Economic Viability of Offshore Aquaculture in Southern California

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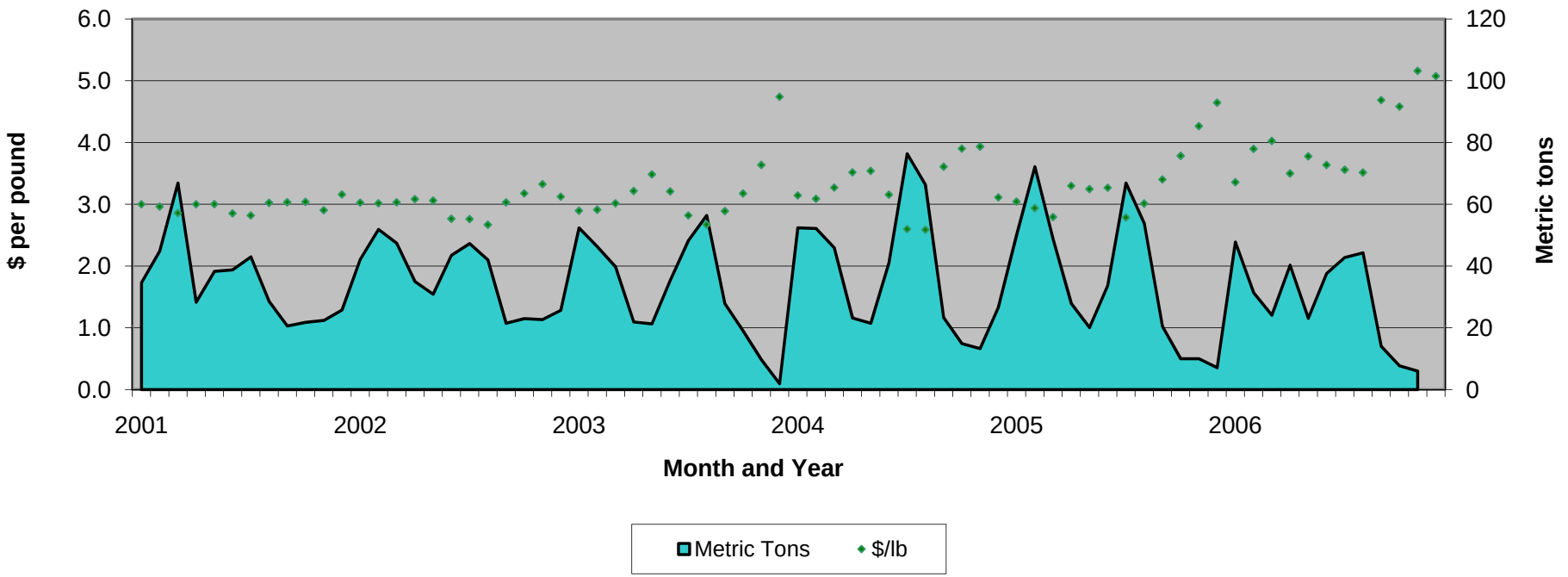
U.S. Commercial Landings California Halibut

