

Everybody loves Ray?????

Marketing Constraints for Cownose Ray
(*Rhinoptera bonasus*)

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Interact with
traditional
fishing gear

Tropical and Subtropical Fisheries Technological Conference of the Americas (Raleigh, NC 1991)

Product Development: Cownose Ray (*Rhinoptera bonasus*)

Robert Fisher, VIMS-VA Sea Grant

Patricia Lacey, VPI-VSAES

For this marketing attempt.....Changed name from Cownose Ray to "Chesapeake Ray"
(more market-friendly name)

CNR Processing yields, Economic Cost

(1990/91)

- Product Yield; edible 29.03%, waste 70.97%
- Cost of producing vacuum packed product

Prime contributors:	Ray purchase	41%
	direct labor	20%
	ice	14%
	packaging	9%

Estimated over all cost to produce vac pack
ray (fillet or steak) \$1.26/lb



Local retail sales effort
fillets, steaks



Public tasting of "Chesapeake Ray"

500 people tried the ray

232 completed the questionnaire provided

207 rated the ray "good" or "very good" (89%)

165 had never heard of cownose ray

After this 1990 pilot project....No industry participation or interest in cownose ray fishery

Technology Development for the Full Utilization of the Cownose Ray (*Rhinoptera bonasus*) R.A. Fisher

Production of edible flesh, oil,
cartilage, and silage

Proposal submitted in 1999 to state and federal agencies for funding.....rejected

Oyster and Bay Scallop Restoration

- Oyster restoration efforts in Chesapeake Bay
 - Lessons learned???? Corp of Engineers, CBF....projects
 - *2004...planted 1.2 million oysters on reef, Within 2 wks >95% eaten by rays
 - *2006...775,500 oysters planted, within 5 days ~94% eaten by rays
- Scallop restoration efforts in North Carolina

- Political involvement
- Public awareness (perception) of CNR through media coverage
 - menace.....get rid of them
 - morsel.....lets eat them
 - shark species.....we need to protect them

Develop commercial and recreational cownose ray fishery

The expected benefit of this work is to explore the potential for the development of a cownose ray fishery which could aid in shellfish restoration efforts in Virginia while also providing another fishery resource for Virginia fishermen to utilize. The proposed work will provide for the development of a new fishery in a **responsible manner**, given the species specific sensitivity to fishing pressure. A sustainable cownose ray fishery has the potential to relieve some ray predation on high valued shellfish, and reduce destruction on sub merged aquatic vegetation.

YEAR_FSHD	SPECIES	SumOfPOUNDS
2007	COWNOSE RAY	205,072
2008	COWNOSE RAY	265,101
2009	COWNOSE RAY	209,161
2010	COWNOSE RAY	136,704
2011	COWNOSE RAY	244,497
2012	COWNOSE RAY	105,060
2013 & 2014	COWNOSE RAY	88,114

SOURCE : VMRC PLANS AND STATISTICS DEPARTMENT

Virginia Marine Resource Commission subsidized cownose ray fishery; for the Development of ray markets. Landing as bycatch in traditional fisheries (no effort data)

Fishery Resource Grants (FRG) supported market development work with fish processors.

VMRC supported marketing efforts with VIMS

Virginia Marine Products Board worked with VIMS, VMRC, Processors to promote ray markets

Cownose Ray Marketable Products

Human Consumption

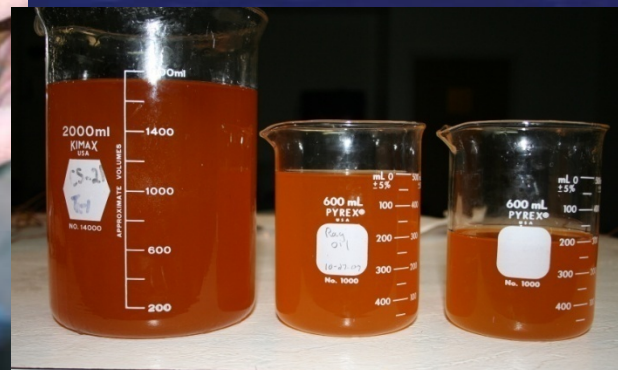
- Whole wings (export)
- Fillets and Loins
(domestic/export)
- Liver oil
- Cartilage (head and wing)

Bait/Silage/Skin

- Fisheries: stone crab, long-line, whelk
- fertilizer from viscera
(formic acid)
- Skin (leather)



Life History, Trophic ecology and Prey Handling by Cownose Rays from Chesapeake Bay



Ray processing:
human consumption
(Wings, fillets, loins)
Skin
Liver oil
Bait



Usable flesh for human consumption: 30-34%

Waste: 66-70%





Bait Market tests: stone crab, shark and grouper long-line, both well received but wanted bait at \$.19-\$.24/lb delivered

