

ECONOMIC POTENTIAL OF OFFSHORE AQUACULTURE IN THE GULF OF MEXICO

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Objectives

- Develop a hypothetical commercial offshore aquaculture production system (COAPS) in the Gulf of Mexico
- Estimate costs and returns of COAPS.
- Evaluate the economic viability of COAPS under different economic and biological scenarios.

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Data Sources

- Offshore aquaculture production system
 - Offshore Aquaculture Consortium (OAC)
- Offshore cage design & operation
 - Ocean Spar and OAC
- Gulf of Mexico ex-vessel prices
 - National Marine Fisheries Service (NMFS)

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Offshore Aquaculture Production System

- Aquaculture Service Vehicle (ASV)
- 3,000-m³ Ocean Spar Sea Station (OSSS) cages
- Moorings, feed distribution system and net cleaners
- Service boats

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Land-based Support Facilities

- 2-ha base camp
- Office building and trailers
- Trucks and service vehicles
- Fish transport vehicle

Initial Fixed Investment

(6-cages or 18,000 m³)

<i>Item</i>	<i>Total Cost (US\$)</i>	<i>US\$/m³</i>
<i>Onshore support facilities</i>	0.33	18
<i>Offshore facilities</i>	3.06	170
<i>Total investment</i>	3.39	188

Initial Fixed Investment (cont.)

(12-cages or 36,000 m³)

<i>Item</i>	<i>Total Cost (US\$)</i>	<i>US\$/m³</i>
<i>Onshore support facilities</i>	0.33	9
<i>Offshore facilities</i>	4.02	112
<i>Total investment</i>	4.35	121

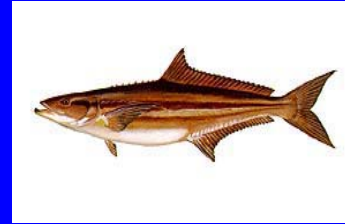
Costs and Returns Estimation

- Recommended management practices
- Biological knowledge of candidate fish species
- Estimated input usage and prices
- Established ex-vessel fish prices

Investment Analysis

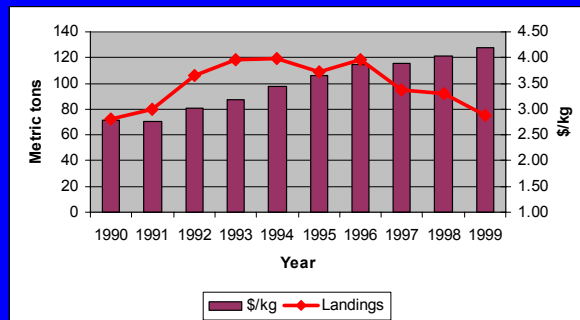
- Payback period (yr)
- Net present value (US\$M)
- Internal rate of return (%)
- Base model assumptions
- Improved growth (+25%)
- Enhanced market (+US\$1/kg)

Cobia, *Rachycentron canadum*



- Successfully cultured in ponds and cages in Taiwan.
- Can be grown to at least 5 kg in 12 months.
- Successfully spawned in USA.

U.S. Gulf of Mexico Commercial Cobia Landings



Cobia COAPS Model Assumptions

Item	Unit	Cobia 6	Cobia 12	Improved growth	Enhanced market
Stocking size	G	50	50	50	50
Stocking density	Fish/m ³	12	10	8	10
Growth rate	G/mo	330	330	412	330
Feed conversion	Kg feed/kg fish	2	2	2	2
Survival rate	%	75	75	75	75
Capital Outlay	US\$M	3.39	4.35	4.35	4.35
Ex-vessel price	US\$/kg	6.61	4.25	4.25	5.25

Cobia COAPS Model Description

Item	Unit	Cobia 6	Cobia 12	Improved growth	Enhanced market
Number of cages	3000 m3	6	12	12	12
Growing capacity	Kg/m3	27	30	30	30
Harvest size	Kg/fish	3	4	5	4
Growout period	Mo/crop	9	12	12	12
Fish production	Mt/crop	489	1083	1079	1083
Fingerlings	1000 pc/crop	216	360	288	360
Feed	Mt/crop	978	2165	2157	2165

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Cobia COAPS Model Results

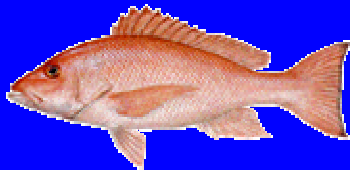
Item	Unit	Cobia 6	Cobia 12	Improved growth	Enhanced market
Total cost	US\$M/yr	2.91	4.60	5.54	4.65
Gross sales	US\$M/yr	3.24	4.60	4.58	5.68
Net returns	US\$M/yr	0.33	0.00	0.05	1.04
Payback period	Yr	11	Indefinite	Indefinite	4
NPV	US\$M	0.57	-1.59	-1.31	4.13
IRR	%	14.24	-0.38	1.57	32.83
Investment Decision		Feasible	Infeasible	Infeasible	Feasible

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Red snapper, *Lutjanus campechanus*



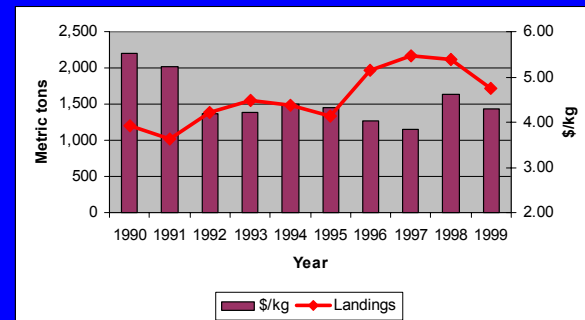
- Experimental results in Alabama showed growth rate of 1.23 g/day.

