Virginia Cobia Farms

Industry Experience in Good Practice Recirculation Systems

Elements of the Presentation

Introduction

Overview of Virginia Cobia Farms and its Cobia Products

Overview of Recirculation Aquaculture

Key Technologies and Industry Experience Growing Cobia in Recirculation

Production of Marine Fish in Land Based Large Scale Production Units is Part of the Solution to the Global Seafood Crisis.

lems. "It is hard, and I don't want to be here, but I don't see any alternative," says Randy Cates, founder of Hukilau Foods, whose 10-year-old moi fish farm in the ocean off the coast of Oahu in Hawaii is considered the oldest and most successful deep-sea venture so far (investors include AOL founder Steve Case). "There's no room along the coasts, and the wild-caught sector is flatlining," he says. "Demand for seafood is only going up, and we're the only sector that can grow."

Production of cobia in recirculation systems is a viable, growing commercial sector that supplies fresh, healthy fish to the market reared in an environmentally responsible sustainable manner.

VIRGINIA COBIA FARMS

Virginia Cobia Farms is a joint venture

Blue Ridge Aquaculture
Martinsville, VA

MariCal, Inc.
Portland, ME

Virginia Cobia Farms
Saltville, VA

North America's l
15+ yr of large sc
Vertically integra

er
gy platform
salinity regulation
culture R&D

Virginia Cobia Farms – Inland Marine Cobia Production

Present Capacity

2009 10 metric tons

Future Production Goals

2010 137 metric tons

2011 450 metric tons

2011+ >1,000 metric tons

Virginia Cobia Farms Products

1kg (2lb) Live Fish

2 kg (4lb) gutted fish or fillets

Production Times (From egg)	**8 months**	**10 months**
(From 100-200g Juvenile)	**4 months**	**6 months**

Virginia Cobia Farms Key Licenses and Permits Obtained

- Virginia Marine Resources Commission Cobia Aquaculture Permit
  - Jun 1, 2007 to May 31, 2017, renewable
  - Permit to produce and sell up to 100 million cobia per year
- Environmental permitting
  - Single Site Discharge permitting approved up to 5 million pounds/year
- Largest permit for recirculation in the US

