

# InSEAS Research

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**I**nitiative for the **S**tudy of the **E**nvironment  
and its **A**quatic **S**ystems (InSEAS):

Research to determine “optimal” conditions  
for fish rearing.



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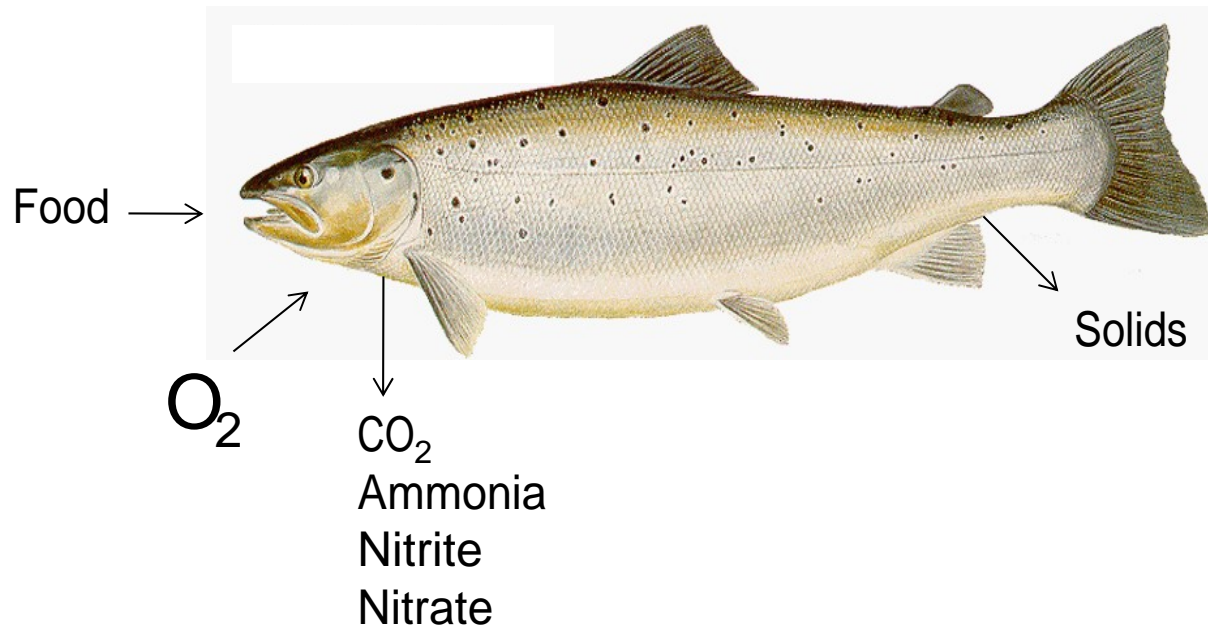
Closed containment systems currently exist.

Profitability is dependent upon optimizing conditions for growth at high density.

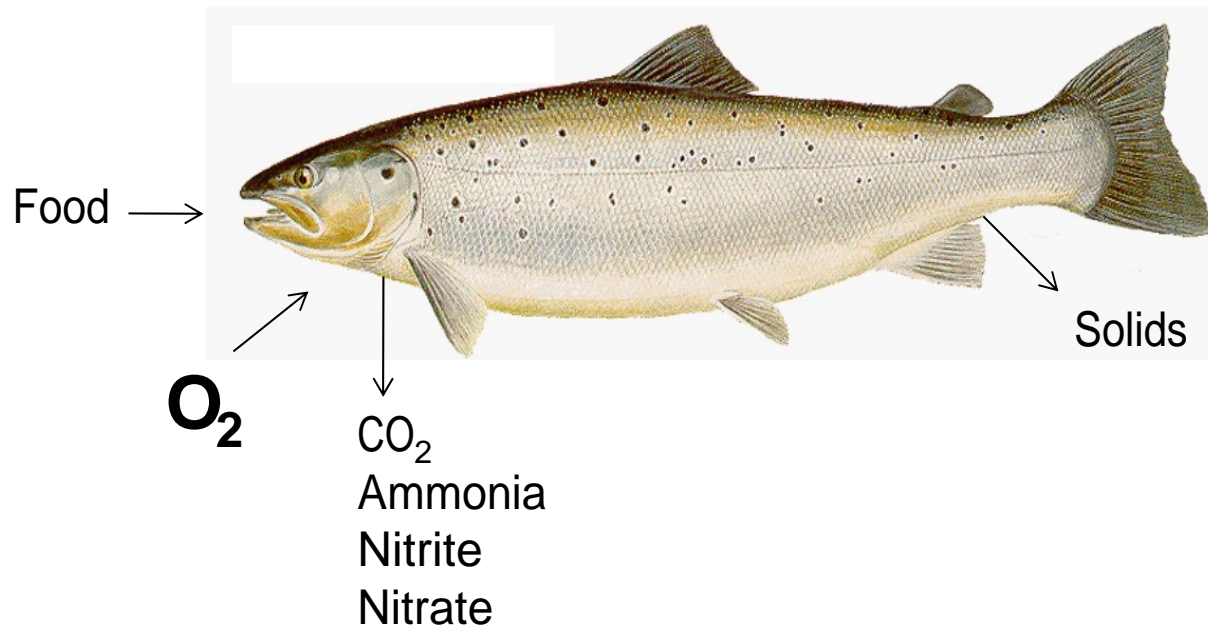
Conditions that result in “adequate” growth in some species are well described but few studies are systematically designed to derive evidence-based “optimal” values promoting fish welfare and product quality and economy.

