

Effects of Environmental Temperature on the Kinetics of Ichthyophoniasis in Juvenile Pacific Herring

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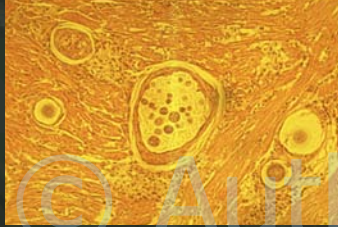


Ichthyophonus Background

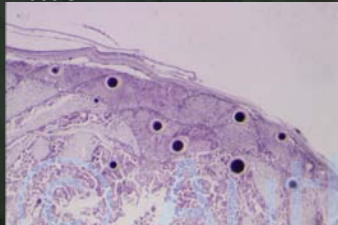
- Fish kills
- Reduced product quality
- Most research has occurred in the North Atlantic, however, since 1980's reported host and geographic range has been expanding in NE Pacific

© Author/ISAAH *Ichthyophonus* in tissues

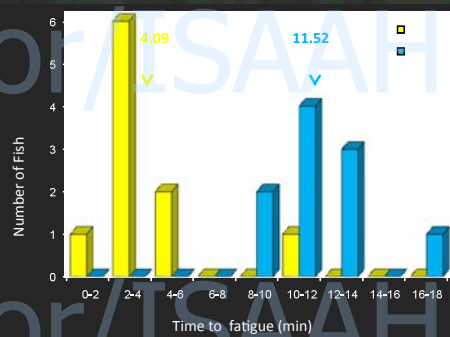
Heart



Muscle



Swimming Performance



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How energetically significant is
Ichthyophonus for YOY herring?



© Author/ISAAH Three Challenges Simulating Overwinter Fast

1) Fasting initiated after disease is established

Ichthyophonus exposure → 19 days → begin fast and temperature treatments

2) Fasting initiated immediately after exposure

Ichthyophonus exposure → 1 day → begin fast and temperature treatments

3) Infection established in fish after fast

56 day fast → Ichthyophonus exposure → begin feeding and temp. treatments

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:

Challenge	Temp. (°C)			Herring			Ichthyophonus
	Low	Amb	High	Age (d)	FL (mm)	Wt. (g)	Inoculum (schizonts / fish)
1) Diseased	6.7	9.3	12.3	164	44	1.0	174
2) Newly Exposed	5.6	7.9	12.4	241	70	3.6	167
3) Fast then Exposed	9.3	12.0	15.3	431	92	6.5	112

3 replicate tanks per treatment, 30 to 50 fish per tank

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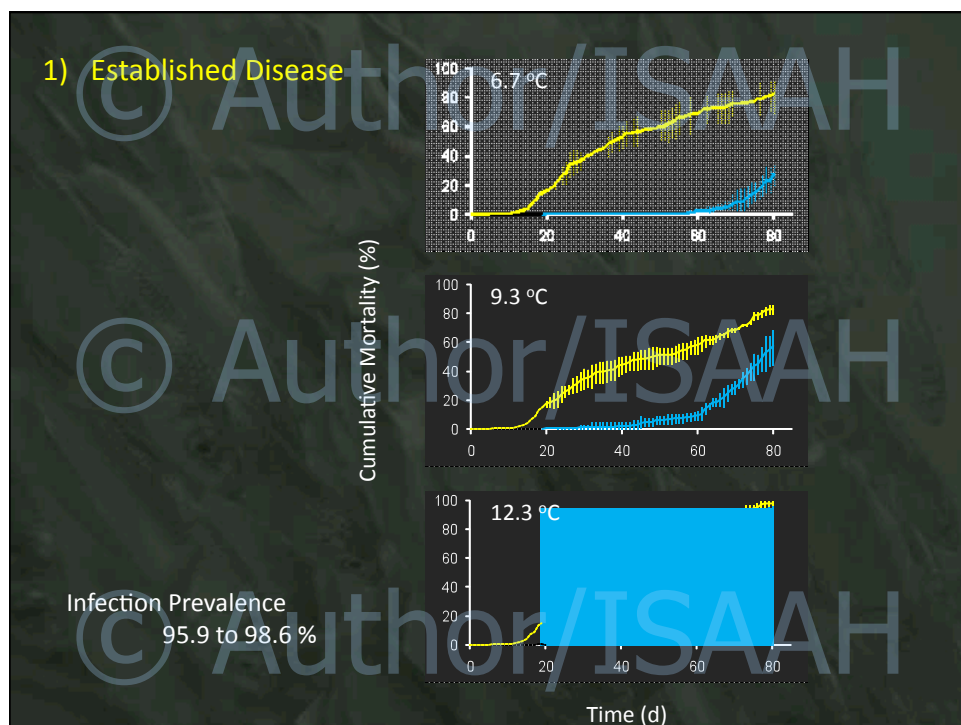
Challenge Variables