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U.S. Gulf of Mexico Commercial Red Snapper Landings



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Red Snapper COAPS Model Assumptions

Item	Unit	Snapper 12	Improved growth	Enhanced market
Stocking size	G	50	50	50
Stocking density	Fish/m3	80	65	80
Growth rate	G/mo	37	46	37
Feed conversion	Kg feed/kg fish	2	2	2
Survival rate	%	75	75	75
Capital Outlay	USSM	4.35	4.35	4.35
Ex-vessel price	US\$/kg	4.50	4.50	5.50

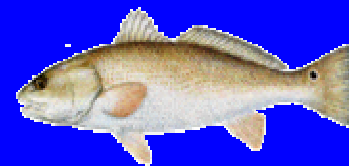
Red Snapper COAPS Model Description

Item	Unit	Snapper 12	Improved growth	Enhanced market
Number of cages	3000 m3	12	12	12
Growing capacity	Kg/m3	30	29	30
Harvest size	Kg/fish	0.49	0.60	0.49
Growout period	Mo/crop	12	12	12
Fish production	Mt/crop	1067	1056	1067
Fingerlings	M pc/crop	2.88	2.34	2.88
Feed	Mt/crop	2134	2113	2134

Red Snapper COAPS Model Results

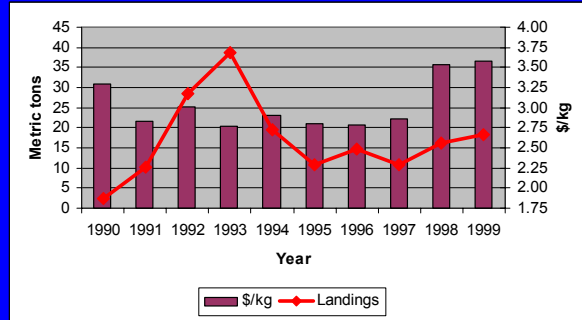
Item	Unit	Snapper 12	Improved growth	Enhanced market
Total cost	USSM/yr	6.66	6.20	6.71
Gross sales	USSM/yr	4.80	4.75	5.87
Net returns	USSM/yr	-1.86	-1.44	-0.84
Payback period	Yr	Indefinite	Indefinite	Indefinite
NPV	USSM	-11.98	-9.65	-6.26
IRR	%	NA	NA	NA
Investment Decision		Infeasible	Infeasible	Infeasible

Red drum, *Sciaenops ocellatus*



- Successfully cultured in ponds and offshore cages in the Gulf of Mexico.
- Can reach 1 kg in 12 months

U.S. Gulf of Mexico Commercial Red Drum Landings



Red Drum COAPS Model Assumptions

Item	Unit	Drum 12	Improved growth	Enhanced market
Stocking size	G	50	50	50
Stocking density	Fish/m ³	40	32	40
Growth rate	G/mo	80	100	80
Feed conversion	Kg feed/kg fish	2	2	2
Survival rate	%	75	75	75
Capital Outlay	US\$M	4.35	4.35	4.35
Ex-vessel price	US\$/kg	3.75	3.75	4.75

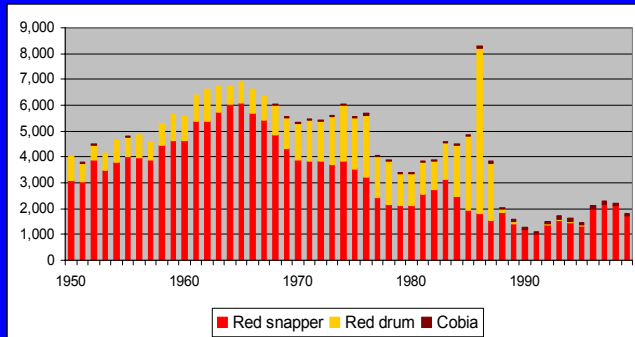
Red Drum COAPS Model Description

Item	Unit	Drum 12	Improved growth	Enhanced market
Number of cages	3000 m ³	12	12	12
Growing capacity	Kg/m ³	30	30	30
Harvest size	Kg/fish	1.01	1.25	1.01
Growout period	Mo/crop	12	12	12
Fish production	Mt/crop	1091	1080	1091
Fingerlings	M pc/crop	1.44	1.15	1.44
Feed	Mt/crop	2182	2160	2182

Red Drum COAPS Model Results

Item	Unit	Drum 12	Improved growth	Enhanced market
Total cost	US\$M/yr	5.49	5.23	5.53
Gross sales	US\$M/yr	4.09	4.05	5.18
Net returns	US\$M/yr	-1.40	-1.18	-0.35
Payback period	Yr	Indefinite	Indefinite	Indefinite
NPV	US\$M	-9.38	-8.17	-3.53
IRR	%	NA	NA	NA
Investment Decision		Infeasible	Infeasible	Infeasible

U.S. Gulf of Mexico Commercial Cobia, Red Snapper and Red Drum Landings



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Summary

- These simulation results are based on experimental or “best guess” scenario.
- Simulation results indicate that the economic viability of COAPS depends on the following:
 - better fish
 - faster growing fish
 - cheaper costs of production

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Limitations

- ASV is still under development
 - capacity (?)
 - costs (?)
- Environmental monitoring
 - equipment, supplies and manpower
 - costs (?)
- Permitting process
 - length of time (?)
 - costs (?)

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Further Economic Research

- Verify simulation model assumptions
 - logistical problems
 - fingerling, feed, fish, manpower, supplies
 - pilot scale experiments
 - fish growth, feed type, feeding, FCR, treatment
 - stocking, harvest, transport
- Develop a marketing plan
 - constraints limiting harvest, possession and sale of fish
 - discover new markets for new fish products
- Develop a model business plan

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ACKNOWLEDGMENT