Virginia Cobia Farms Branding

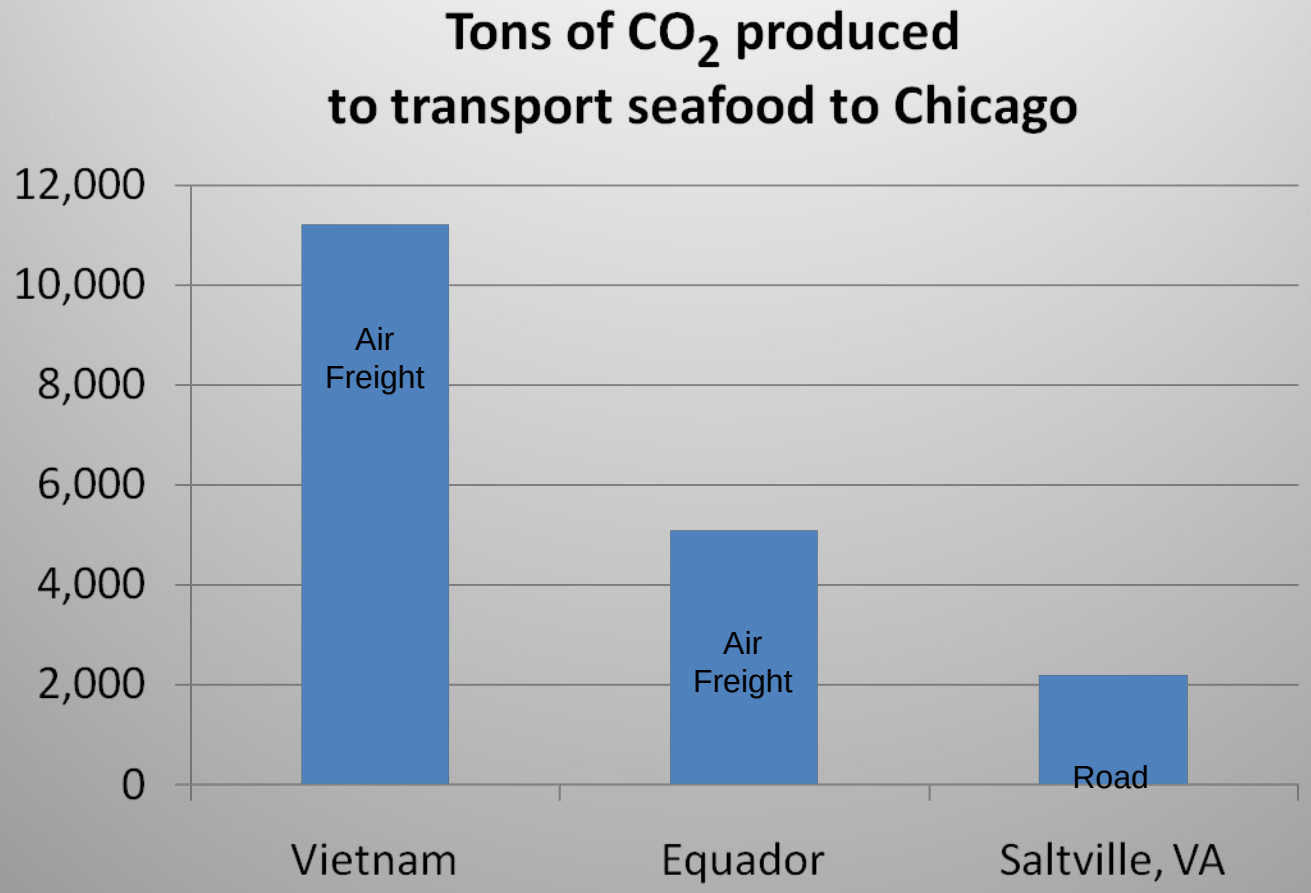
Safe Harbor
CERTIFIED SEAFOOD

Seafood Watch
Seafood Report
MONTEREY BAY AQUARIUM®

VIRGINIA COBIA FARMS
JUDGED
"#1 COBIA IN AMERICA"
- Jesse Sartain, Chef du Jury
American Masters of Taste
Awarded by the *Masters of Taste* of the
Chefs In America Awards Foundation.
GOLD SUPERIOR TASTE U.S.A. TASTE CHAMPION
AUGUST 26, 2008
Chefs In America
imonial may only be used in conjunction
Gold Medal Endorsement Program.

VIRGINIA COBIA FARMS

Aquaculture's Carbon Footprint



- Based on 1 million lbs of seafood (5.3 billion lbs were imported to US in 2007)
- Calculated using the Friends of the Sea Carbon Footprint Calculator

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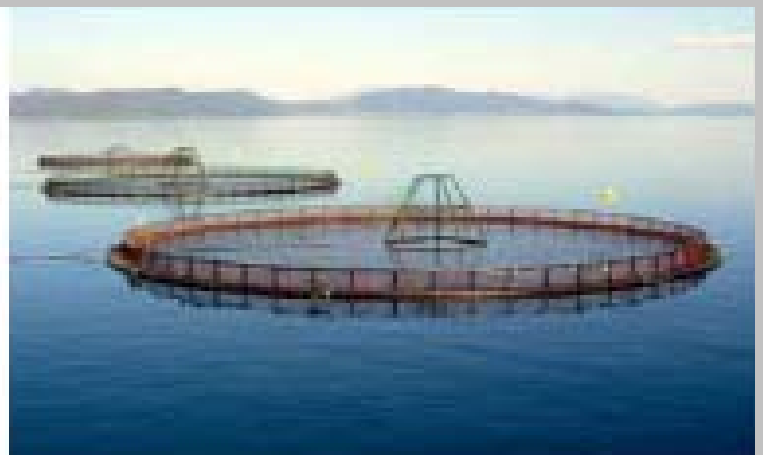
At present, sea cage farming of marine fish is the dominant production platform – Near Shore vs. Offshore



- Coastal Less expensive historically vs. other production platforms
- Seawater considered “free”.
- No need for pumping or cleaning seawater
- No need for land and limited construction

