Modeling Walleye Production & Profitability: A Case Study for walleye production in RAS

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The Case for US Aquaculture

70-85%	**#1**	**$17bn**
of US Seafood is Imported	Importer of Seafood	Trade Deficit

National Security, Food Security, and Economic Security Concerns

Headwinds Facing the US RAS Aquaculture Industry

- *Experience Gap*
- *Difficult to find knowledgeable labor*
- *Site selection difficulties*
- *Emerging Technologies*
- ***Financial Barriers***
  - ***High up-front capital costs***
  - ***Require large scale operations***
  - ***High operating expenses***

[Sources] NOAA, Department of Homeland Security, Regulatory Landscape of the U.S. Aquaculture Supply Chain

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Options for the US RAS Aquaculture Industry

Either invest a tremendous amount of money to build a large scale operation and benefit from economies of scale

Or focus on small scale with a niche species or niche market where a high price can be fetched, and you are not competing with cheaper means of production

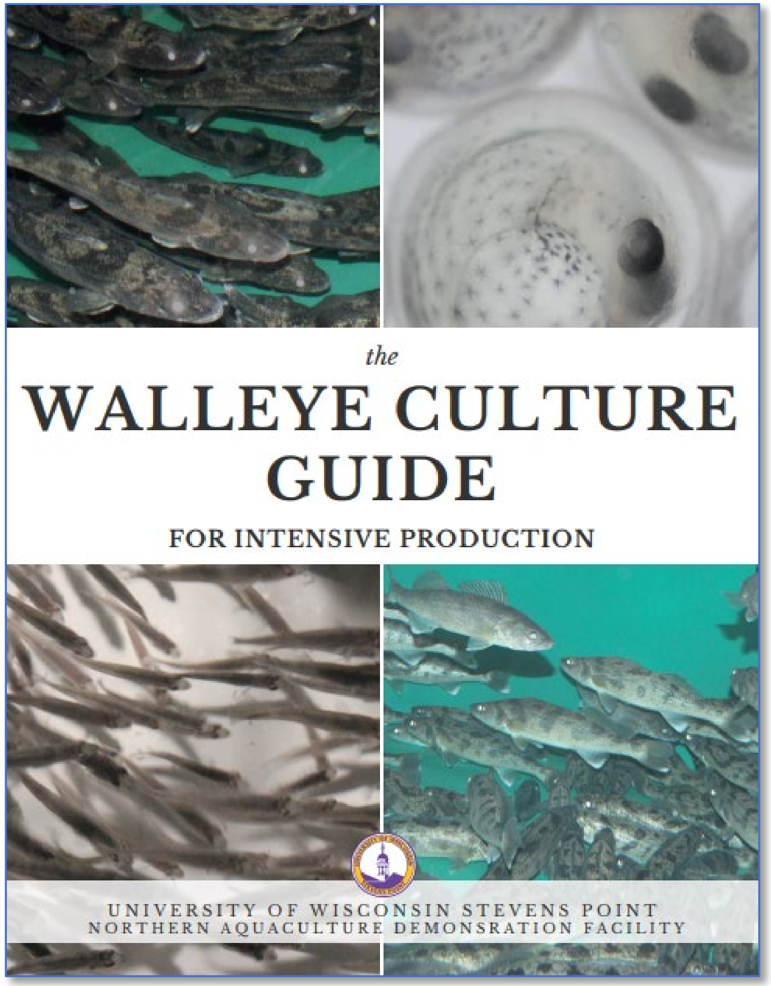
[Sources] NOAA, Department of Homeland Security, Regulatory Landscape of the U.S. Aquaculture Supply Chain

Walleye Recirculating Aquaculture

Growing a Midwest staple – sustainably, year-round, and without depleting wild supply

Why Walleye?