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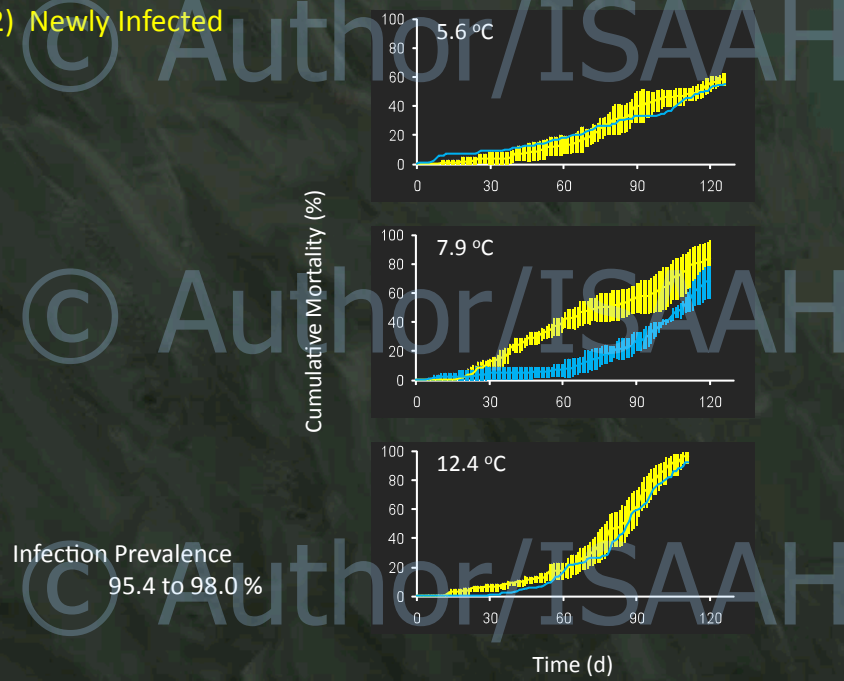
Challenge	Temp. (°C)			Herring			<i>Ichthyophonus</i>	
	Low	Amb	High	Age (d)	FL (mm)	Wt. (g)	Inoculum (schizonts / fish)	schizonts / gram
1) Diseased	6.7	9.3	12.3	164	44	1.0	174	168
2) Newly Exposed	5.6	7.9	12.4	241	70	3.6	167	46
3) Fast then Exposed	9.3	12.0	15.3	431	92	6.5	112	17

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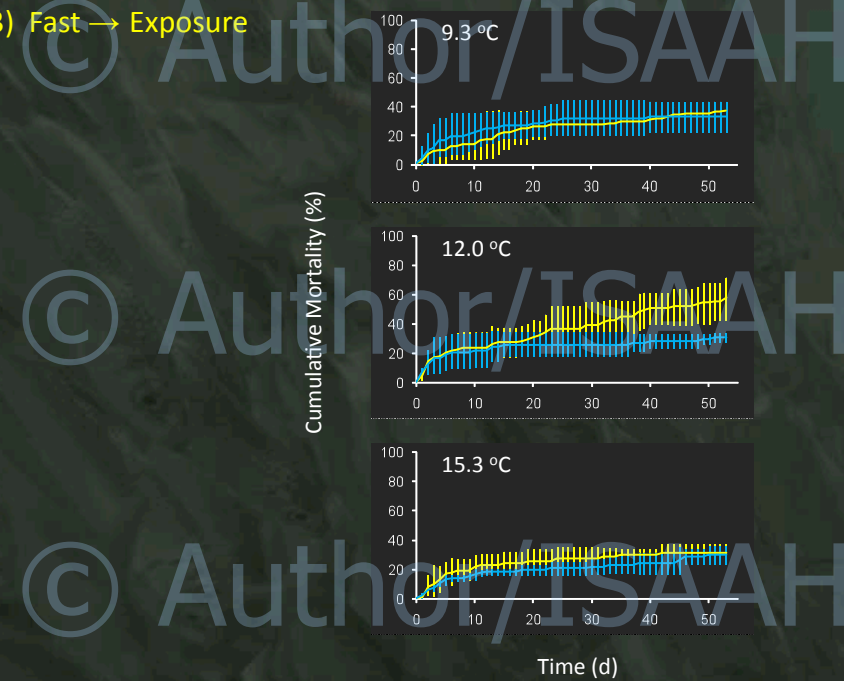
3 replicate tanks per treatment, 30 to 50 fish per tank