<u>Continuing Issues and Challenges</u>

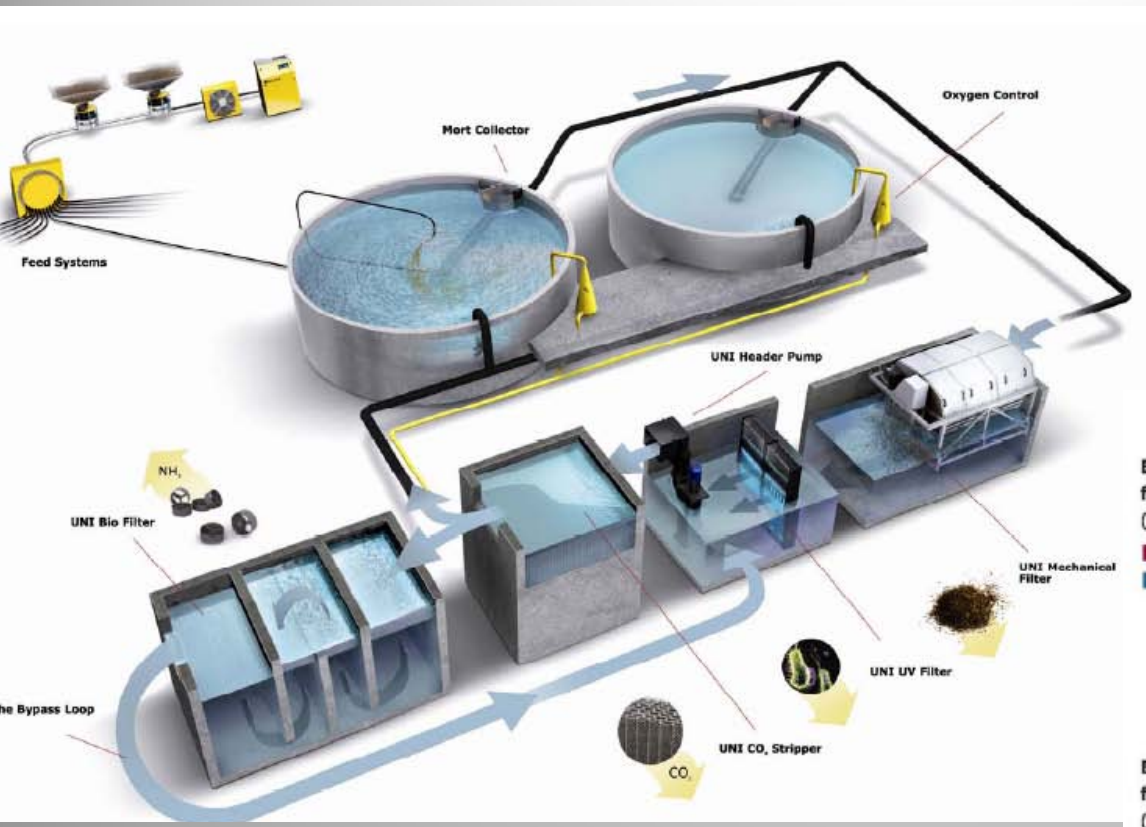
- Disease
- Pollution
- Escapes – fish as well as gametes
- Vulnerability to extreme weather conditions
- Accessibility – economic overlays.

VIRGINIA COBIA FARMS

Land based recirculation aquaculture systems (RAS) have many advantages

- Location flexibility
  - Logistics and real estate costs
  - Freshness
  - Independent of sea site requirements
  - Employee environment and proximity
- Disease and quality control
- Controlled production environment
- Impact on wild fish stocks and environment
- utilization of water and land resources

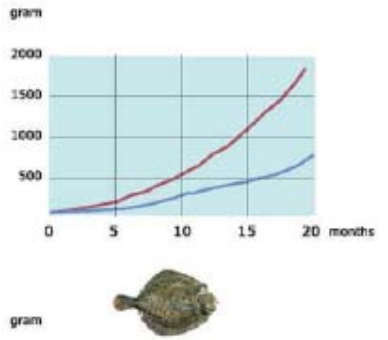
RAS Systems Become More Reliable, Cost Effective and More Integrated



Recirculation Aquaculture Systems
Large, Reliable, Integrated Formats

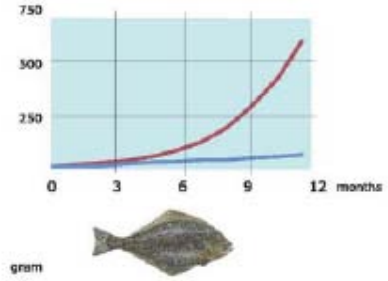
Experienced growth rates for Turbot:
(Months from 5g.)

Recirculation
Flow through



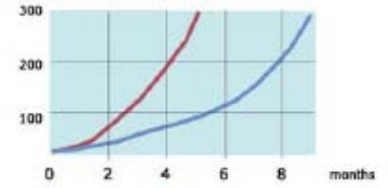
Experienced growth rates for Halibut:
(Months from 5g.)

Recirculation
Flow through



Experienced growth rates for Rainbow Trout:
(Months from 2g to 300g.)

Recirculation
Flow through

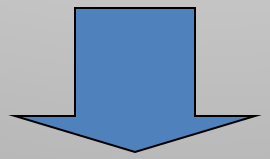


Growth Improvements

Land based RAS increasingly important production platform

- Increasing importance of land based advantages (quality, disease, environment, product consistency)

- RAS technology development advancements have lowered costs



Land based RAS necessary component to meet future demands from developed countries

Global Recirculation Aquaculture – 2009 Status

- Currently smaller than sea cage production but growing rapidly. A number of drivers are responsible for this growth. Increases in costs of sea cage farming and reductions in the costs of capital infrastructure to build and maintain RAS facilities.

- Currently there are between $300 - $500 million USD being invested or planned for investment in 2009-2010 time frame in 100+ RAS facilities of various sizes (large range $200,000 - $10 million USD for individual sites).

- Locations in wide variety of continents (North and Southern Hemispheres).

- Wide variety of fish species – salmon, halibut, yellowtail, cobia, tuna, sturgeon.

- Full spectrum of uses for RAS facilities – broodstock, hatchery, juvenile and full scale production facilities.

- Sizes of facilities are also growing significantly. Facilities of >1000 metric tons.

- Sizes and revenues of companies providing RAS facilities are also growing.

