

Economics of Aquaculture Production

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Production Process

- Fish production is a biological process
 - There are production processes and needs
 - It is farming in a water medium and requires managing the medium for optimum growth of the fish
 - Understand feeding issues – frequency and associated demands at various stages of production
 - Growth performance – growth rates, weight gain/ period, survival
 - Biomass / carrying capacity
 - Other growth parameters – survival, aeration needs, etc

Bio-economics

- Technical / Biological:
 - ❑ Production requirements
 - Have a good understanding of your production system
 - Volume of water being used
 - What does it takes to produce a specified quantity of fish product?
 - ❖ Tanks, water, feed, oxygen, temperature, etc., needs
 - Sources and availability of inputs
- Economic / production costs
 - Have a good understanding of your production system
- Marketing
- Management – decisions and skills

Financials

- Know how much investments needed
- Expected profit levels
- Recovery of the initial investments
- Start-up costs
- Operational costs
- Major cost items

Economic Measures

- Net Returns – Snap shot assessment of revenue vs costs
 - Budgeting
 - Income Statement
 - Sensitivity Analysis
- Cash Flow Measures
 - Net Present Value (NPV) – measures future returns in today's \$s
 - Payback Period (PP) – measures time to recover initial investment
 - Return on Investment (ROI) – measures gains over costs
 - Internal Rate of Return (IRR) – measures timing of returns vs costs

Cost Terminologies

- Total cost of production – cost of **ALL** inputs used
 - **Variable Costs** – costs that change with the quantity produced, e.g., PLs, fingerlings, juveniles, feed, hired labor, chemicals, utilities, taxes, etc
 - Can be cash and non-cash (in-kind) expenses
 - **Fixed Costs** – costs associated with fixed inputs / assets and do not change with quantity produced
 - Land or property costs
 - Equipment, tools, vehicles
 - Interests charges, salaries, property taxes
 - Licensing fee, depreciations, etc.

Funding the Enterprise

- Initial investments
 - Planning, designing, permitting fees
 - Capital acquisitions, constructions, etc.
 - Value/costs of existing or own assets to be used
- Funding sources
 - Equity funds – capital contributions from owner
 - Borrowed capital (loans) with interest
 - Grants
- Think of immediate, intermediate, and long term cash needs (startup, operating & cash flow).

Assessing Net Returns

- Enterprise Budgeting
 - Assumes a new enterprise
 - A generalized snapshot of profitability (costs & returns) for a time period
 - Specify farm size / production level & time period (year or production cycle)
 - Items include Gross Receipts, Variable Costs, Fixed Costs & Total Costs
- Determine Breakeven prices
- Sensitivity Analysis – vary important cost items & market prices to assess profitability

Assessing Net Returns

- Partial Budgeting

- Assumes a existing enterprise with some changes
- Define a base production scenario and add planned changes
- Items include additional revenue, additional costs, reduced revenue, and reduced costs
- Determine net changes in profitability

- Financial / Income / Profit-Loss Statements

- Provides a quick picture of business profitability

- Cash flow Analysis

- Profitability is not the same as cash flow
- Shows liquidity – ability to meet financial obligations

Spreadsheet Models

- <https://ag.purdue.edu/agecon/Pages/Aquaculture-Budget.aspx>
- Cage Aquaculture Example
- Pond Aquaculture Example
- Recirculation Aquaculture Systems Example
- Species-specific
 - Pacific White Shrimp (*Litopenaeus vannamei*)
 - Hybrid Striped Bass
 - Yellow Perch
 - Tilapia

Shrimp Example



	Unit	Cost / Unit (\$)	Quantity	Cost (\$)	% of Total cost
Sales Receipts	lb	16.00	6,222	99,557.31	
<u>Variable Inputs:</u>					
PL	#	0.10	201,600	20,160.00	24%
Feed Price	lb.	1.20	7,904	9,484.87	11%
Electricity	kw-hr.	0.06	9,333	560.01	1%
Hired Labor	Hour	10.00	1095	10,950.00	13%
Heating	year	8.00	560.64	4,485.12	5%
Chemicals	\$	100.00	8	800.00	1%
Insurance	%	148.51	12	1,782.10	2%
Loan + Interest	%			7,794.97	9%
Total Variable Costs (TVC)	\$			56,017.07	65.42%
Cost/lb				9.00	