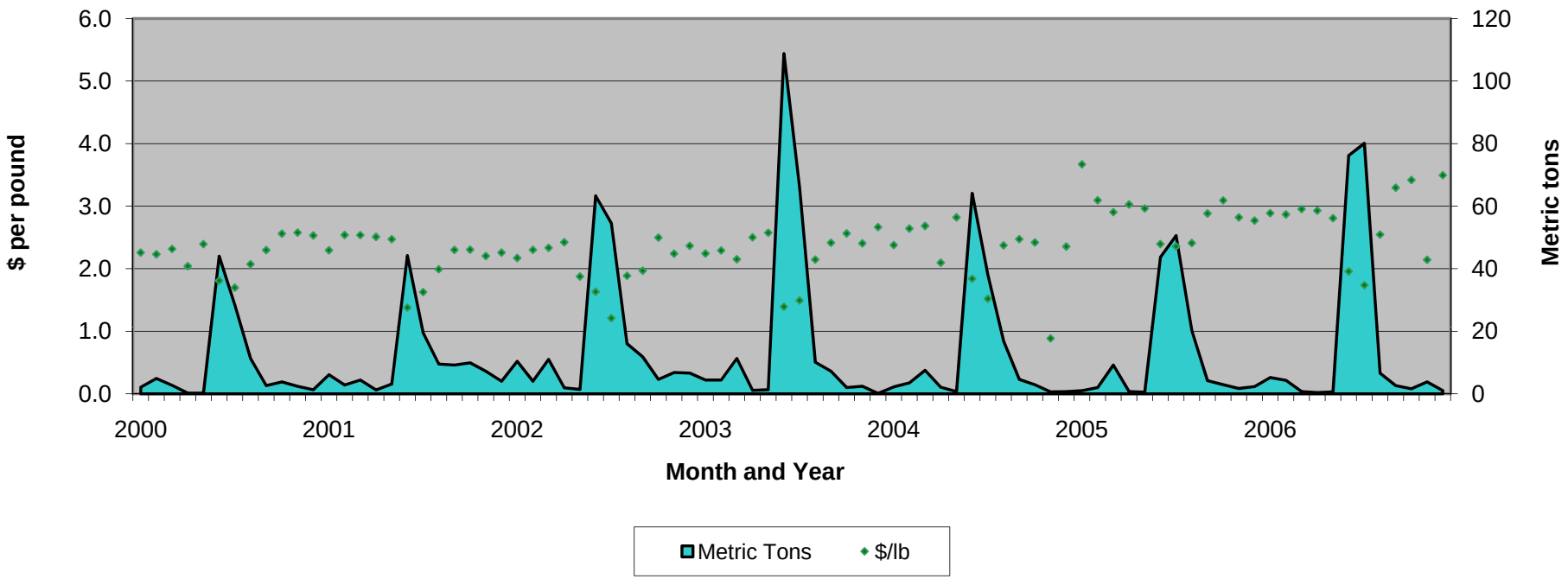
California flounder, *Paralichthys californicus*



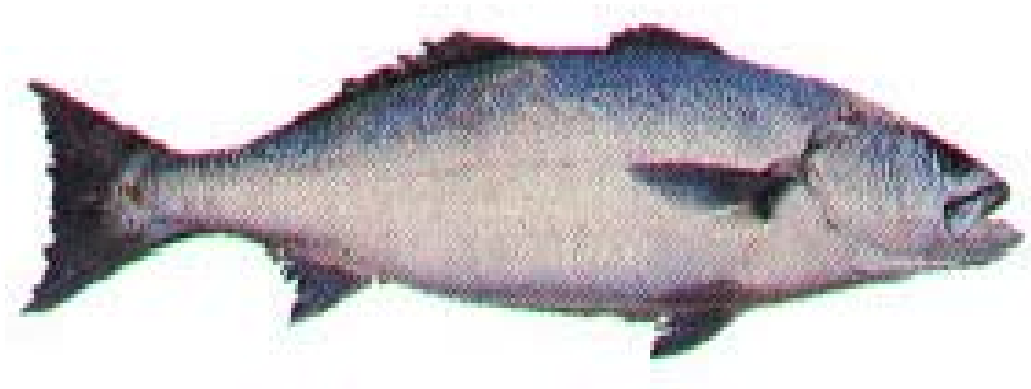
	LBS	$	$/LB
Mean	74,462	232,119	3.32
StDev	37,551	100,801	0.58