- Strong regional demand at a premium price/lb
- Limited & inconsistent commercial supply
- UWSP NADF has 15 years of experience raising walleye
- Emerging species in the upper Midwest
    - Rapid growth in walleye-focused facilities

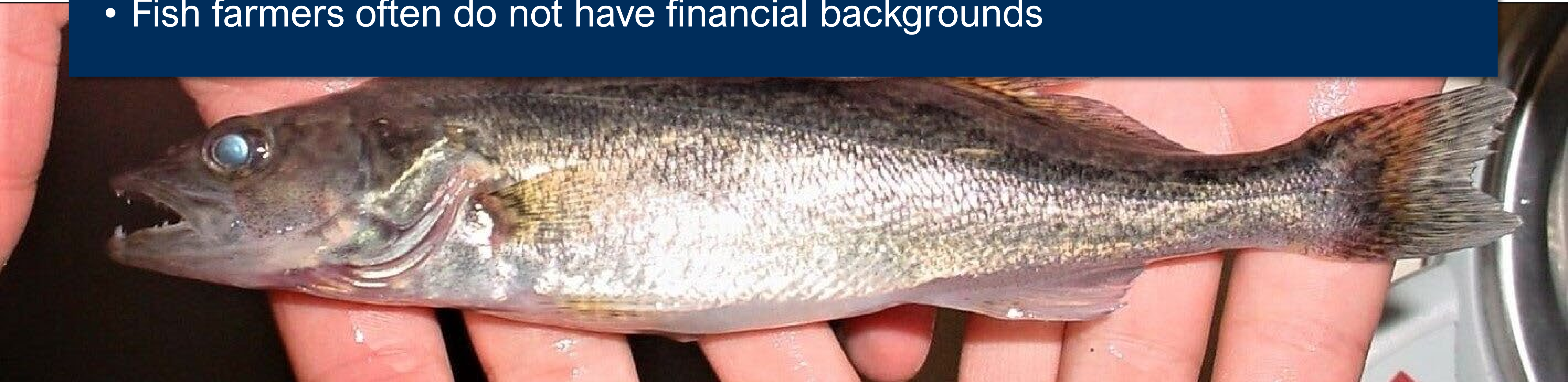


Walleye Recirculating Aquaculture

Growing a Midwest staple – sustainably, year-round, and without depleting wild supply

Why Model Operating Breakeven?

- Demonstrate the path to profitability and create a public extension tool for walleye farmers
- It’s challenging to find information on true operation costs
- Bioplanning information is not readily available
- Fish farmers often do not have financial backgrounds



Objective

- **Develop a model to estimate operating costs and breakeven prices to be used as a tool by prospective walleye farmers**
  - **Allow farmers to understand scope of potential costs**
  - **Allow farmers to input own values and estimate prices they will need to fetch to breakeven**

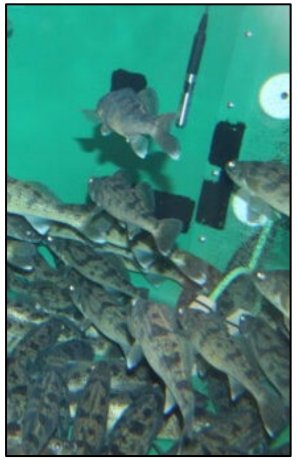
- **Use values from NADF as a case study and validation of the model**

Model Options

Model allows user to change most inputs

- **Number of fish raised**
- **Initial and market size**
- **Whole fish or processed fillet final product**
- **Rearing density**
- **Mortality rates**
- **Operating and capital expenses**
- **Labor costs**
- **Final price**

Provides an exhaustive list of costs and ballpark default values to guide users



Key Assumptions

- Facility focusing on purchasing feed-trained fingerlings (1g) and growing them to food market-size walleye (~.5kg)
- 1 cohort of fish raised per cycle
  - Cycle from fingerling to market size takes ~440 days
- Assuming the facility has the size and capacity of the Northern Aquaculture Demonstration Facility
  - Using energy, O2, and other equipment cost estimates
  - Including capacity to raise 34,330 market size walleye


A.
B.
C.
D.
E.
F.

Operating Breakeven Price

A tool for farmers to conceptualize their costs and find a market price

$$Operating\ Income = Revenue - COGS - OpEx$$

$$0 = (Price\ x\ Qty\ Sold) - COGS - OpEx$$

SOLVE FOR:
Minimum price at which walleye must be sold to be at operating breakeven

Based on UWSP NADF Growth Data, Fish Mortality Rates, Feed Conversion Ratio, and Observed/Estimated Costs/Expenses, etc.