	Unit	Cost / Unit (\$)	Quantity	Cost (\$)	% of Total cost
Fixed Inputs:					
Building	\$	4,500.00	0.03	150.00	0%
Complete Tank System	\$	46,800.00	0.10	4,680.00	5%
Water Heater	\$	4,230.00	0.10	423.00	0%
Water Storage	\$	2,340.00	0.10	234.00	0%
Emergency Generator	\$	4,050.00	0.07	270.00	0%
Purge Tank	\$	405.00	0.10	40.50	0%
Agitators	\$	4,320.00	0.20	864.00	1%
Blower	\$	3,060.00	0.20	612.00	1%
Monitoring Equipment	\$	675.00	0.20	135.00	0%
Water Quality Equipment	\$	4,636.80	0.20	927.36	1%
Fish Handling Equipment	\$	900.00	0.50	450.00	1%
Feed Storage	\$	450.00	0.20	90.00	0%
System Set-up labor	\$	5,120.00	1.00	5,120.00	6%
Miscellaneous equipment	\$	4,500.00	0.20	900.00	1%
Maintenance	\$	297.02	12.00	3,564.21	4%
Management	\$	928.80	12	11,145.60	13%
Total Fixed Costs				29,605.67	34.58%
Total Costs (TC)	\$			85,622.74	100.00%
Break-even price (BEP)	\$/lb			13.76	
Profit Above TVC	\$/lb			4.76	35%
Profit Above TC	\$/lb			2.24	16%