U.S. Commercial Landings White Seabass

White weakfish, *Atractoscion nobilis*

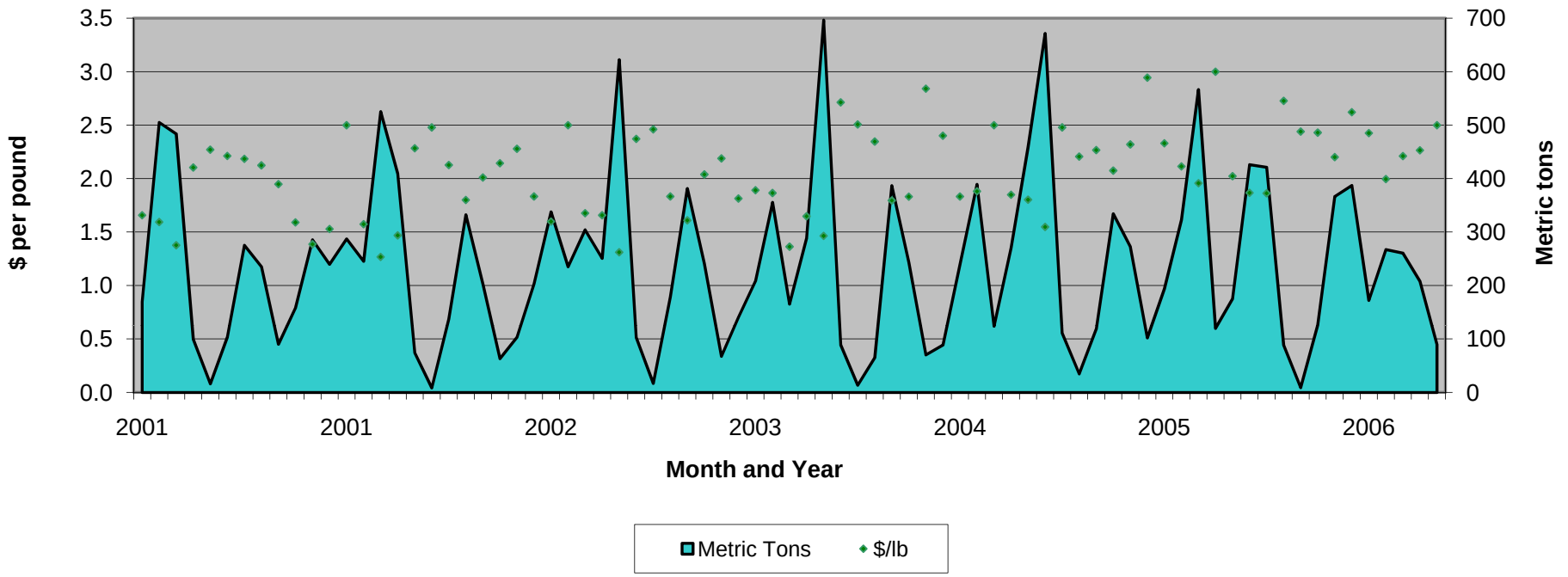


	LBS	$	$/LB
Mean	28,923	54,766	2.37
StDev	47,643	79,396	0.50



U.S. Commercial Landings Striped Bass

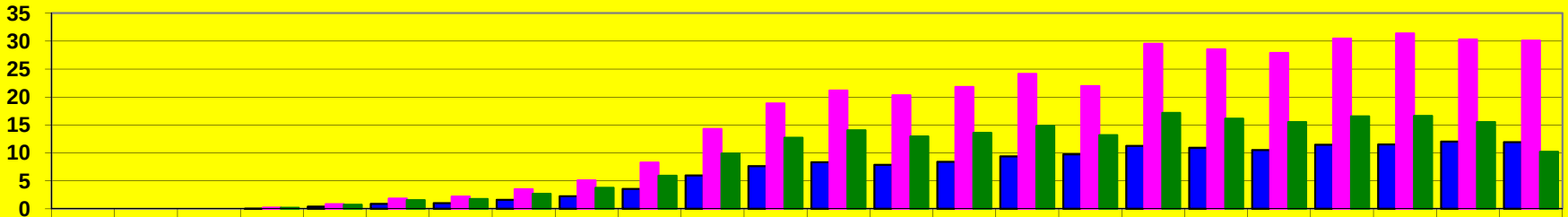
Morone saxatilis, rock or rockfish



	LBS	$	$/LB
Mean	519,297	977,416	2.05
StDev	353,254	571,570	0.40

U.S. Striped Bass Aquaculture

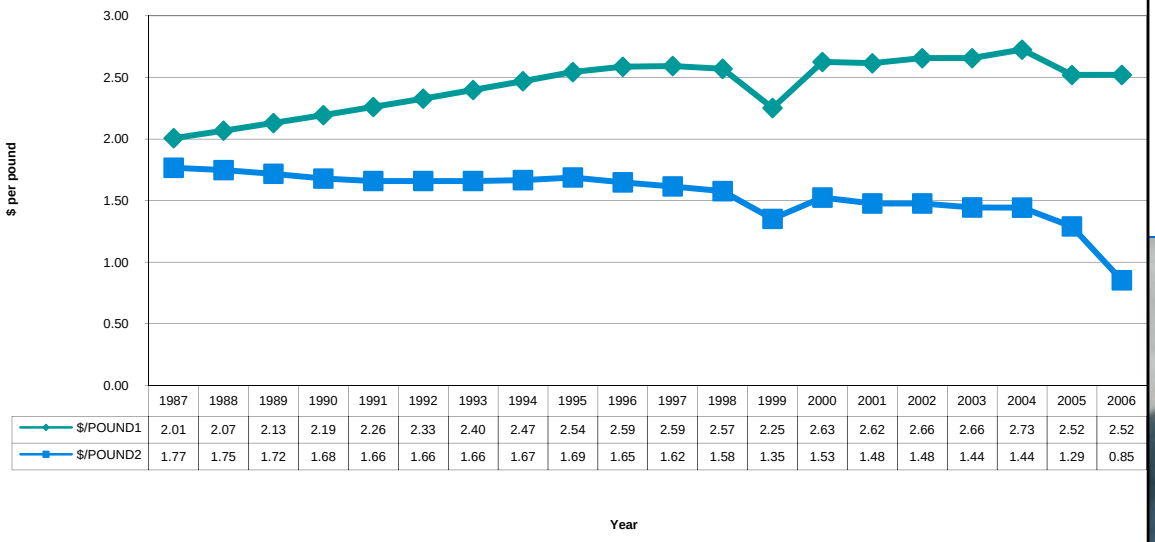
U.S. Aquaculture Production: Striped Bass



	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
MILLION LB	0	0	0	0	0	1	1	2	2	4	6	8	8	8	8	9	10	11	11	10	11	12	12	12
MILLION $	0	0	0	0	1	2	2	3	5	8	14	19	21	20	22	24	22	30	29	28	30	31	30	30
DEF MIL $	0	0	0	0	1	2	2	3	4	6	10	13	14	13	14	15	13	17	16	15	17	17	16	10

Year

FARM-GATE PRICES: STRIPED BASS



	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
$/POUND1	2.01	2.07	2.13	2.19	2.26	2.33	2.40	2.47	2.54	2.59	2.59	2.57	2.25	2.63	2.62	2.66	2.66	2.73	2.52	2.52
$/POUND2	1.77	1.75	1.72	1.68	1.66	1.66	1.66	1.67	1.69	1.65	1.62	1.58	1.35	1.53	1.48	1.48	1.44	1.44	1.29	0.85

Year

	LBS x1000	$ x1000	$/LB1	$/LB2