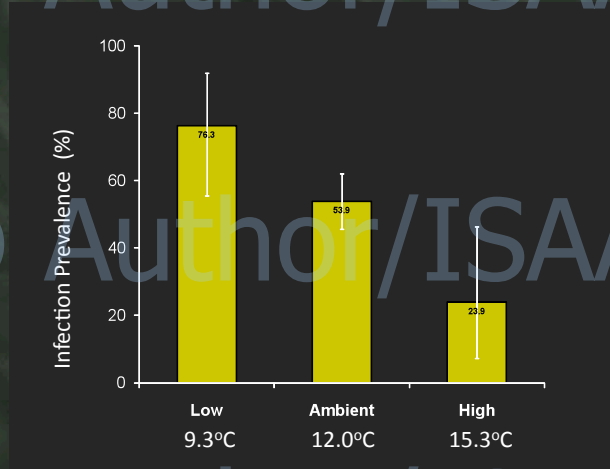
2) Newly Infected



3) Fast → Exposure



3) Fast → Exposure



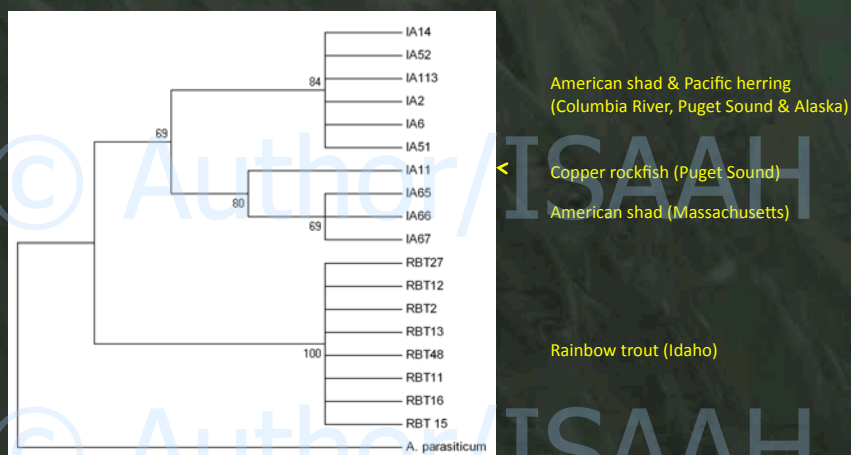
Discussion

- Mortality reduced by Increase and Decrease in Temperature.
 - Ichthyophonus growth (*in vitro*) varies directly with temperature between ≈ 4 and 25°C .
 - Within the homeostatic range of the fish, immune function tends to improve with increasing temperature.
- Environmental temperature at time of *Ichthyophonus* exposure may determine infection prevalence over ensuing months and years.
 - This study: 6°C temperature increase → 69% lower prevalence.
 - Dose dependant.

© Author/ISAAH Acknowledgements

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Relationship of *Ichthyophonus* isolates based on the majority consensus sequence of the ITS region (partial ITS1, 5.8s and partial ITS2) inferred using the neighbor-joining method (distances calculated using Kimura 2 parameter method).