The goal of InSEAS is to determine “optimal” conditions for fish rearing and provide timely and efficient transfer of science based information to Industry.

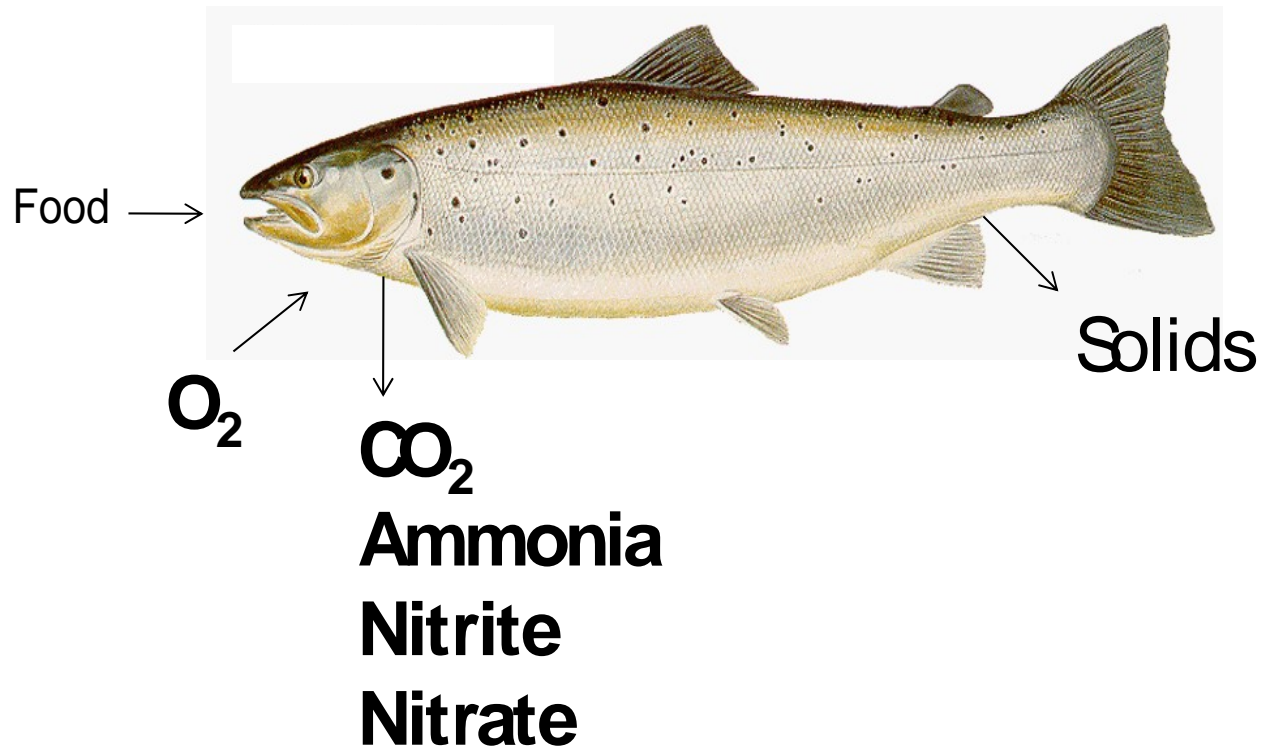
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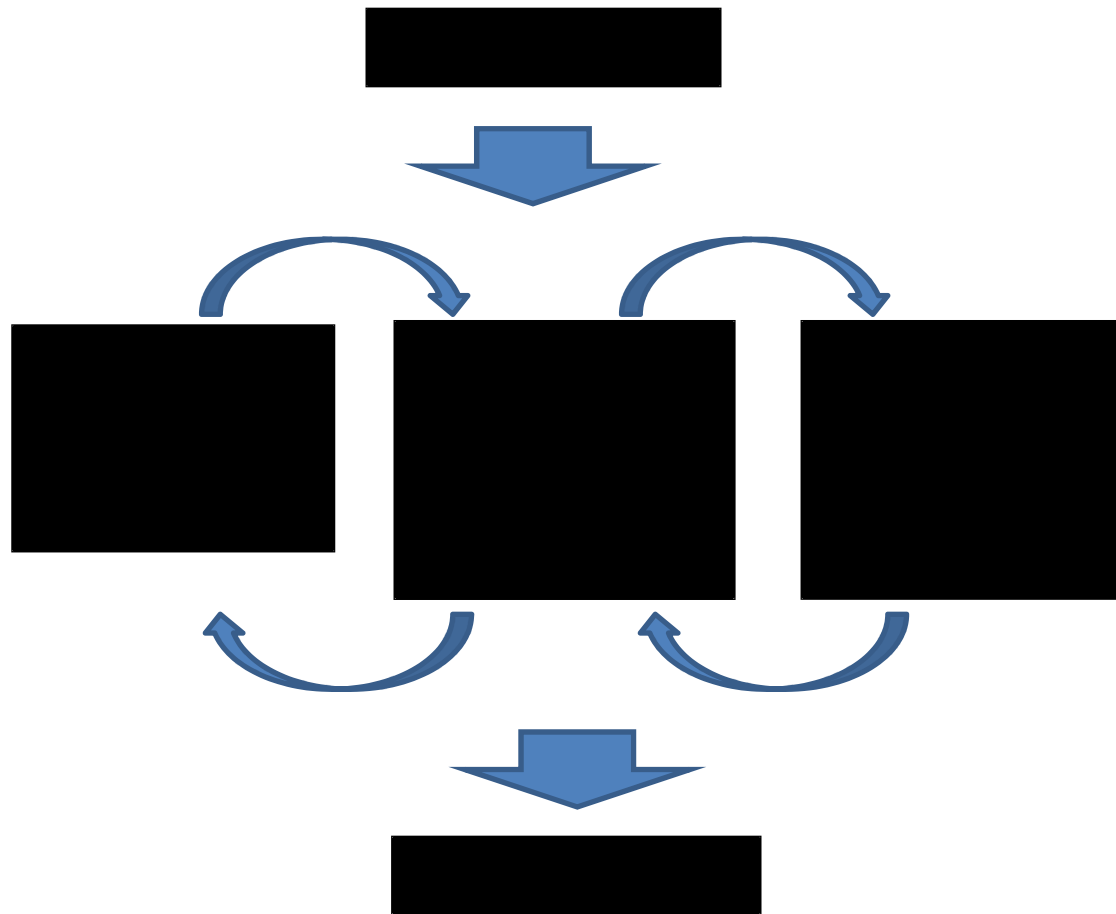
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## Biological Factors: Conclusions