Mean	11,062	29,166	2.64	1.43
StDev	374	1,464	0.07	0.07

Economic Model
Commercial Offshore Aqua Prod System

- Develop hypothetical model for Southern California.
  - Estimate investment requirements
  - Estimate annual costs and returns.
  - Develop annual cash flows.
- Evaluate the economic and financial feasibility using NPV & IRR methods.
  - Use base model scenarios
  - Incorporate risks and uncertainties using Simetar.

- Commercial offshore aquaculture production system
  - Gulf of Mexico Offshore Aquaculture Consortium
  - Hubbs-SeaWorld Research Institute
- Offshore cage design & operation
  - Ocean Spar Sea Station (OSSS)
  - Other manufacturers
- U.S. commercial ex-vessel and wholesale prices
  - NOAA Fisheries
  - Urner Barry
  - Market discovery

Risks and Uncertainties

Biological

- Harvest sizes
- Growth rates
- Survival rates
- Feed conversion
- Diseases

Environmental

- Temperature changes
- Natural disasters
- Predators
- Poachers

Fish markets

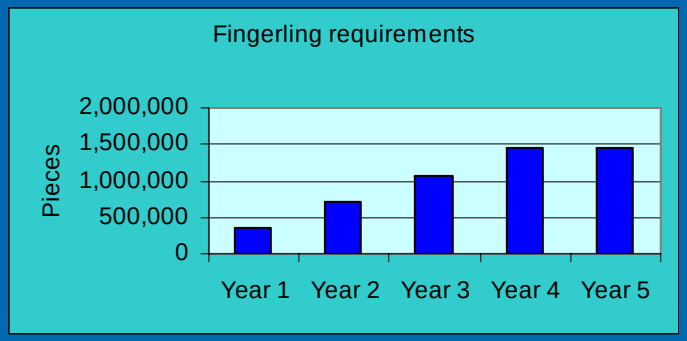
- Whole fish prices
- Live fish prices
- Headed & gutted fish prices
- Steak fish prices
- Fillet prices

