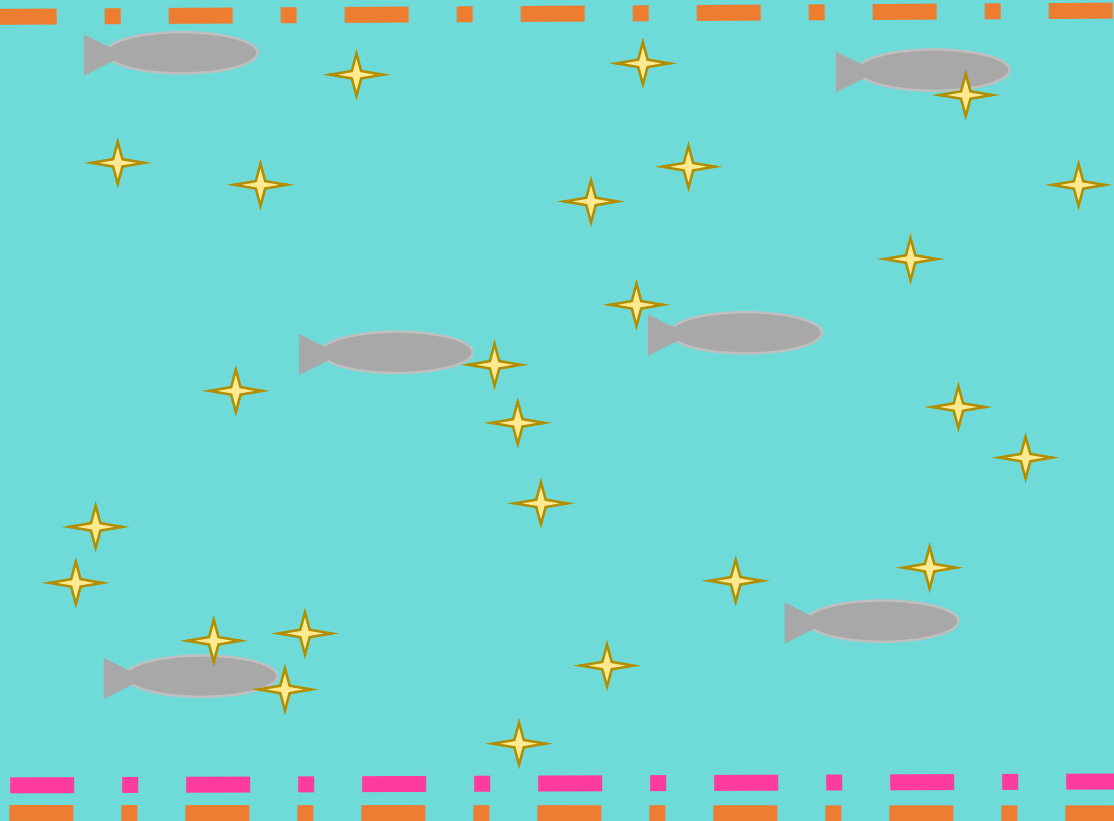
Location

Willamette Hatchery
Minto Fish Facility
Foster Dam
McKenzie Hatchery
Cougar Dam
Fish Performance and Genetics Laboratory





Reservoir



0-20ft
14-18° C

Juvenile range
0-200 feet

6-14° C

2016 Summary

Fish injected with *A. salmonicida*

Fish #	Kidney	Spleen	Egg Sacs
1	-	-	5/5 -
2	+	+	4/5 +
3	+	+	6/11 +
4	-	-	2/2 -
5	+	---	3/3+
6	+	+	3/4 +

~50% or more of the egg sacs from infected fish tested at least weak +
Eggs sacs from negative fish: All negative