If we know the market price for walleye, we can also solve for the minimum quantity of fish to make an operating profit

1. Define Input Assumptions
2. Model Walleye Growth
3. Define COGS & OpEx
4. Solve for Min Price at Qty
5. Solve for Min Qty at Price

1. Define Input Assumptions

Operating Assumptions		Input	Units
Number of Fingerlings Purchased	1	34,330	*fingerlings*
Initial Fingerling Size		1.0	*grams*
Initial Fingerling Cost		2.00	*$/gram*
Transfer Mortality Rate		2.0%	
Number of Fingerlings Stocked		33,643	*fingerlings*
Growout Mortality Rate	2	4.0%	
Final Market Size		478.04	*grams*
Fillet Yield		47.0%	
Fillet Size		0.25	lbs
Fillet Size		3.96	oz
Density at Harvest		70.0	*kg/m3*
Minimum Total Tank Size at Harvest	3	220.7	*m3*
Minimum Total Tank Size at Harvest		58,312	*gal*

Initial Outputs			Units
Days per Cycle		400	*days*
Feed Conversion Ratio	4	1.33	*kg feed/kg weight gain*
Ending # of Walleye at Harvest		32,323	*Fish*
Ending Biomass at Harvest		15,452	*kg*
Ending Biomass at Harvest		34,065	*lbs*

Entire model is set up in a similar format, with farmers able to adjust yellow cells based on their operation