Continuing Issues and Challenges For Recirculating Aquaculture

- Capital costs
- Operational costs
- Design Flaws – “Margin For Error” Capacities within Systems
- Failures to maintain good biological isolation – disease problems
- Mechanical and operational failures
- Necessity for continued innovative refinement.

Production Costs For Cobia - Estimates

USD/lb	Sea Cage		RAS
	China	Ecuador	US*
Fry	$0.08	$0.27	$0.07
Feed	$0.85	$0.98	$0.65
Labour	$0.14	$0.03	$0.20
Other	$0.09	$0.11	$0.27
Depr	$0.20	$0.14	$0.35
Total LW	$1.35	$1.53	$1.54

* Estimate at LW 10 mill lb annual volume
Source: Various by Virginia Cobia Farms

Other Cost Advantages for RAS: Harvesting, transport and processing cost

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Key Technologies and Industry Experience Growing Cobia in Recirculation

- **High Quality Juvenile Production**
- **Rearing Cobia Under Low Water Salinity and RAS Conditions**
- **Sustainable In House Feed Formulation for Cobia**
- **Water recapture and use of fish waste as a resource.**

Virginia Cobia Farms Historical Timeline

• MariCal and BRA worked on cobia for years prior to formation of VCF	
• Cooperation discussions between MC and BRA	• Early 2006
• Virginia Cobia Farms founded	• Sep 2006
• Pilot production and hatchery constructed	• Jan 2007
• Testing and technology development	• Jan 2007 – Mar 2009
• Commercial validations completed	• Jan 2009

STRATEGY FOR SUCCESSFUL LARGE RECIRCULATING AQUACULTURE FACILITY

“STANDARD” COMPANY PLAN	**VS.**	**VIRGINIA COBIA FARMS PLAN**
Select Production Species		Selected Cobia
Academic/2nd Hand Production Information		Obtain First Hand Production Data
Modeling		Perform Smaller Scale Production
Build Large Turn Key System		Design and Build Optimize System
OUTCOME		***OUTCOME***
Time lost to “optimize” system		Large system layered on smaller system
Retrofits and Compromises		Retrofits minimized, Compromises built into the design and operation of system.
Stressed Fish – Disease etc.		Efforts made to reduce stress and disease

The Key To Successful and Reliable Cobia RAS Production Is Successful and Reliable Production of High Quality Juveniles

