Economic Feasibility 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 annual costs and returns of COAPS.
- Develop annual cash flows for COAPS.
- Evaluate the economic and financial feasibility of COAPS under different economic and biological scenarios.

Data Sources

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

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

Land-based Support Facilities

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

Initial Fixed Investment (12-cages or 36,000 m3)

Item	*Total Cost (US$)*	*US$/m3*
Onshore support facilities	0.33	9
Offshore facilities	3.52	98
Total investment	3.85	107

Costs and Returns Estimation

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

Investment Analysis

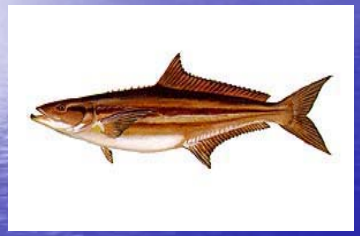
- Payback period (yr)
- Net present value (NPV, US$M)
- Internal rate of return (IRR, %)

- Base model assumptions
- Improved growth *(+25%)*
- Enhanced market *(+US$1/kg)*
- Enhanced market + improved growth
- Increased or reduced capital outlay
- Higher or lower FCR & feed costs
- Element of risk & uncertainty

CANDIDATE FISH SPECIES

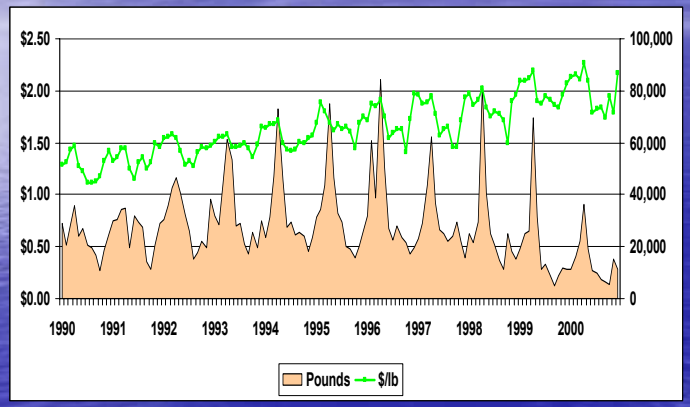
- Culture characteristics
  - Spawning and hatching
  - Growth potential
  - State and federal regulations
- Commercial Harvest
  - Landings
  - Ex vessel Prices
  - South Atlantic
  - Gulf of Mexico

Cobia or Lemon Fish or Ling
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.**
- **Commercial harvesting is subject to state and federal regulations**

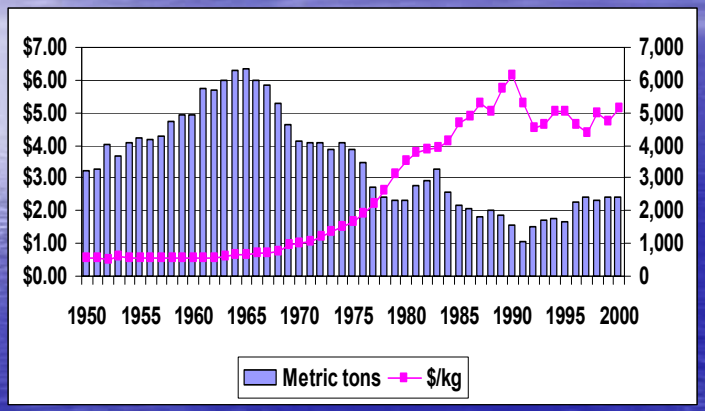
Monthly U.S. Commercial Cobia Landings



Red snapper *Lutjanus campechanus*

- Experimental results in Alabama showed growth rate of 1.23 g/day.
- Commercial harvesting is subject to state and federal regulations

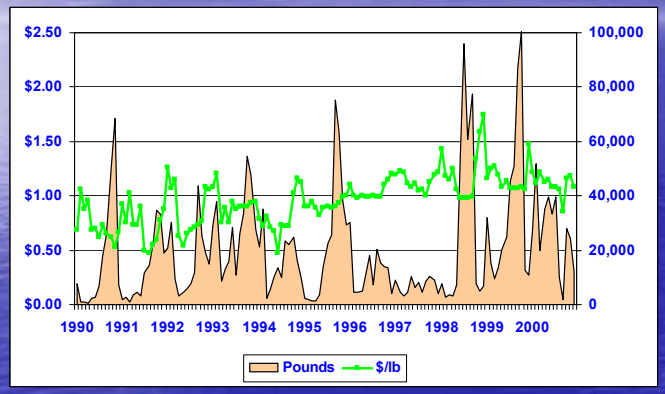
Annual U.S. Commercial Red Snapper Landings



Red drum or Redfish *Sciaenops ocellatus*

- Successfully cultured in ponds and offshore cages in the Gulf of Mexico.
- Can reach 1 kg in 12 months
- Commercial harvesting is subject to state regulations
- Illegal to harvest or possess in federal waters