1. Example uses 34,330 one-gram fingerlings at $2/fingerling

2. 4% mortality in grow-out phase is standard, with growth to ~1lb market weight

3. Required tank size feeds into a separate CapEx tab, helping the farmer understand initial investment

4. Output from feed model

2. Model Walleye Growth in RAS Conditions

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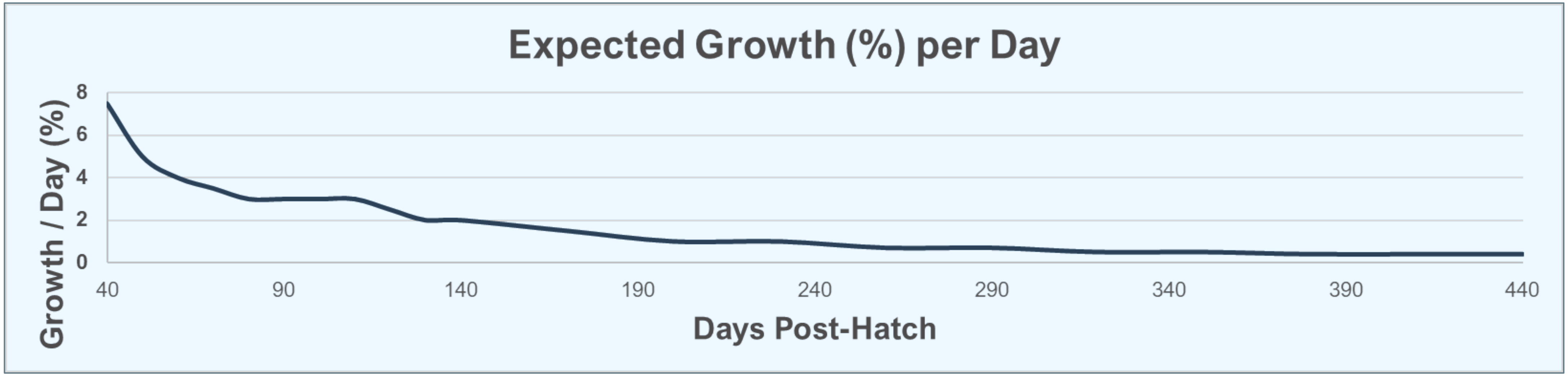
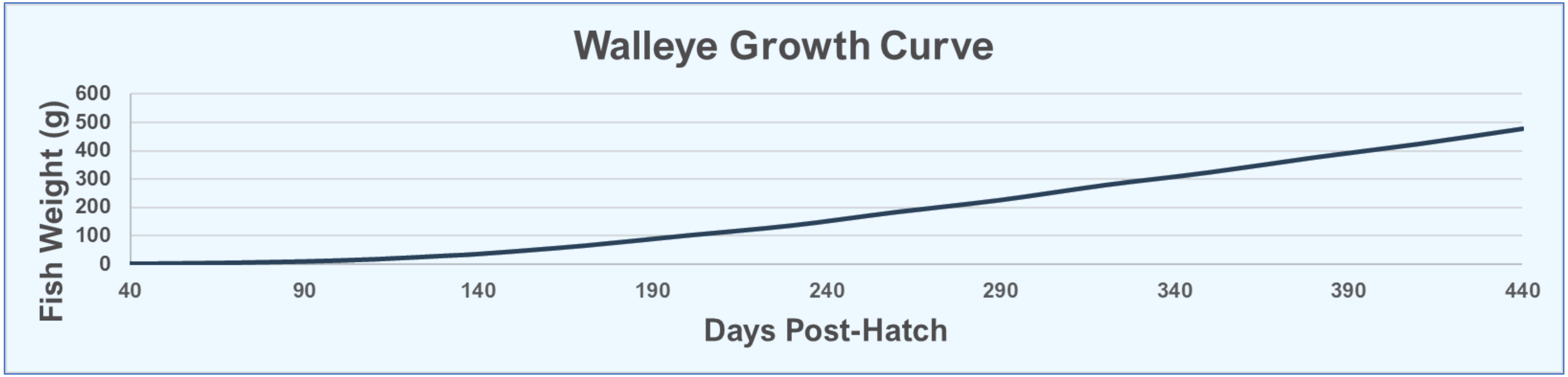
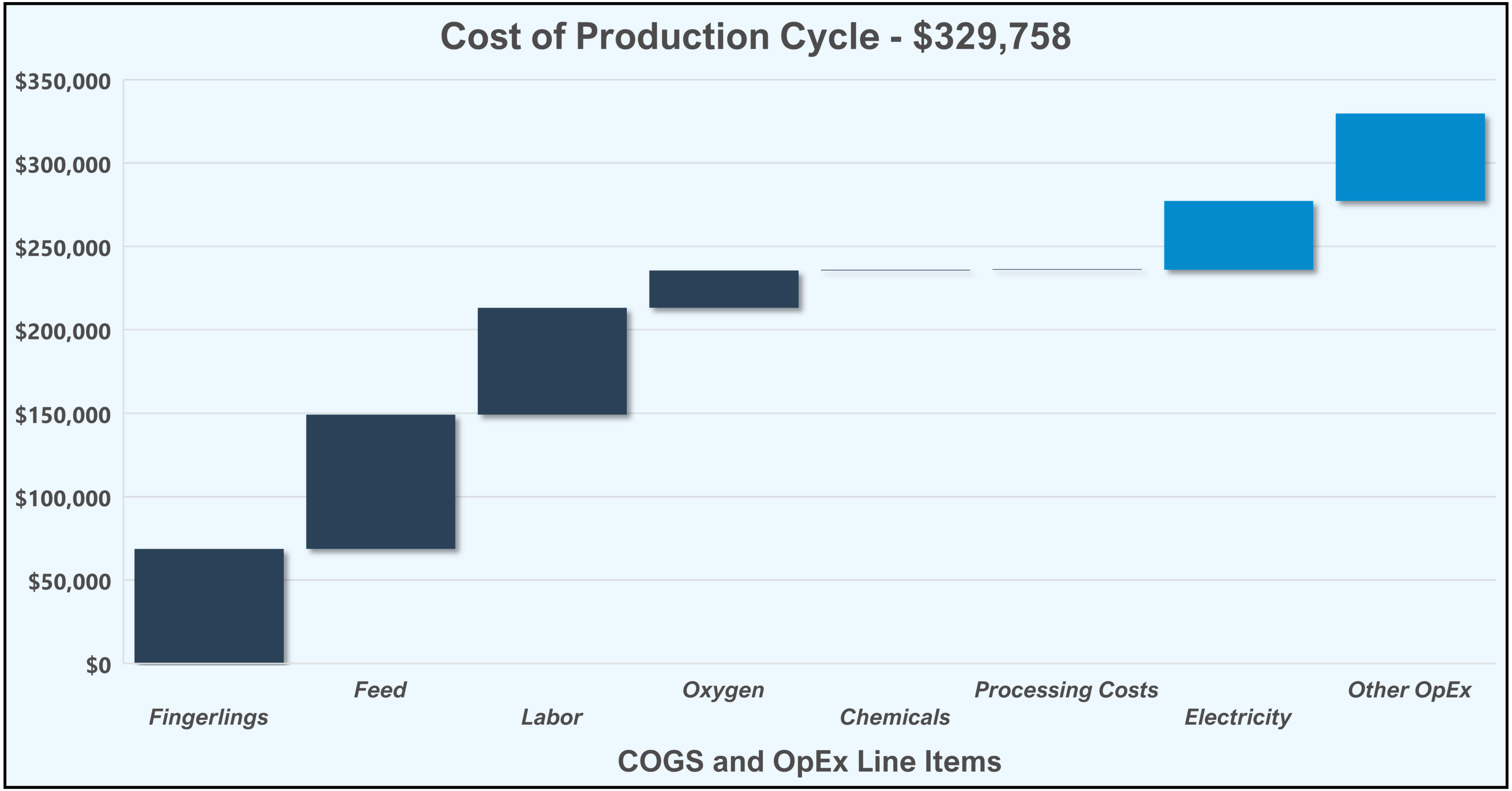
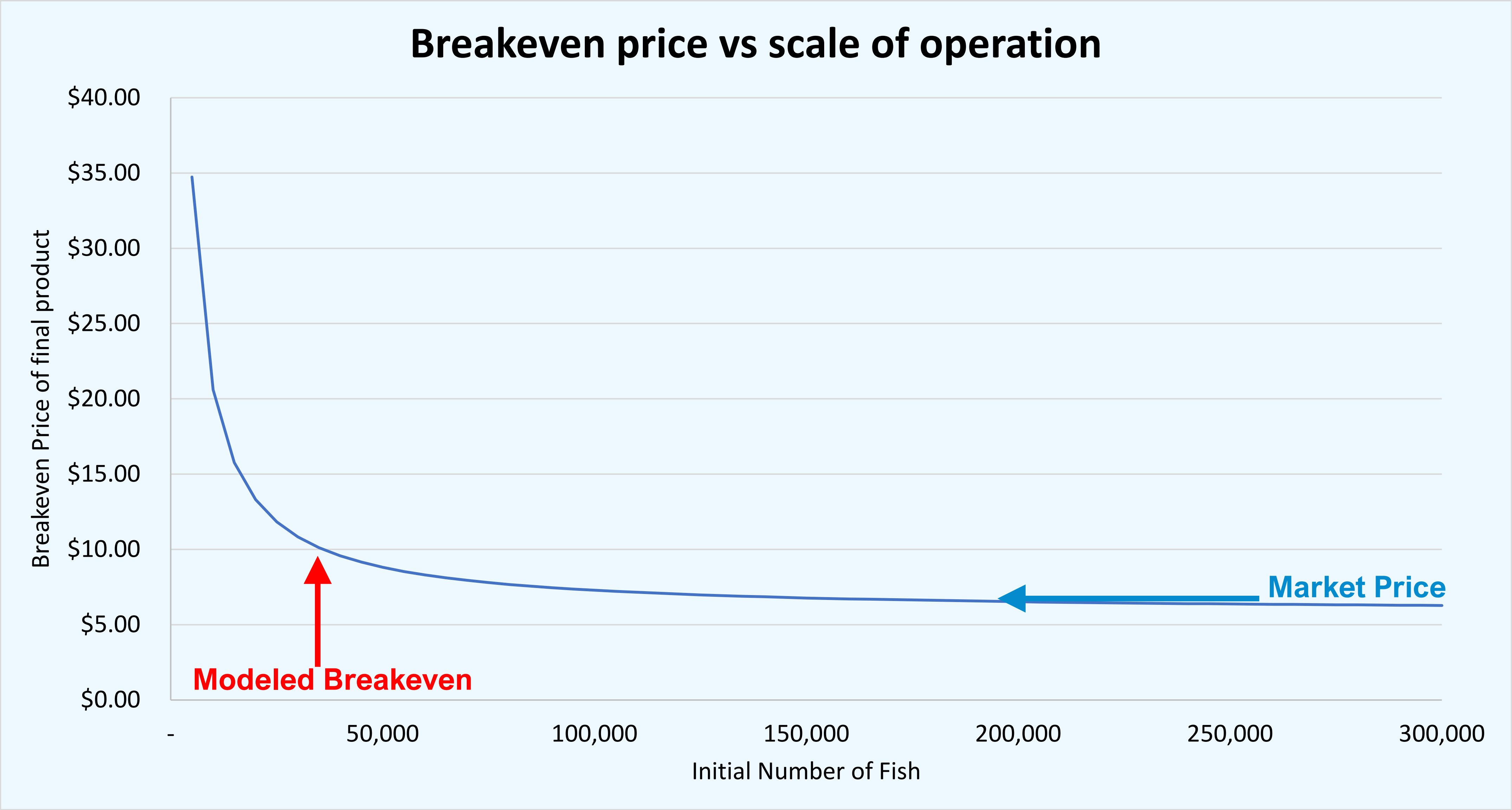