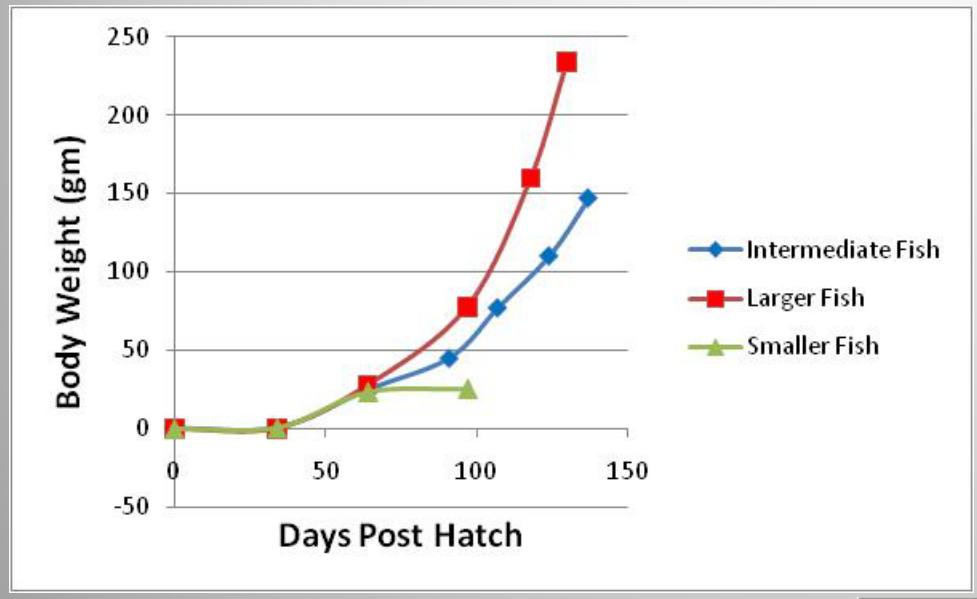
Broodstock

Egg Collection

Larval Rearing

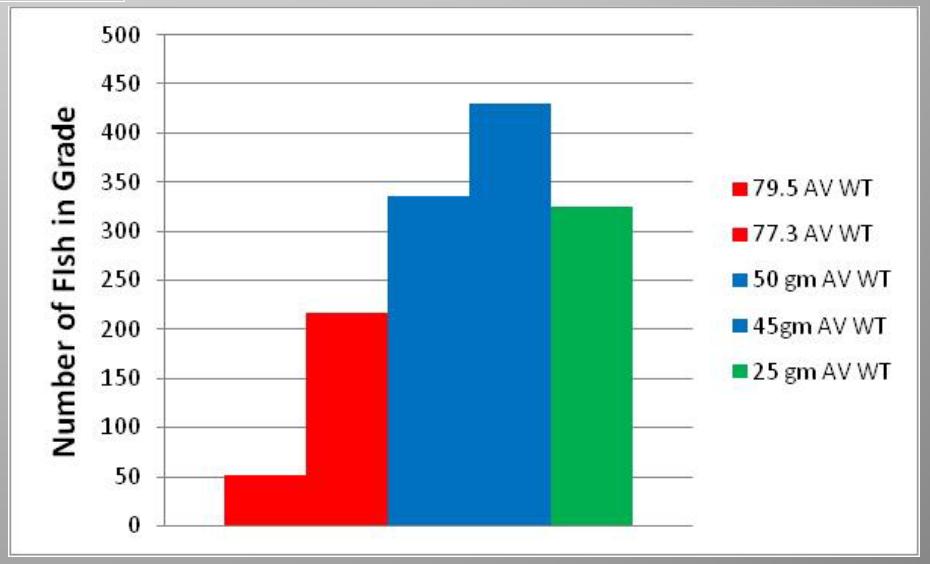
0.5gm Weaned Juveniles

Early Grading of Cobia Juveniles Critical to Achieving Good Performance



Data for Day 95 Grading Juvenile System

% of total	Tank	# of fish	Ave wt.		
24.7	20	336	50	16800	
31.6	22	430	45	19350	
23.9	23	325	25	8125	
16.0	16	217	77.3	16774.1	
3.8	21	51	79.5	4054.5	
					Av. Wt.
100.0		1359		65103.6	47.91



VIRGINIA COBIA FARMS

Presentation to SCAD II

25Sep09

Performance Tracking of Cobia Juveniles – Growth and FCR

Snapshot at 100 days Post Hatch

Longer Term Performance Parameters

SGR	FCR	Mortality Rates	
>3.25	~1	Very Low	<2%
2.5-3	1-1.5	Low	~ 5%
2.0-2.5	1.5+	Moderate	~10%
<1.0	6+	Very High	>20%

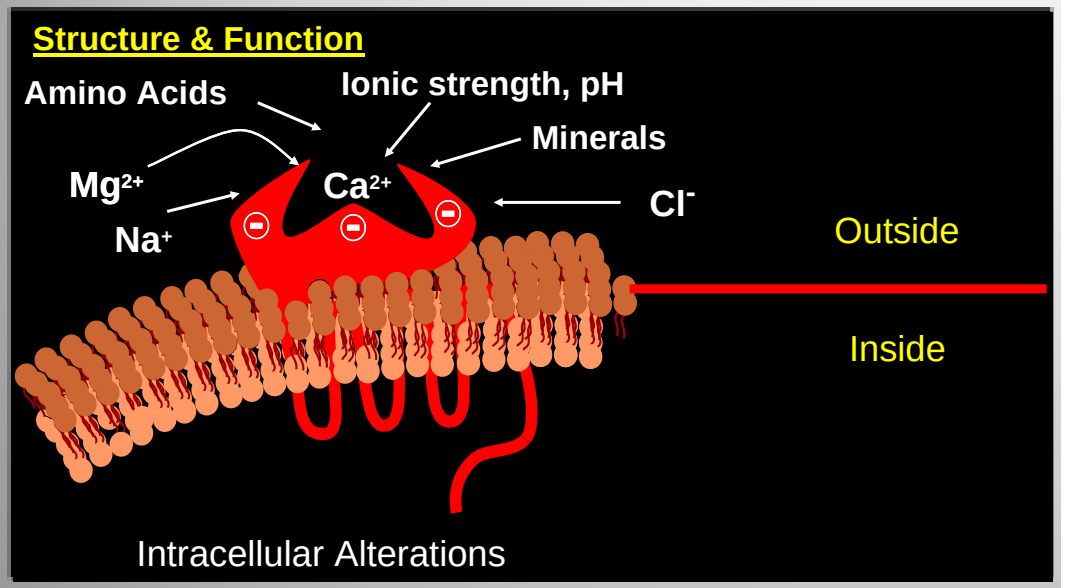
- Juvenile grading essential for optimal performance
- Future benefits from selective breeding development