Monthly U.S. Commercial Red Drum Landings



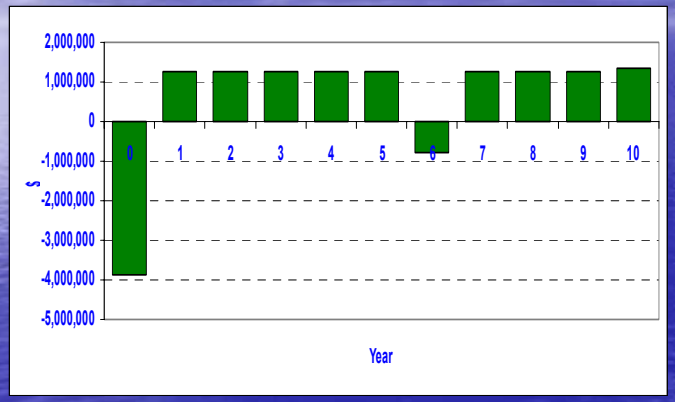
COAPS SIMULATIONS

- Base Model
  - 12-cages, one crop per year
- Enhanced Market Model
  - Farmgate price = $1/kg more
- Improved Growth Model
  - Growth rate = 25% more

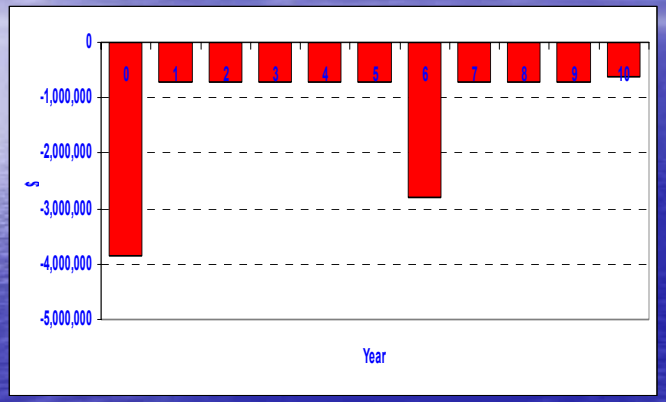
12- Cage COAPS Base Model

Item	Unit	COBIA12	SNAP12	DRUM12
Stocking density	Fish/m3	7	83	41
Growth rate	G/month	583	37	80
Ex-vessel price	$/kg	4.25	4.50	3.75
Harvest size	Kg/fish	5.25	0.45	0.97
Fish production	1000 mt/yr	1.08	1.08	1.08
Net returns	$M/yr	0.8	<0	<0
Payback priod	yr	5.6	Undefined	Undefined
NPV	$M	2.56	<0	<0
IRR	%	26	<0	<0
Investment decision		Feasible	Infeasible	Infeasible

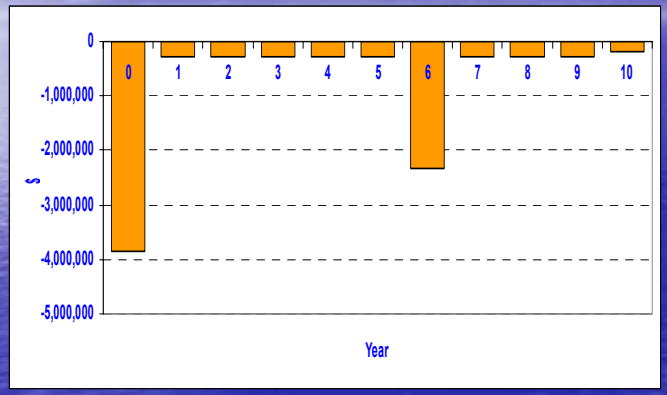
10-year Annual Net Cash Flow COBIA12 COAPS Base Model



10-year Annual Net Cash Flow
SNAP12 COAPS Base Model



10-year Annual Net Cash Flow
DRUM12 COAPS Base Model



12- Cage COAPS Enhanced Market Model

Item	Unit	COBIA12	SNAP12	DRUM12
Stocking density	Fish/m3	7	83	41
Growth rate	G/month	583	37	80
Ex-vessel price	$/kg	5.25	5.50	4.75
Harvest size	Kg/fish	5.25	0.45	0.97
Fish production	1000 mt/yr	1.08	1.08	1.08
Net returns	$M/yr	1.84	<0	0.17
NPV	$M	7.84	<0	-0.45
IRR	%	53	<0	7
Investment decision		Feasible	Infeasible	Infeasible

12- Cage COAPS Improved Growth Model

Item	Unit	COBIA12	SNAP12	DRUM12
Stocking density	Fish/m3	6	67	33
Growth rate	G/month	729	46	100
Ex-vessel price	$/kg	4.25	4.50	3.75
Harvest size	Kg/fish	6.57	0.56	1.21
Fish production	1000 mt/yr	1.14	1.08	1.08
Net returns	$M/yr	1.0	<0	<0
NPV	$M	3.4	<0	<0
IRR	%	32	<0	<0
Investment decision		Feasible	Infeasible	Infeasible

Implications

- COAPS modeling was based on experimental or recommended management practices.
- Economic viability of COAPS depends on the combination of:
  - better fish
  - faster growing fish
  - lower costs of production
- Harvesting (and marketing) are subject to regulations governing capture fisheries

Technical Limitations

- ASV is still under development:
  - capacity and purchase & operating costs
- Environmental monitoring:
  - procedures, equipment, supplies and manpower and costs
- Permitting process:
  - forms, agencies, length of time and costs

Biological, Economic and Marketing Limitations

- COAPS model assumptions not verified:
  - logistical problems: fingerlings, feed, fish, manpower, supplies
  - pilot scale experiments: fish growth, feed type, feeding, FCR, treatment, stocking, harvest, transport
- Not incorporated in the COAPS model:
  - Broodstock, hatchery and nursery components
  - Processing and distribution components
    - product forms and yields
    - packaging and pricing

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