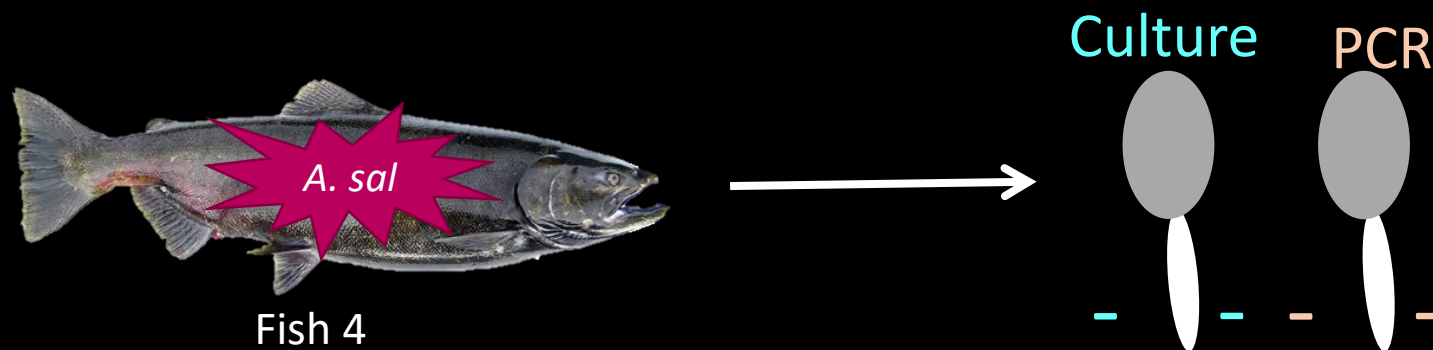
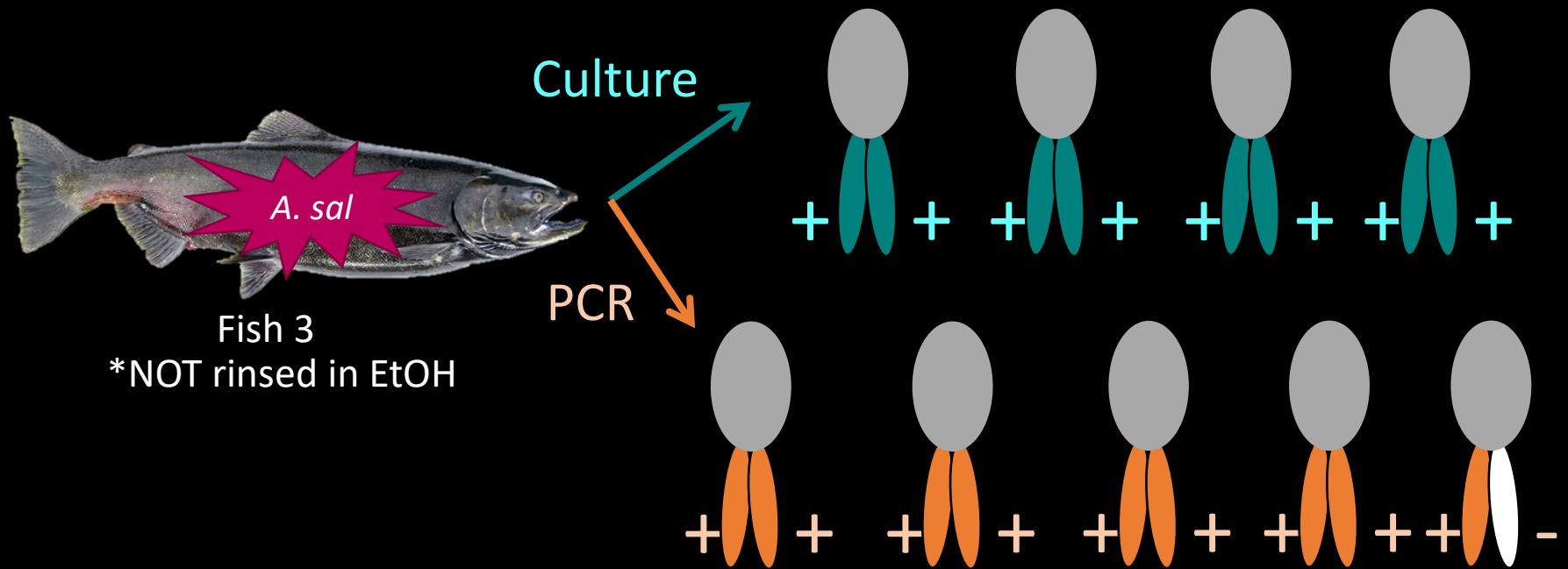
2017 Positive Fish: unsplit egg sacs from positive fish

Fish #	Copepod #	Sac A	Sac B
3	1	Culture +	Culture +
	2	Culture +	Culture +
	3	Culture +	Culture +
	4	Culture +	Culture +
	5	PCR +	PCR +
	6	PCR +	PCR +
	7	PCR +	PCR -
	8	PCR +	PCR +
	9	PCR +	PCR +
4	1	Culture -	---
	2	PCR -	---