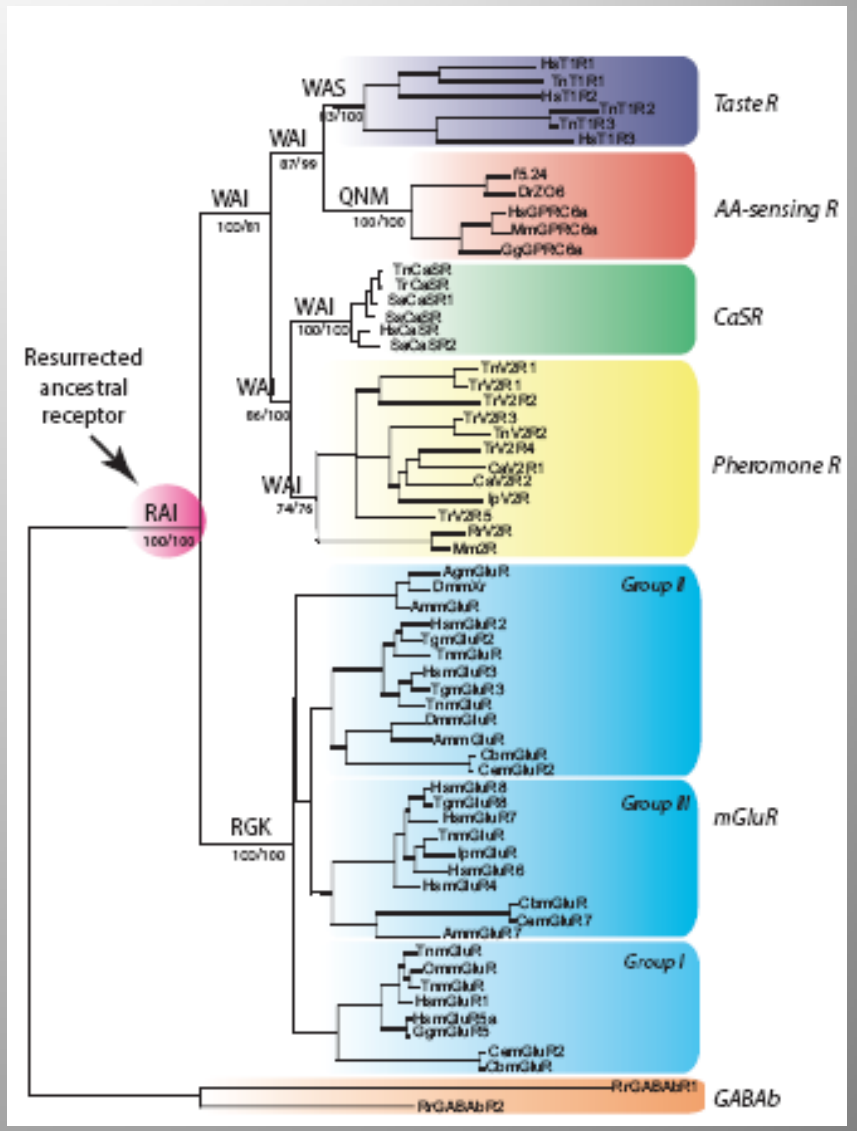
VIRGINIA COBIA FARMS

Why grow marine fish in low salinity?

- Coastal property for shore based tank farms with access to natural seawater is very expensive
- Political and regulatory pressures are highly restrictive on the coast in industrialized countries
- Environmental regulations limit amount of saline water that can be discharged from inland Recirculating Aquaculture System (RAS) facilities – principally Chloride ions
- Lower cost of marine seafood production in recirculation system
    - Costs of adding and removing salt cut sharply
    - Reduced deterioration of production system caused by salt
- Lower risk of disease introduction by excluding use of natural seawater.
    - Easier to establish a disease free facility.