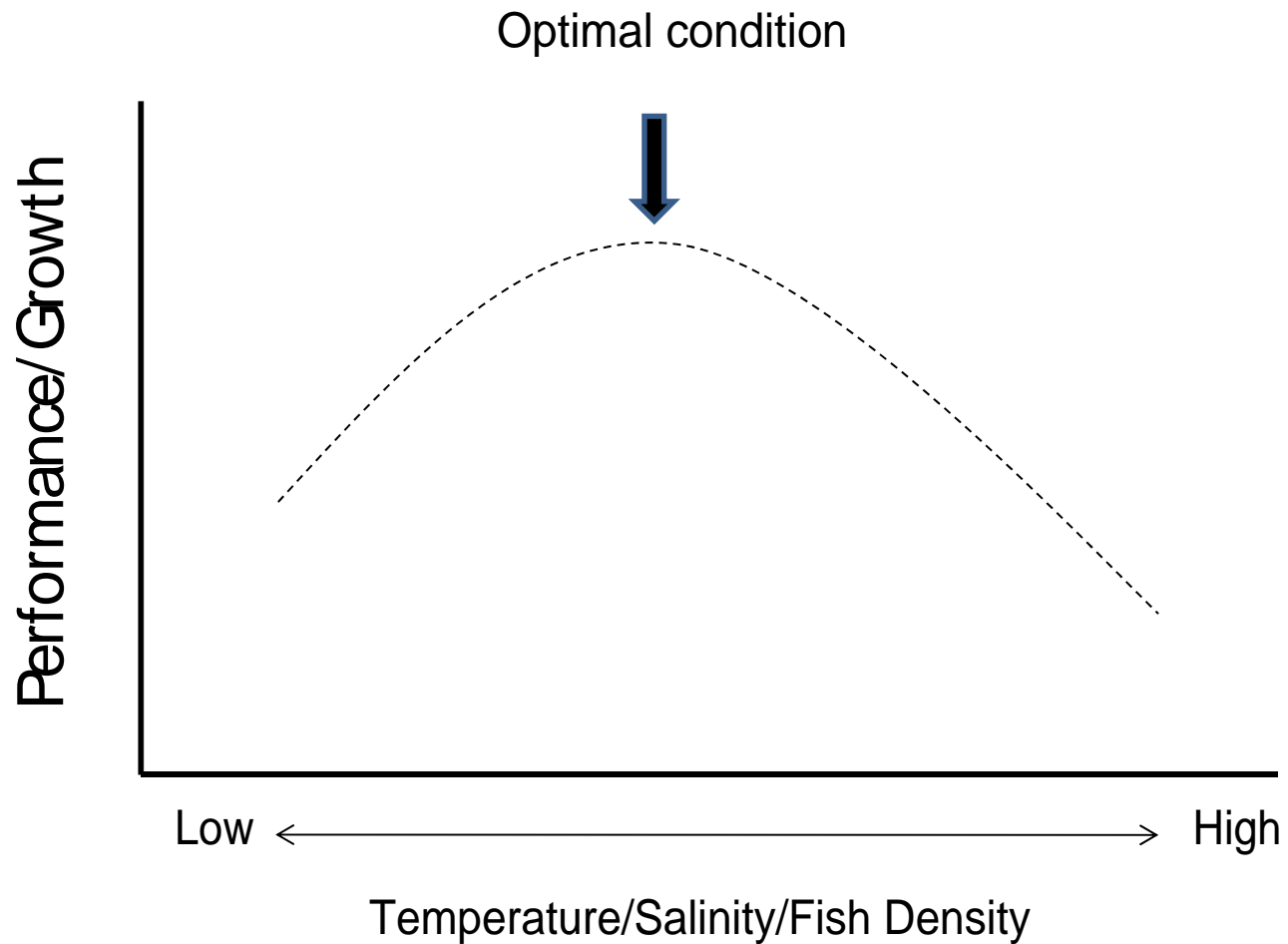
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There are currently large knowledge gaps in water quality “thresholds” in candidate species.