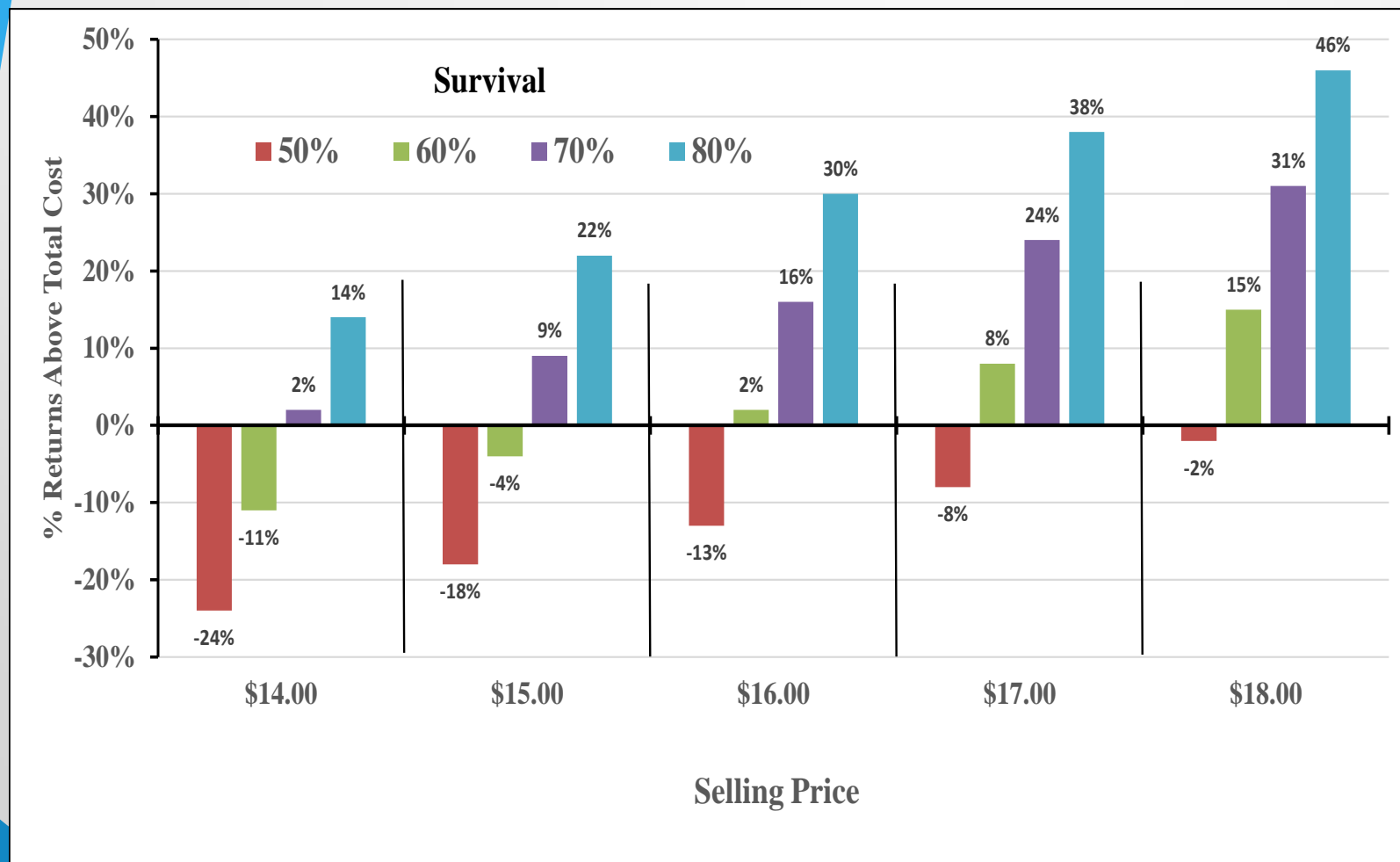
Profitability

- Breakeven price is \$13.76/lb - price point where the sale price covers total cost (both fixed and variable)
- Profit is obtained with selling price higher than \$13.76.
- Aquaculture is a high-risk industry, so target at least 15% profit margin.
- Controllable factors
 - Management – Stocking size, densities, survival, feeding, water quality, etc
- Less Controllable factors
 - Input costs, input supply, prices

Sensitivity Analysis

- Variables that significantly affect profitability are survival rate (or mortality) and selling price
- Scenario analysis of profit margin with a range of selling prices and survival rates.
 - survival rates of 50% – 80%
 - selling price from \$12.00 – \$18.00

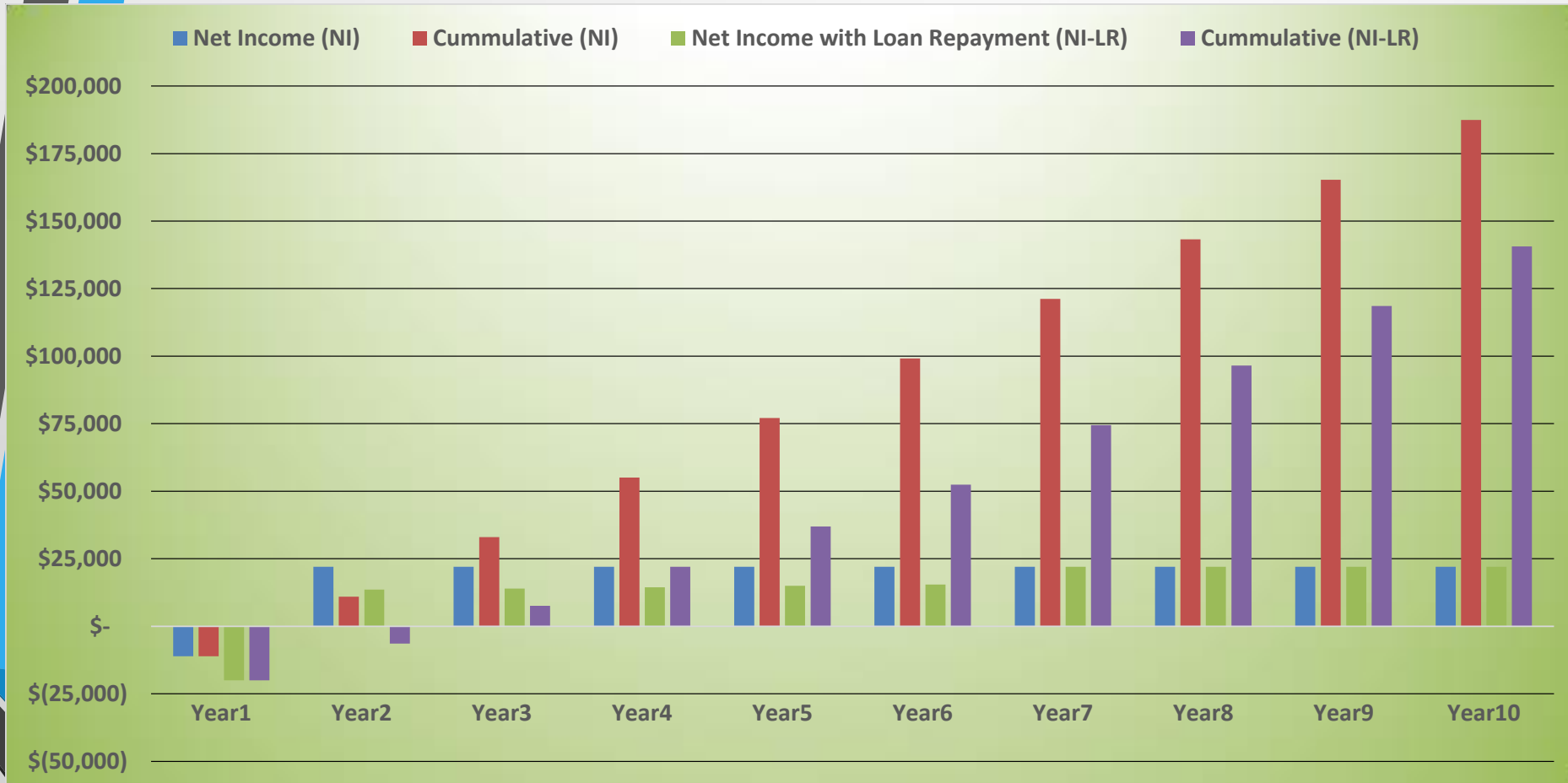
% profit for "21/25" Count (1.3g, 14wk)