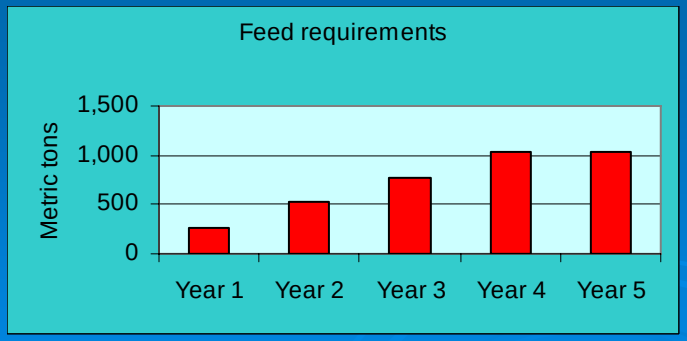
Input markets

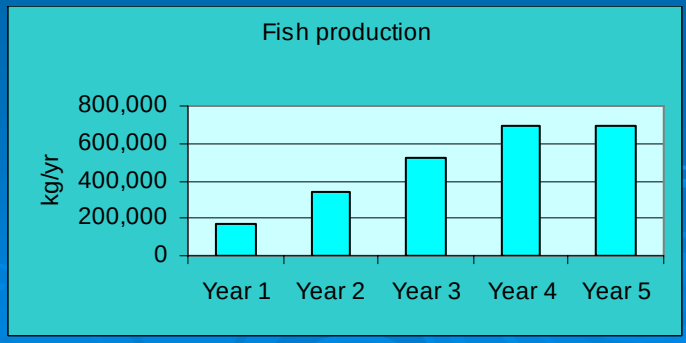
- Fingerling cost
- Feed cost
- Fuel cost
- Labor costs
- Interest rates
- Processing costs
- Storage costs
- Transport costs

Base COAPS Model Description

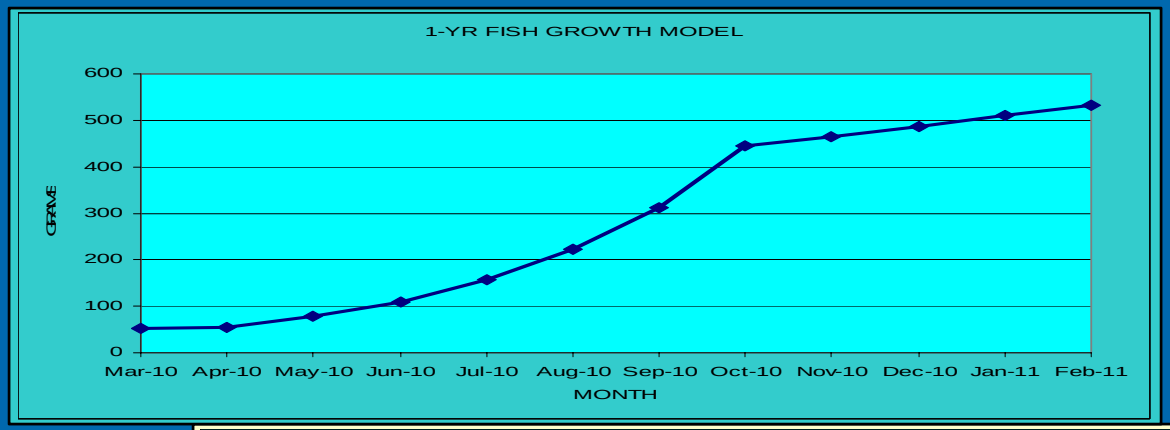
Item	Unit	Risk-free
Stocking density	Fish/m3	40
Growth rate	G/year	483
Harvest size	Kg/fish	0.53
Culture period	Month/crop	12
Number of cages	Cage	12
Ex-vessel price	$/kg	5.22
Diesel fuel cost	$/gal	4.25