Even less is known regarding how water quality parameters interact.

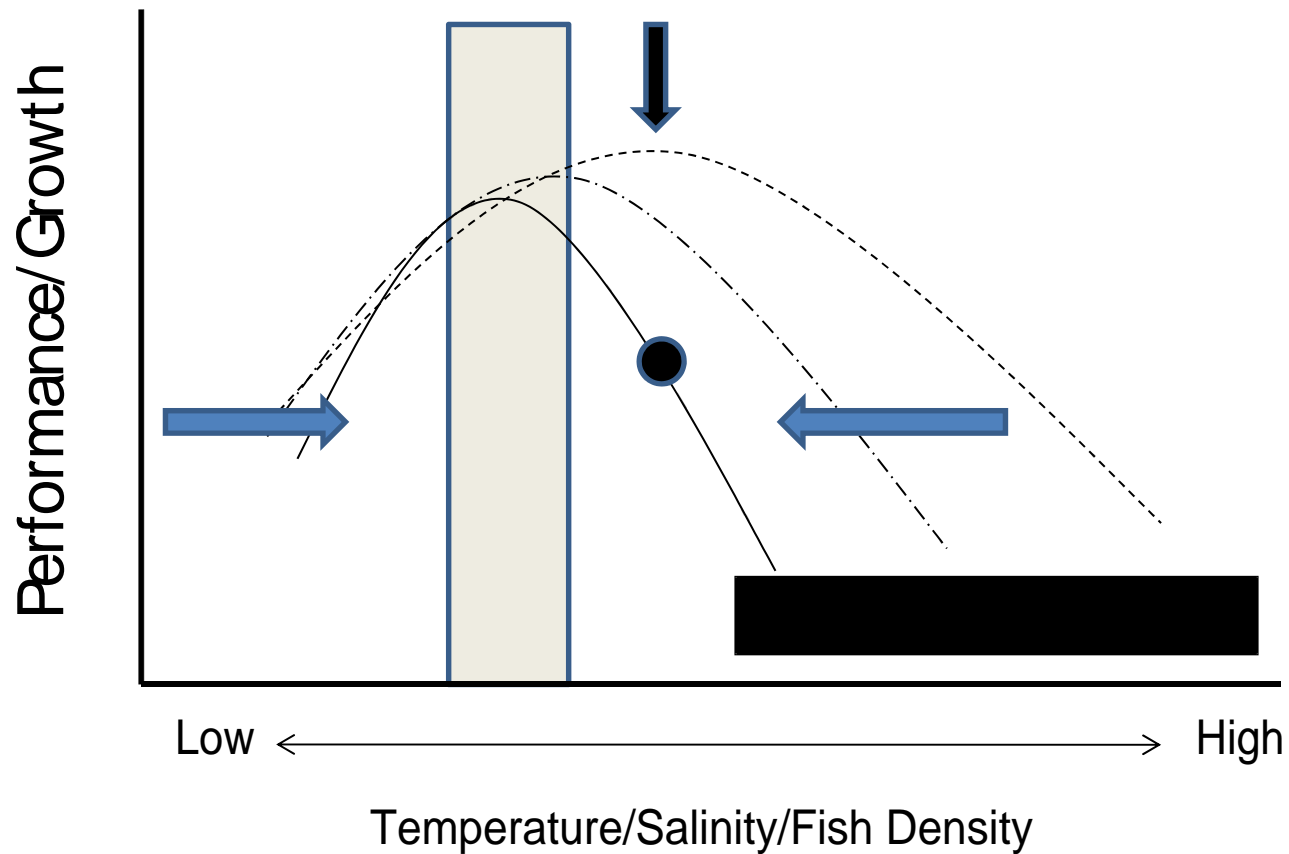
This information can be provided through small scale research based systems to provide information required for optimal production.