Cash Flow Analyses

- Net Present Value (NPV) – measures future returns in today's \$s; *better at higher amounts but depends on discount rate used*
- Payback Period (PP) – measures time to recover initial investment; *shorter preferred for reinvestment*
- Return on Investment (ROI) – measures gains over costs; *higher % is better*
- Internal Rate of Return (IRR) – measures timing of returns vs costs; *higher IRR (%) is better*

Income Stream "21/25" Count



Hybrid Striped Bass Example



Hybrid Striped Bass Example

	Unit	Cost / Unit (\$)	Qty	Cost (\$)	% of Total cost
Sales Receipts	lb	3.75	9,540	35,775.00	
<u>Variable Inputs:</u>					
Fingerlings (4")	Number	0.55	9,091	5,000.00	16%
Feed Price	lb.	0.60	10,710	6,426.00	20%
Electricity Cost	kw-hr.	0.15	14,310	2,146.50	7%
Hired Labor	Hour	10.00	400	4,000.00	13%
Transportation Costs	fish	0.15	9,091	1,363.64	4%
Chemicals	year	100.00	12	1,200.00	4%
Insurance	%	20,136.13	0.02	402.72	1%
Loan + Interest	%			1,819.03	6%
Total Variable Costs (TVC)	\$			22,357.88	71%
Cost/lb				2.34	