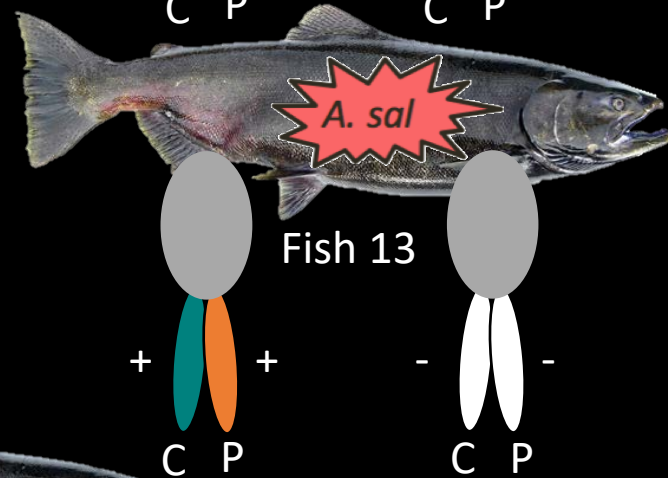
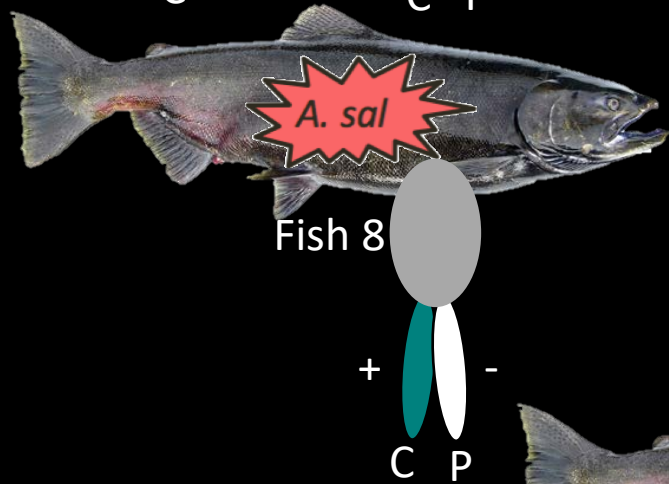
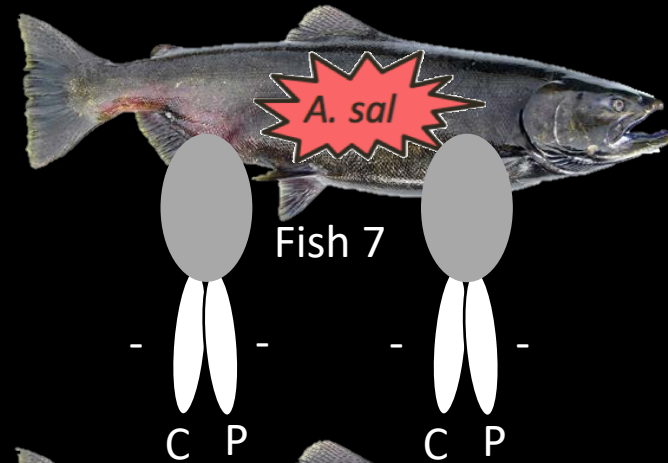
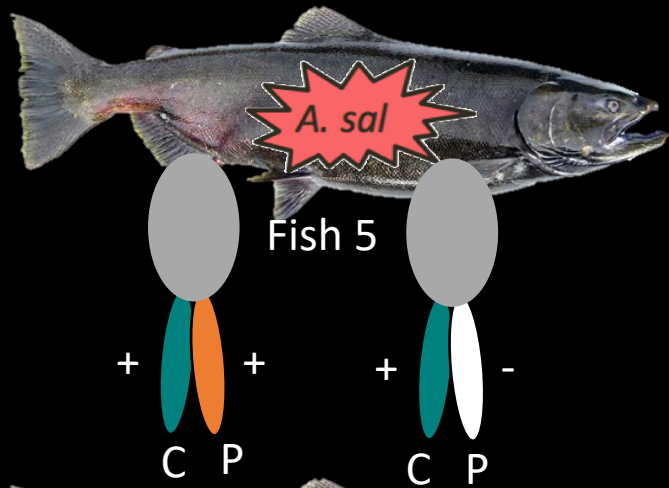
Split egg sacs

Fish #	Copepod #	Sac A	Sac B
5	1	Culture +	PCR -
	2	Culture +	PCR +
6	1	Culture +	---
	2	Culture -	---
7	1	Culture -	PCR -
	2	Culture -	PCR-
8	1	Culture +	PCR -
10	1	Culture +	---
13	1	Culture +	PCR +
	2	Culture -	PCR -
*15	1	Culture - & PCR -	---

2017 Results – Non-split Egg Sacs



2017 Results – Split Egg Sacs

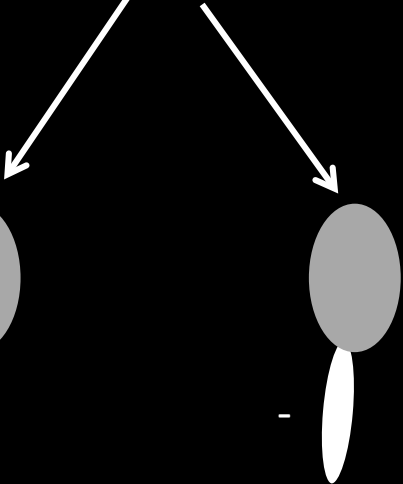


- ½ of egg sac cultured, ½ tested by PCR

2017 Results – Culture Only



Fish 6



Fish 10