# Optimal growth under specific conditions





# Optimal growth under specific conditions



Because stress is cumulative, as stressors are added, optimal conditions for growth and product quality may shift.

# InSEAS Research: The People

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Two full-time dedicated aquatic technicians available 24/7 for aquatic life support.

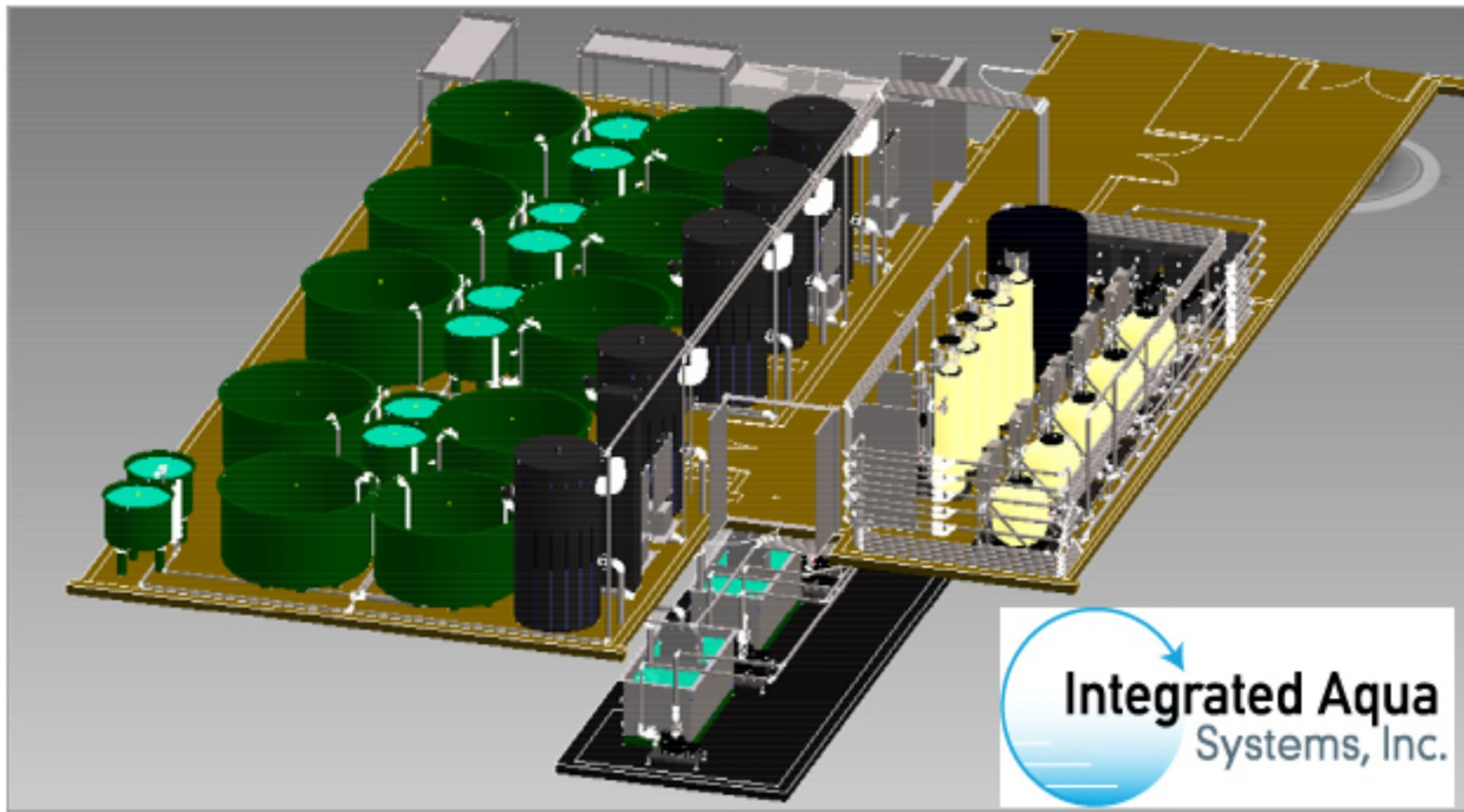
A team of 17 internationally recognized PI's in fish physiology and fish biology.