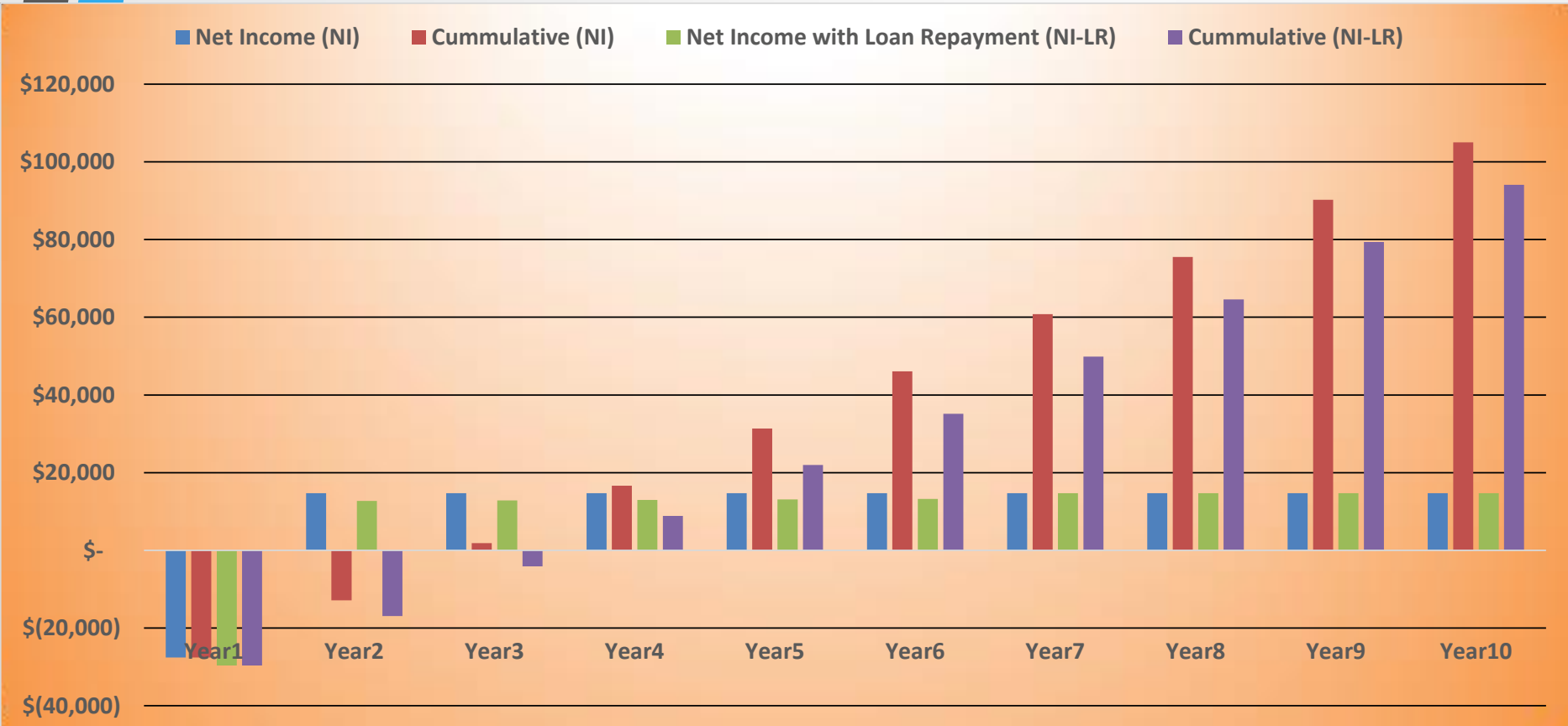
Hybrid Striped Bass Example

	Unit	Cost / Unit (\$)	Qty	Cost (\$)	% of Total cost
<u>Fixed Inputs:</u>					
Water acres	acre	250.00	12	3,000.00	9%
Cages	Number	9,000.00	0.2	1,800.00	6%
Storage Building	\$	1,500.00	0.1	150.00	0%
De-stratification system	\$	3,000.00	0.1	300.00	1%
Dock/Boat	\$	2,000.00	0.1	200.00	1%
Misc farm equipment	\$	3,000.00	0.2	600.00	2%
Maintenance	\$	181.50	12	2,178.00	7%
Admin / Management	%	20,136.13	5%	1,006.81	3%
Total Fixed Costs				9,234.81	29%
Total Costs (TC)	\$			31,592.69	100%
Break-even price (BEP)	\$/lb			3.31	
Profit above TVC	\$/lb			1.41	42%
Profit above TC	\$/lb			0.44	13%

Profit Margin Scenarios



Income Stream



Take Aways

1. Aquaculture economics is a bio-economic process; if the biology works efficiently at less costs, the economics will also work.
2. Understand all factors affecting production and the cost at each stage of production.
3. Profitability is not the same as Cash flow
 - Profitability analysis gives you a snap shot at the enterprise
 - Cash flow analysis shows liquidity; ability to meet financial obligations

THANKS

QUESTIONS