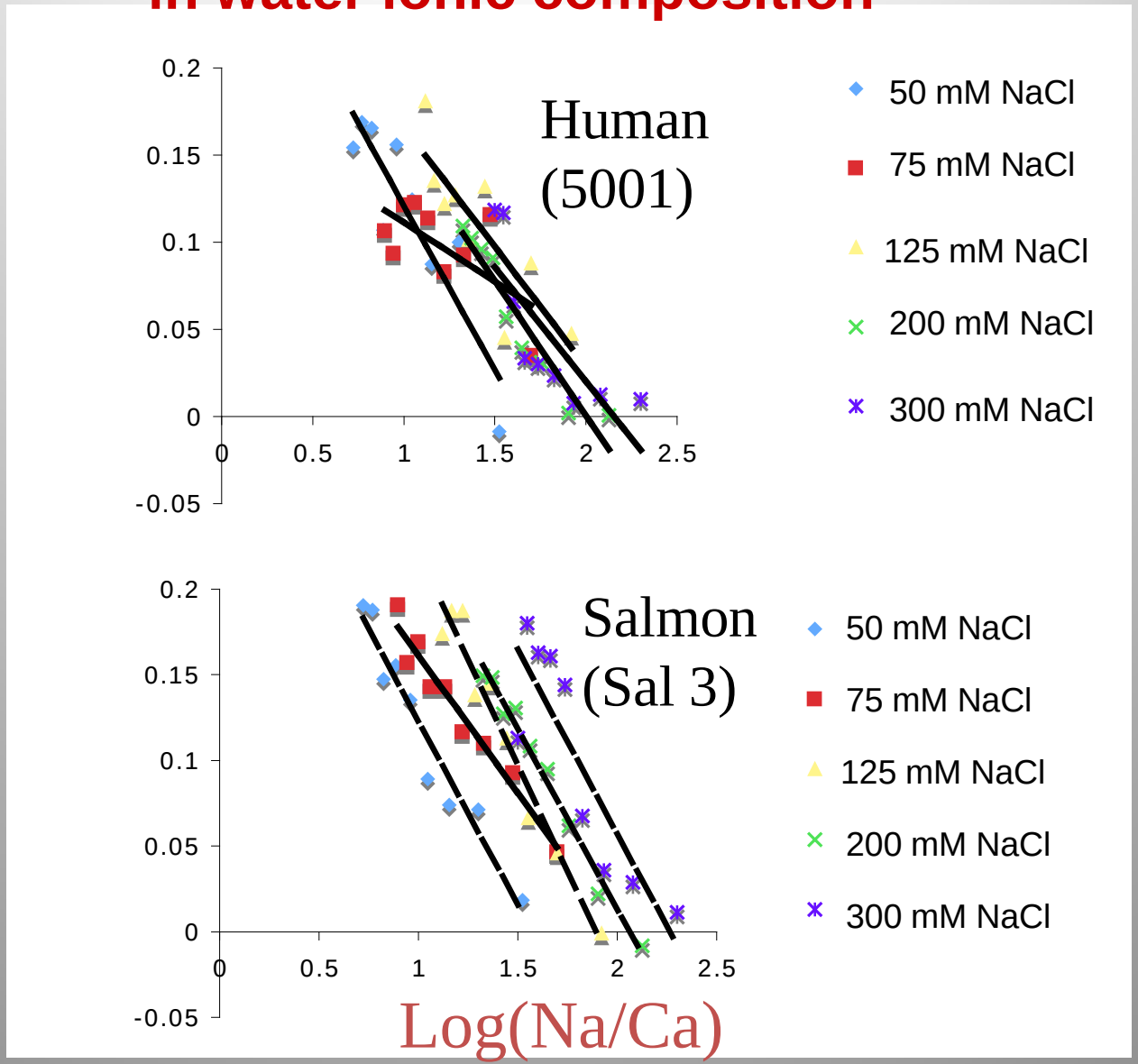
CaSR receptor – Ancient nutrient salinity sensor is key physiological integrator in fish and humans.





Fish & human CaSRs modulated by simple changes in water ionic composition

CaSR Response



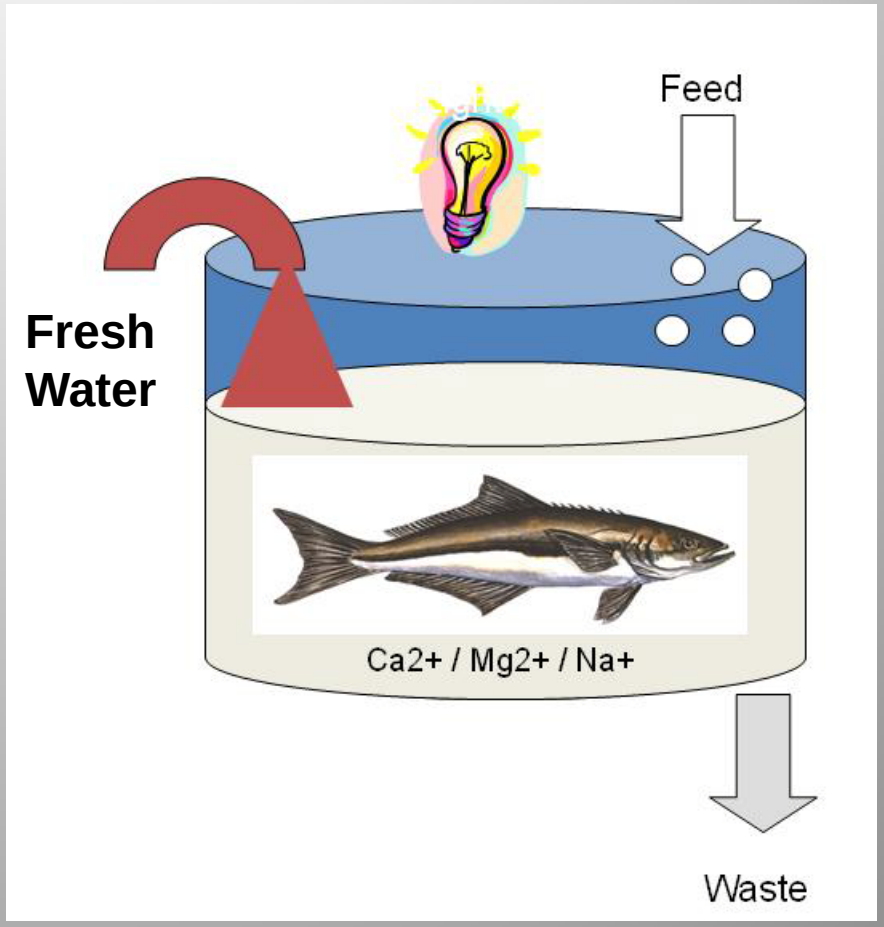
Producing marine fish in low salinity

- Salinity sensor in fish does not “sense” absolute concentrations of salts in the water but rather the ratios of specific salt ions

- Maintaining the appropriate ratios of key salt ingredients, particularly Ca2+, Mg2+ and Na+, with respect to one another at concentrations that are much lower than actual seawater provides a means to activate or maintain a seawater status in fish while the fish is reared under very low (8-10ppt) salinity conditions

- Ability to “finish or polish” fish after grow out under different salinity and ionic conditions – flavor profile from bland to marine tasting using salinity acclimation and diets.