# InSEAS Research: The Facility

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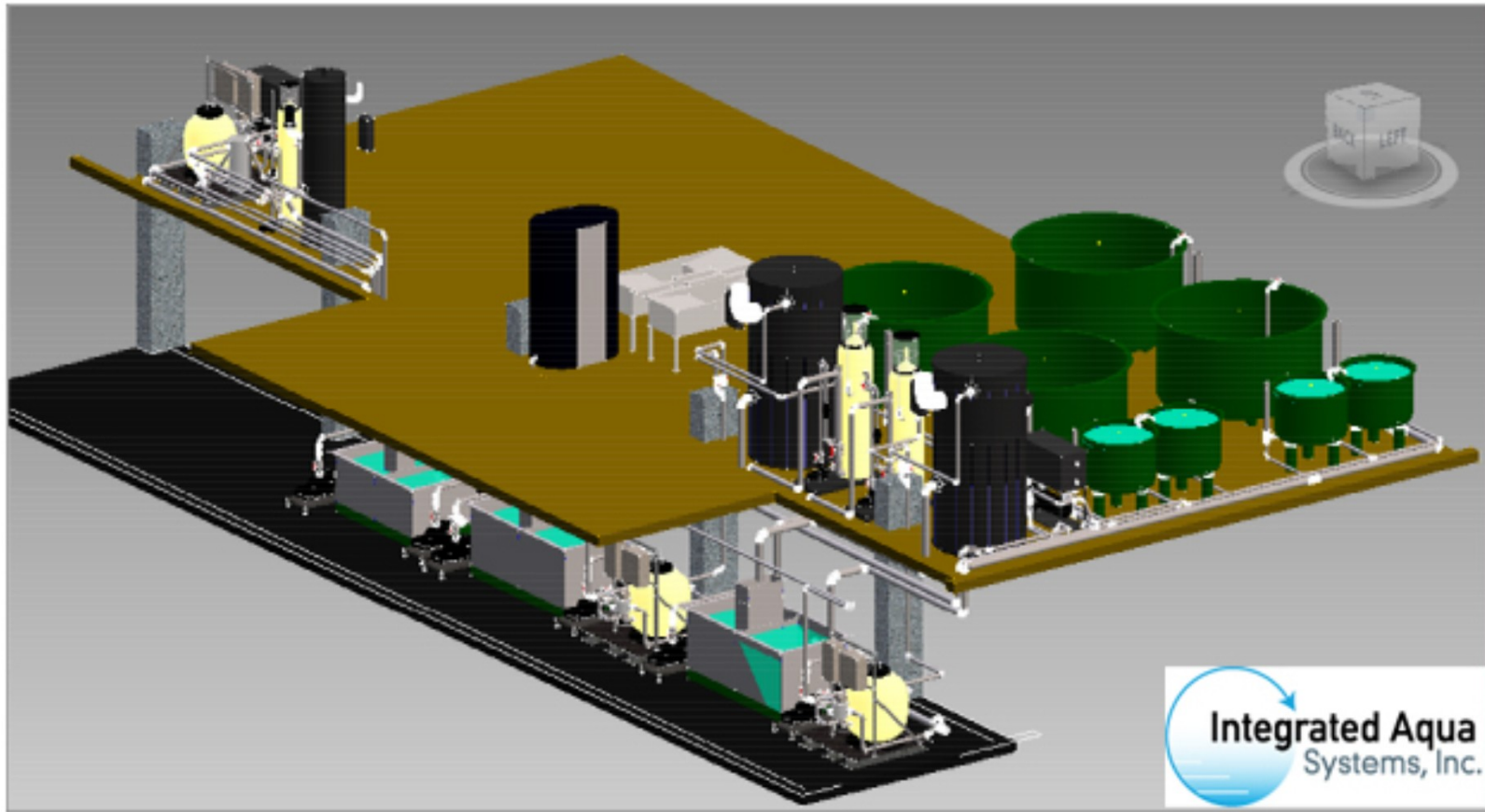
- 33,000 sq. ft. state-of-the-art aquatics research laboratory.
- 7 RASs for high-density fish rearing, each with 4 replicate tanks.
- 6 RASs for low-density fish rearing, each with 10 replicate tanks and experimental wet tables.
- all RASs are capable of precise control and remote monitoring of water salinity, T,  $\text{CO}_2$ , ammonia,  $\text{O}_2$  and pH.
- 10 environmentally controlled chambers rooms (3 x 5m).
- 5 analytical laboratories equipped with state-of-the-art facilities for physiological, biochemical, and behavioural analysis.

# InSEAS Research: The Facility



5 RASs for high-density fish rearing, each comprised of 2-8 ft diameter ( $5\text{m}^3$ ) and 2-42" diameter ( $0.7\text{m}^3$ ) tanks with precise control and remote monitoring of water salinity, temperature, ammonia,  $\text{CO}_2$ ,  $\text{O}_2$  and pH.

# InSEAS Research: The Facility



2 RASs for high-density fish rearing, each comprised of 2-8 ft diameter ( $5\text{m}^3$ ) and 2-42" diameter ( $0.7\text{m}^3$ ) tanks with precise control and remote monitoring of water salinity, temperature, ammonia,  $\text{CO}_2$ ,  $\text{O}_2$  and pH.