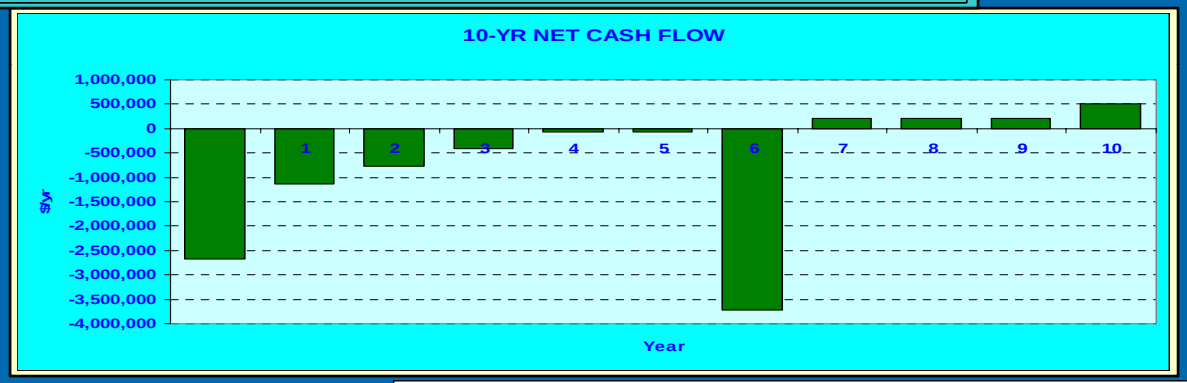


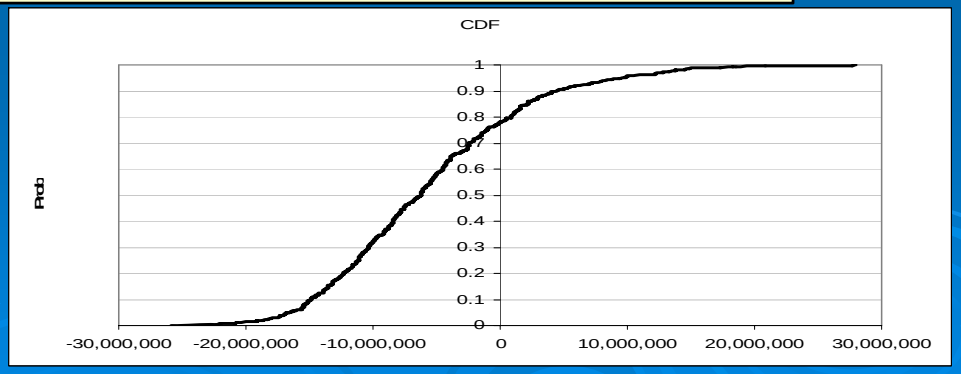




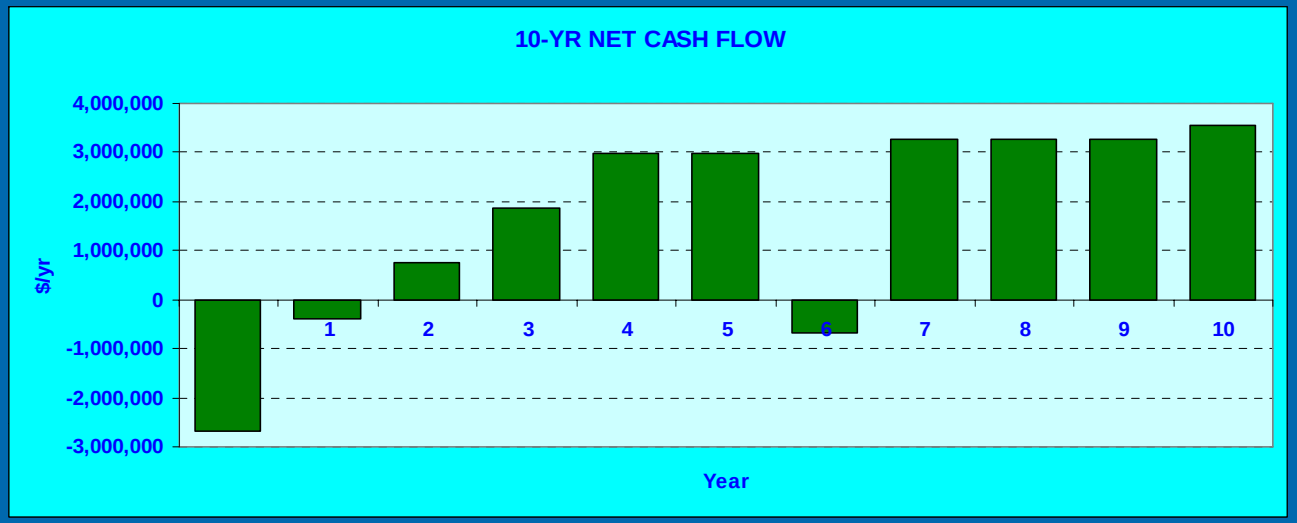
Base COAPS Model Results

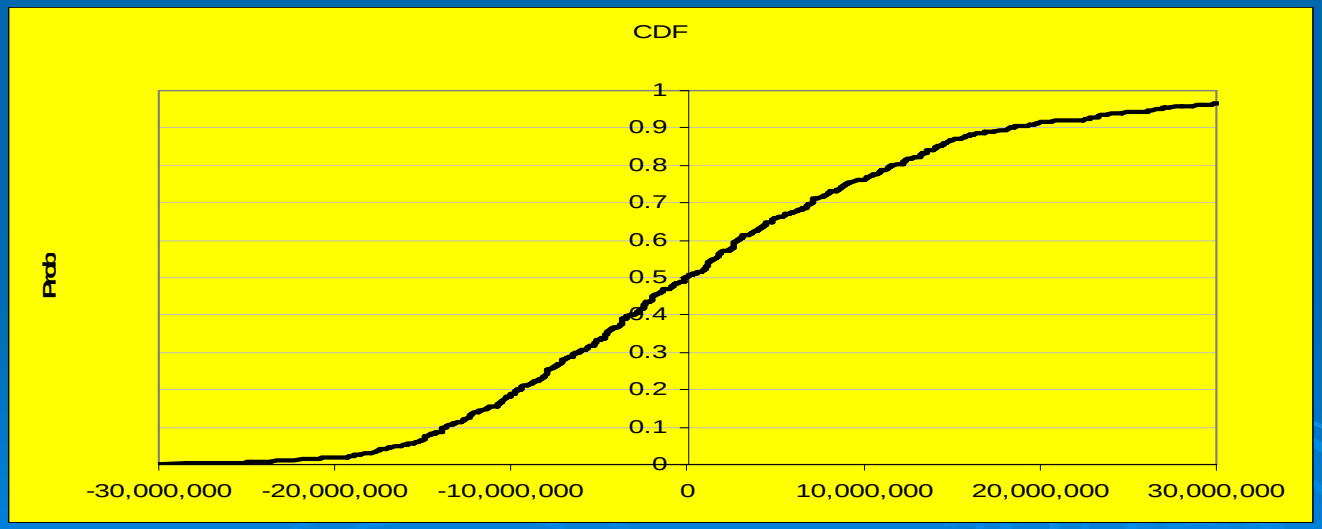






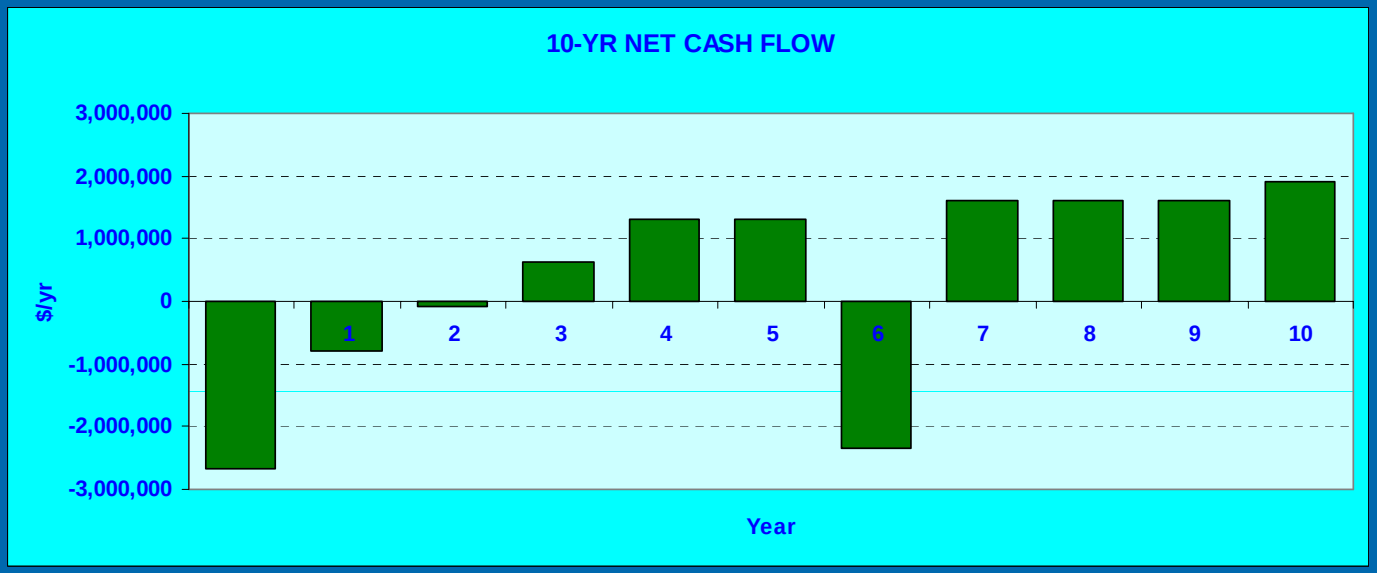
25% Improved Growth Model Results

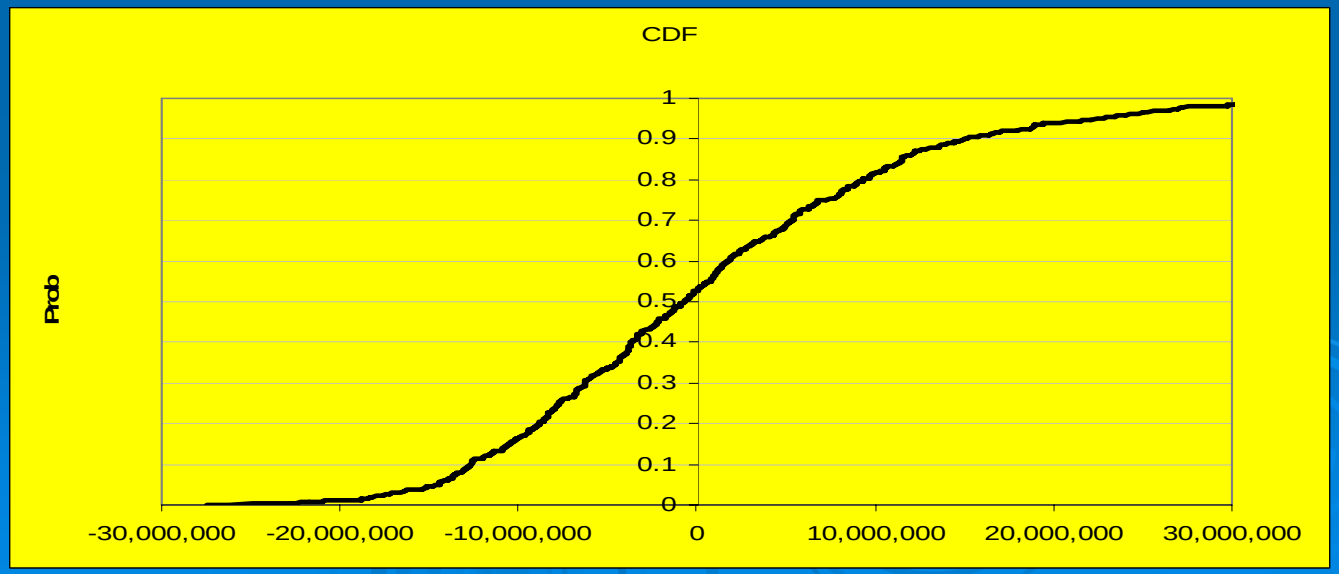




25% Market Enhanced Model Results

Average whole fish ex-vessel price	$/lb	3.31	$/kg	7.30	Stochastic price





POTENTIAL ECONOMIC BENEFITS

Annual gross receipts per farm - $3.6 million
Annual output created - $8.3 million
Annual value added created - $3.8 million
Annual employment generated – 126 jobs
Annual labor income earned- $3.4 million
Annual indirect taxes collected - $0.27 million

Current COAPS Model Implications

- COAPS modeling was based on experimental or recommended management practices.
- Economic viability of COAPS depends on the combination of:
  - better fish (higher price)
  - faster growing fish (~ 2 lbs per year)
  - lower costs of production
- The model simulation results indicate that offshore aquaculture is economically feasible subject to some elements of risk and uncertainty.