- MariCal has 8 issued US and international patents on growing marine fish in low water salinity – all licensed to Virginia Cobia Farms.

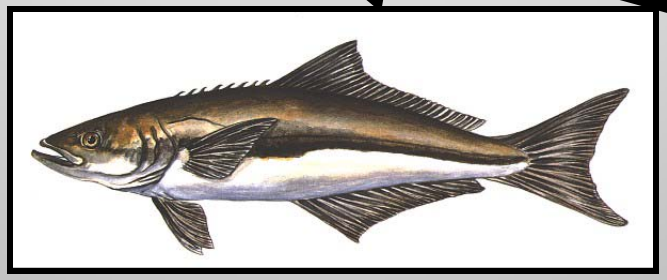


Integrated Recirculation System Production Parameters for Cobia

Low Water Turbidity
Particulate Content

Tank Conditions
Temperature
Photoperiod
Water Flow in
Tanks

Good Water Quality
NH3, Alkalinity, pH



Good Gas Exchange
Oxygen, CO_2, Ozone

Stocking Densities
50-75 kg/m3

(i.e. 7.5% fish
92.5% water)

Virginia Cobia Farms Nutritional Objectives

- Optimize sustainability in formulations
- Source only highest quality, traceable, domestically produced feedstuffs
- Utilize novel feed additives/amino acid supplementation to enhance production and health
- Focus upon final product quality.

VCF Nutritional R&D Program

- In house, 20 years experience in marine warm water fish nutrition and culture—brood stock through grow-out
- In house, commercial feeds formulation experience
- Drawing on over 30 independent studies with juvenile cobia—forefront of cobia nutritional innovations

VIRGINIA COBIA FARMS

Virginia Cobia Farms Diet Formulations*

(All values expressed as % of diet)

Ingredient		COMMERCIAL	VIRGINIA COBIA FARMS
Fish meal	CLOSED FORMULATION	(30-35)	10.0
Plant proteins		(30-40)	57
Wheat		(12-20)	15
Fish oil		(12-15)	5.0
Soy oil			5.0
Fish meal protein		**30-35 %**	**10.0 %**
Animal by-products		**8-18%**	**0.0 %**
Total plant ingredients		**43-60 %**	**> 72 %**
Total soy		**20-30 %**	**> 55 %**
FI:FO		**2.2-3.6****	**0.83-0.90****

** based upon Seafood Watch Seafood Report: Farmed Cobia

*Work supported by generous funding from United Soybean Board

Utilizing Fish Feces and Uneaten Feed As A Resource And Not As Discarded Waste.

Economic Considerations

- Significant cost inputs for RAS cobia are:
    1. heating and moving water.
    2. disposal of fish waste – sewerage fees.
    3. Solids separation methods already efficient collect waste.
    4. Augmentation of solids/water separations reduce salt use and increase water reuse.
    5. RAS staff already familiar with large tank-based stage processes.

Integration of RAS Aquaculture With Anaerobic Digester Technology.

ELECTRICITY

HEAT

RAS UNITS
VA COBIA FARMS

Fresh Fish Products

Biogas
Co-generator

Recycled Water

Selective Membrane Filtration System

Bioaugmented Bioreactor Waste Processor

BIOGAS

Anaerobic

Aerobic

Single Cell Protein

Feed Mill Substitute For Fish Meal Protein Source

Algal Production

CO2

Calculations For Cobia Fish Waste Generation and Recovery for 1,000,000 lbs Market Size Fish

Fish Waste – A Resource

Generation of Waste

1,000,000 lb (454,545kg) cobia produced @ FCR 1.5 =
1,500,000 lb (681,820kg) feed fed for market size fish.

Cobia waste @ 50% of feed load = 750,000lb (340,900 kg) +
Mortalities (8% harvest biomass) = 80,000 lb (36,360 kg)

Generation of Waste Recovery Components

68% of cobia waste is volatile solids; ~26% protein.

Waste collected as ~50% slurry (6% dry solids) yielding 660 liters biogas/kg of dry waste. A total of 377,000 kg of waste yields ~240,000 m3 of biogas.

Economic and Environmental Payoff

Biogas driven electrical-heat co-generator yields 400,000 kWh of electricity PLUS heat equivalent to 2,900,000 ft3 of natural gas

Aerobic digestion of remaining anaerobic digest mass yields 5 tons of single cell protein (SCP) – fish meal substitute.

VIRGINIA COBIA FARMS

Thank You