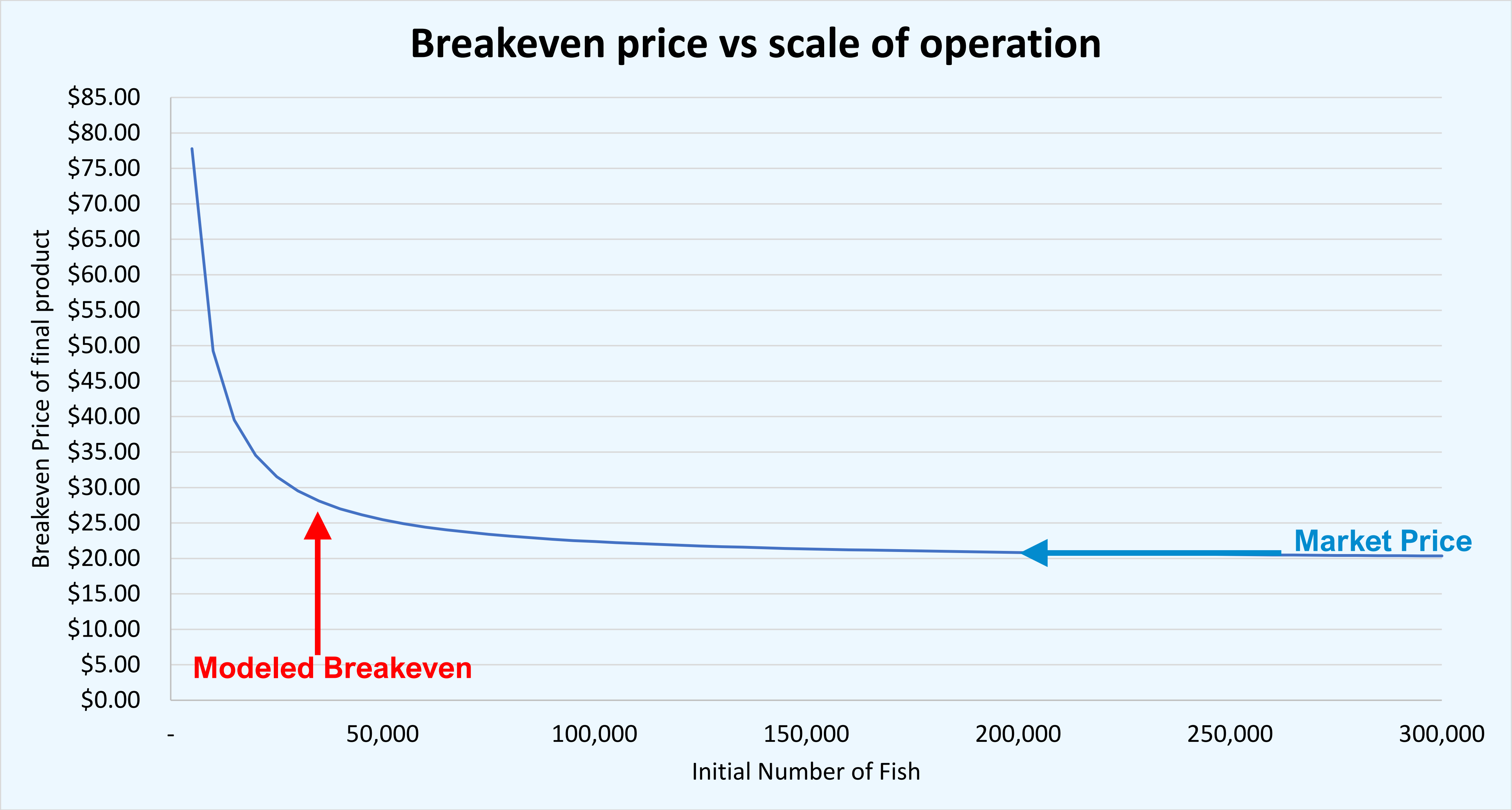
3. Define COGS & OpEx



4. Minimum Sale Price at Operating Breakeven (Whole Fish)



4. Minimum Sale Price at Operating Breakeven (Processed Fillet per pound)



Conclusions

- **If the Northern Aquaculture Demonstration Facility were converted to a walleye growout operation, we would not be able to compete with Canadian wild-caught frozen walleye fillets**
  - **34,330 fish is too small of an operation**
  - **Costs associated with our research facility are likely not very efficient compared to a dedicated growout facility**
  - **Possible that we could command a premium price by offering a "fresh, never frozen" alternative to frozen wild-caught fillets**