# InSEAS Experimental Approach

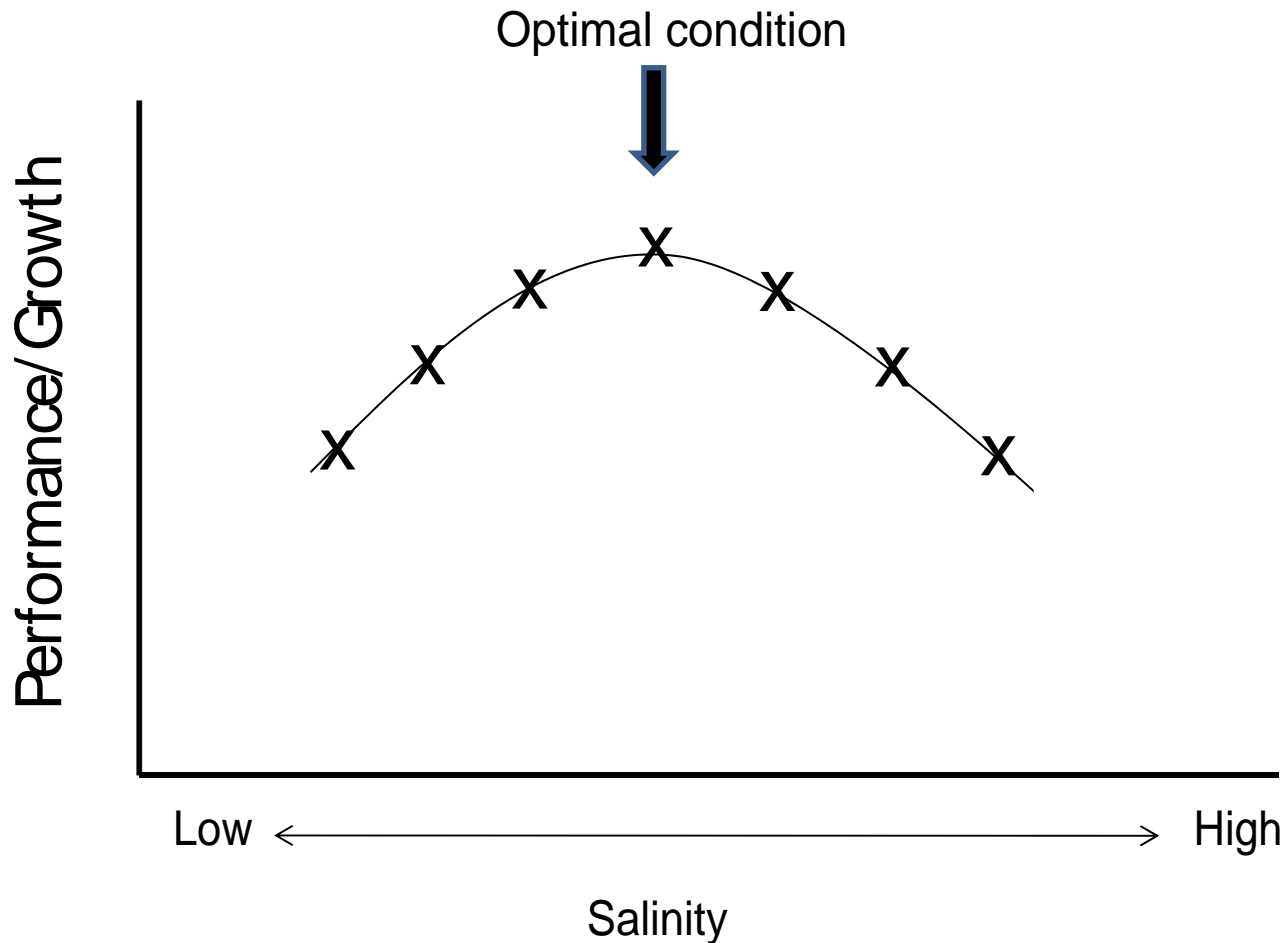
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The possible combinations of parameters (salinity, temperature, ammonia,  $\text{CO}_2$ ,  $\text{O}_2$  and pH) that InSEAS can investigate in isolation or in combination with a range of biotic variables (strain/species, life stage, density, diet) are enormous.

Two-tiered multi-factorial approach to determine the “optimal” rearing conditions for salmon:

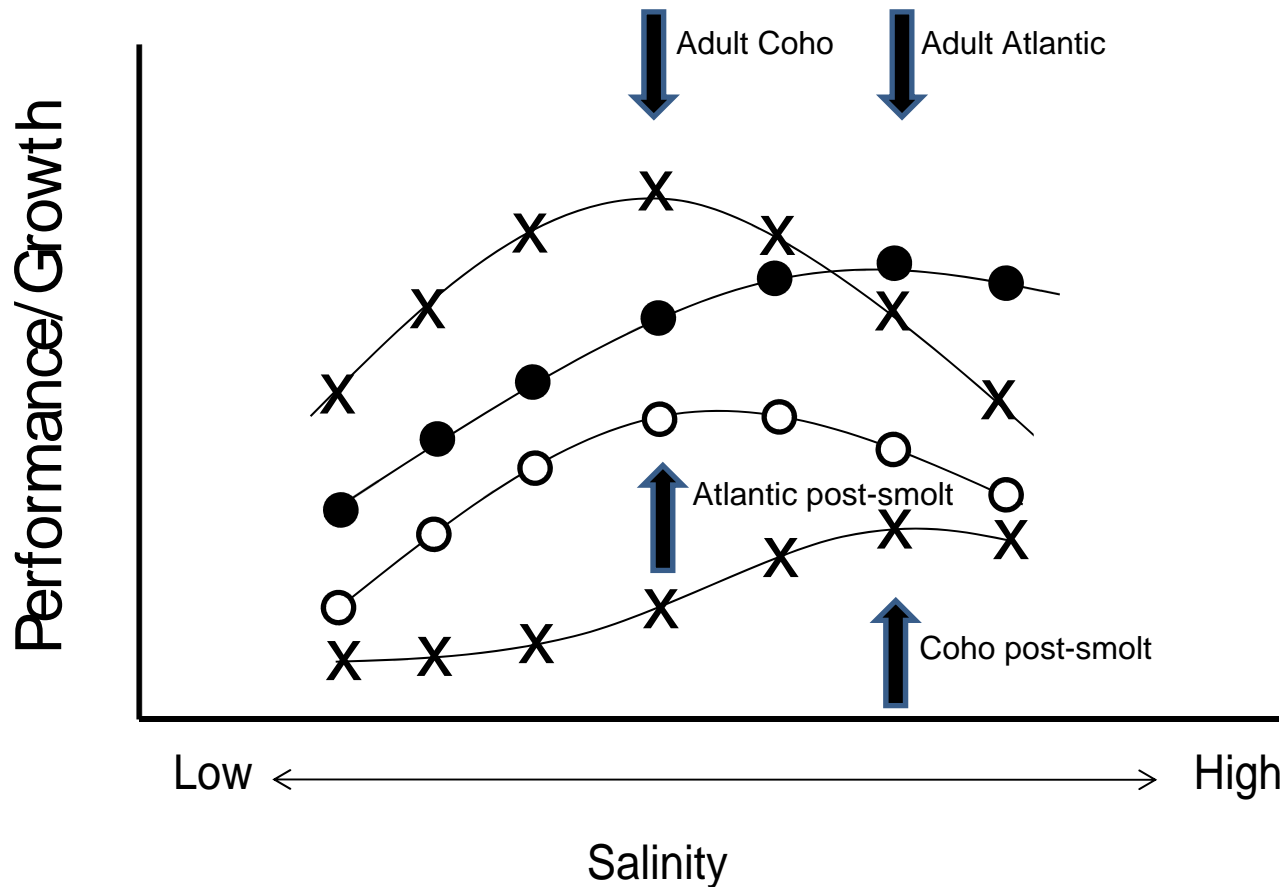
- 1) Regression Approach
- 2) Subsequent rigorous replication:

# InSEAS Regression Approach



**Objective 1:** *Determine the optimal salinity for growth performance and welfare of Atlantic and coho salmon, at multiple life stages of development (from smolt to adult).*

# InSEAS Regression Approach



Outcome of a single experimental trial using a regression approach in 7 RASs (each with 4 replicate tanks) to identify the optimal value for a given parameter on for example, 2 species at 2 life stages simultaneously in a single experimental trial.



# InSEAS Subsequent Replication

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Regression approach would be used to identify 2 or 3 salinities that could be further investigated in duplicate or triplicate.

From this InSEAS can precisely quantify the benefit of the “optimal” condition relative to a control condition (for example FW vs SW) which can be incorporated into economic feasibility models.

# Scientific Facilitation Board

The InSEAS Scientific Facilitation Board consists of:

5 UBC Faculty members from UBC Zoology and Forest Sciences,  
2 research scientists from DFO  
2 representatives from the Aquaculture Industry

Responsibilities of the Scientific Facilitation Board:

To identify research funding and facilitate linkages between  
*InSEAS* and government/industry stakeholders.  
To facilitate maximum utilization of all facilities.  
To provide advice and counsel on strategic research  
initiatives and priorities.

# InSEAS Research Outcomes

InSEAS can precisely control environmental conditions over a broad range to rigorously identify “optimal” conditions for closed-containment production.

The overall goal of InSEAS will be:

- i) Define water quality parameters (salinity, T,  $\text{NH}_3$ ,  $\text{CO}_2$ ,  $\text{O}_2$ , pH,) and other conditions (density, alternate diets) that result in “optimal” growth performance and welfare of salmon at all life stages of development from larvae, fry, smolt to adult on a species/strain of choice.
- ii) Timely and efficient transfer of scientific information that can be used in economic forecasting of the costs and benefits of using “optimal” or “sub-optimal” conditions in production.

# Acknowledgements



Western Economic  
Diversification Canada

Diversification de l'économie  
de l'Ouest Canada

**TIDES**canada  
uncommon solutions for the common good