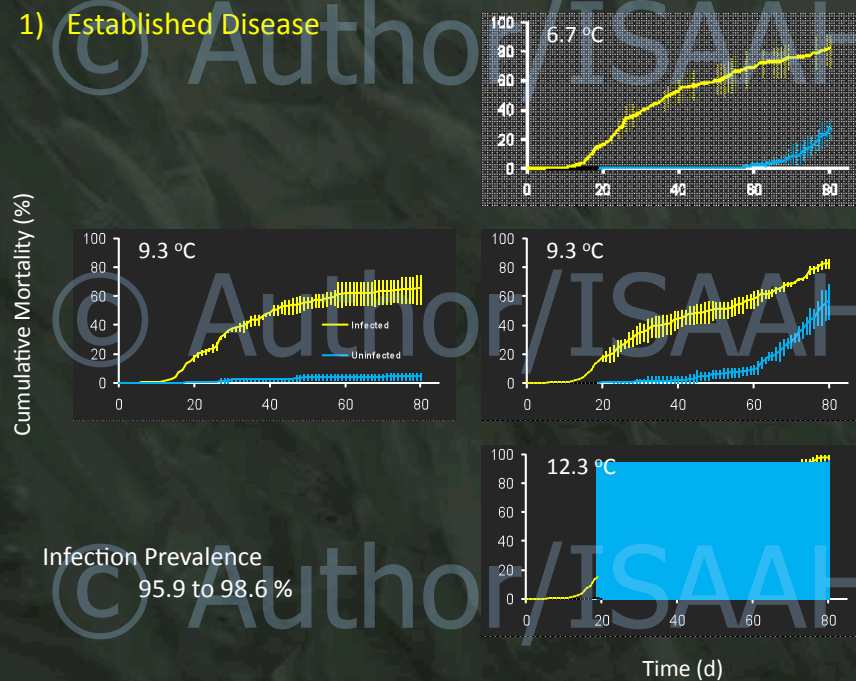
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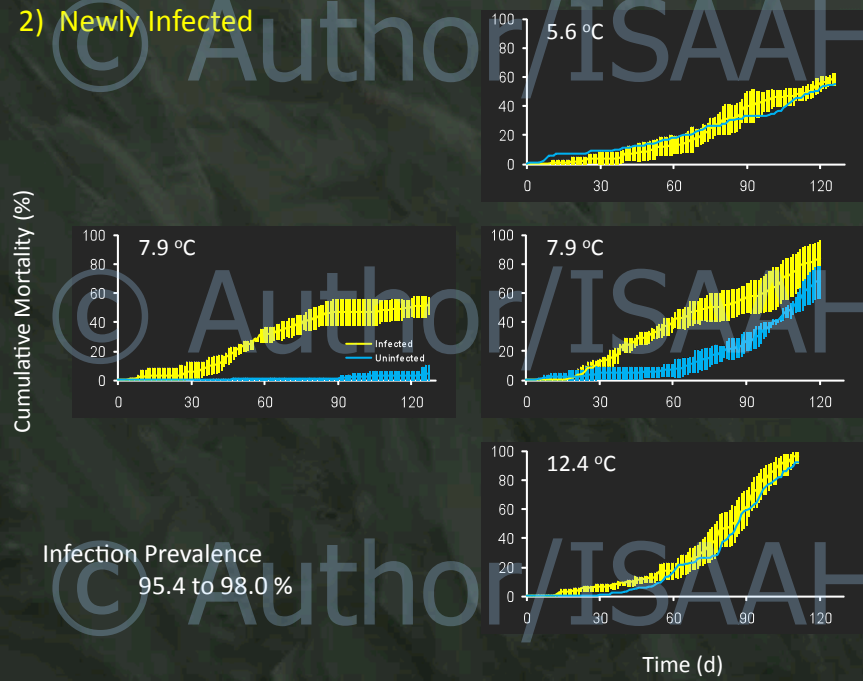
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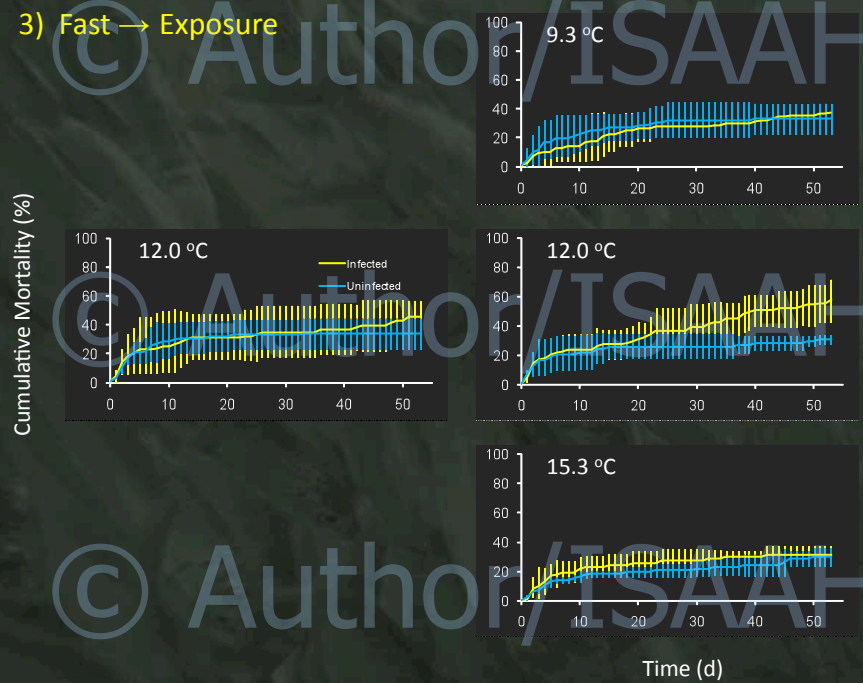
1) Established Disease



2) Newly Infected



3) Fast → Exposure



3) Fast → Exposure