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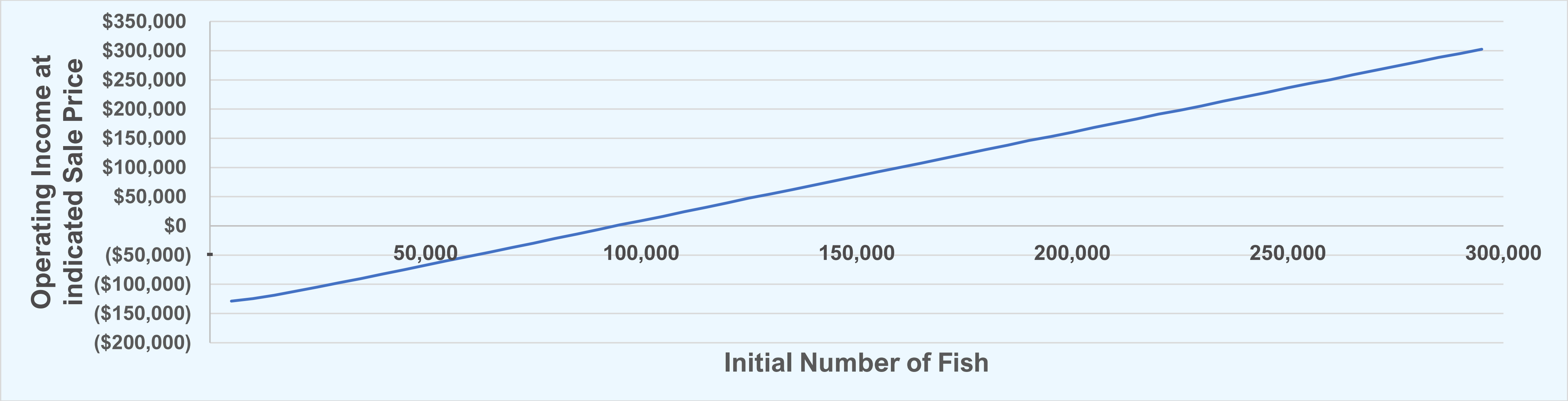
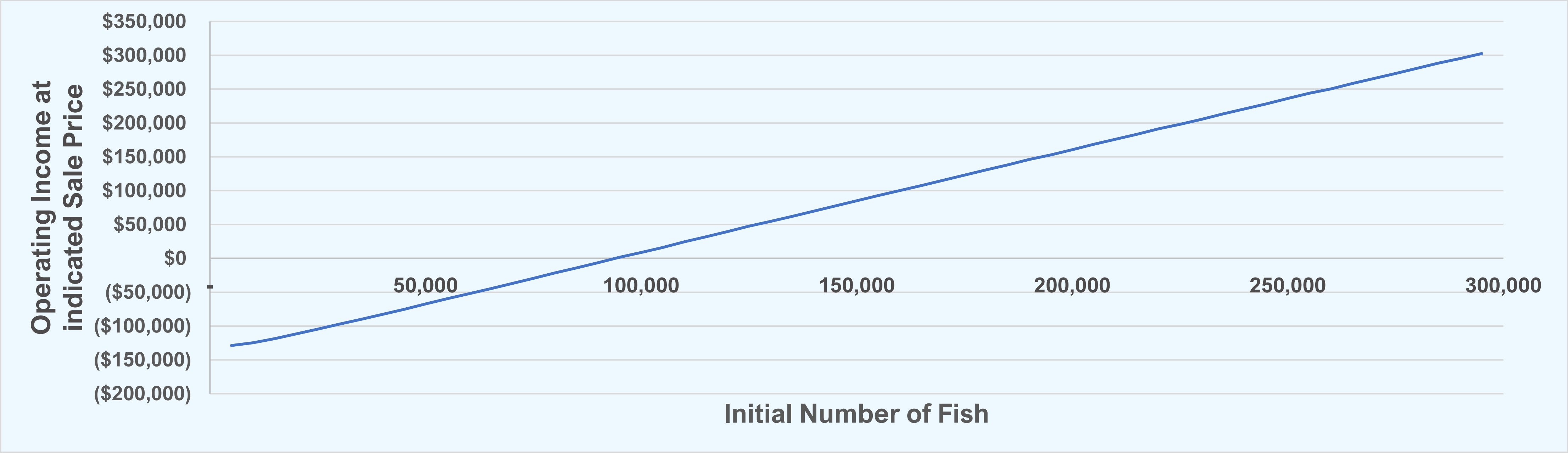
Operating Income breakeven scale at $7/ whole unprocessed walleye



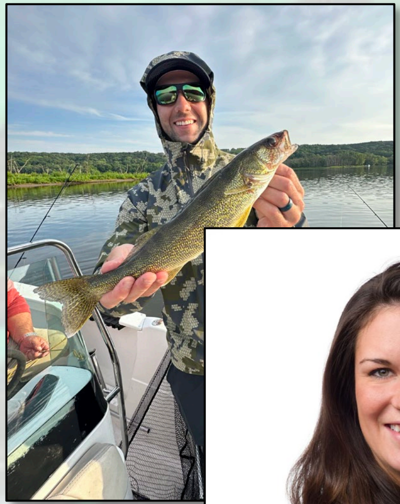
Operating Income breakeven scale at $22/lb of filleted walleye

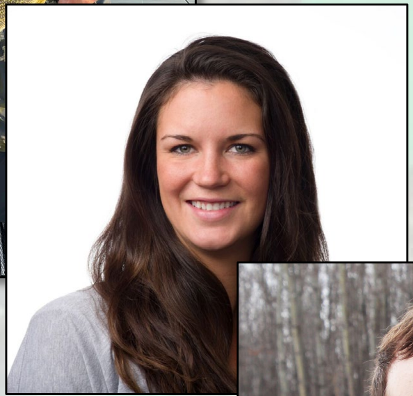


Conclusions

- **These types of analyses are critical for prospective farmers**
- **This tool is intended to make business planning much easier and more accessible to walleye farmers**
  - **Hopefully facilitates informed operation development**
  - **Can easily be modified to estimate any species**

Thank you!





For a copy of the model, email: tyfirkus@uwsp.edu

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