Now...~\$.25-\$.35 compete with mullet frames/pig feet

Aquariums; shark feed

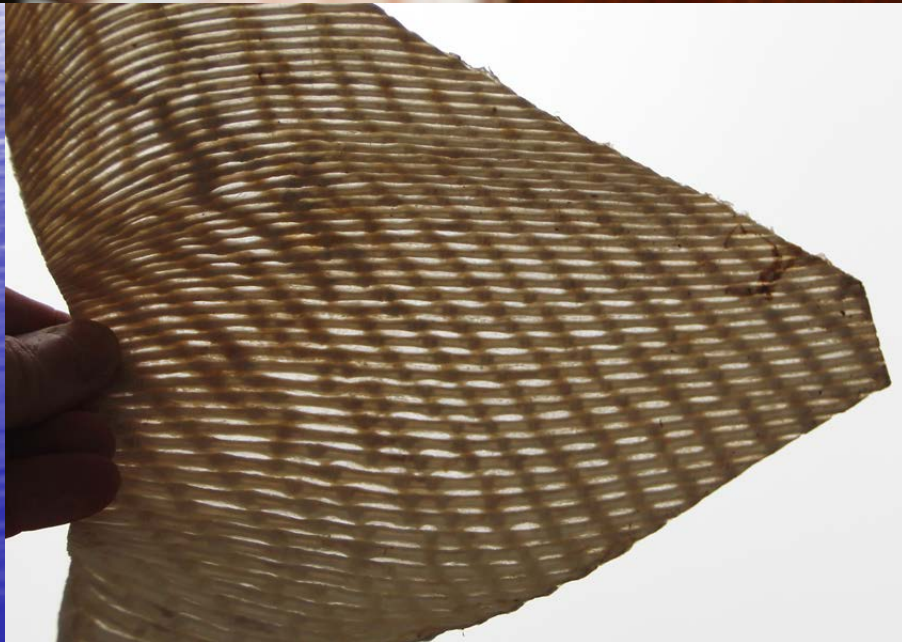
VA whelk (conch) fishery



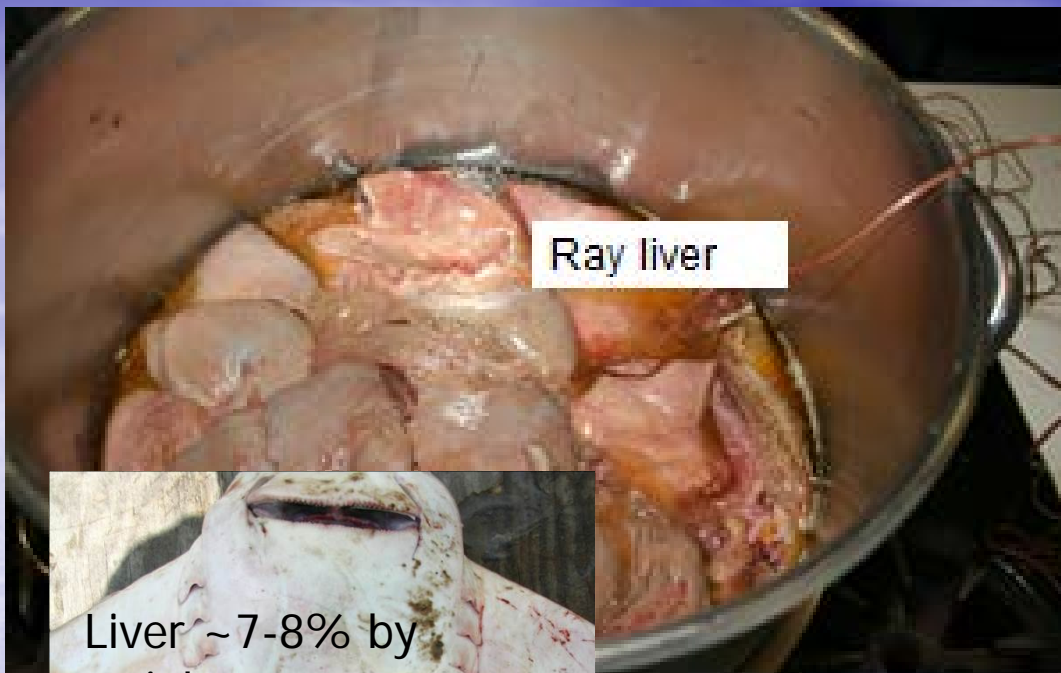


Ray skin:

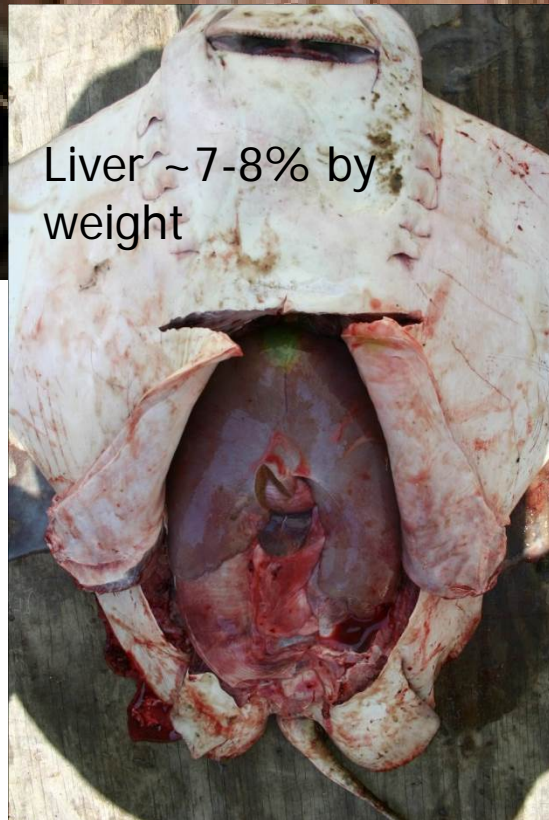
Tested different methods of skinning. Skin from wing fillets most practical to initiate tanning trials. Comparable cost to alligator skin tanning



VA Processor....."Cartilage samples were submitted to a commercial processor of chondroitin for the pharmaceutical market and our product was found suitable for this purpose. The collagen found in the skin was tested and is suitable for the cosmetic industry. Unfortunately, the low yield of both cartilage and skin relative to the raw material requires a significant quantity to be processed to produce a saleable quantity of each. We do have a source lined up for both by-products whenever we begin full scale processing of the ray."



Ray liver



Liver ~7-8% by weight



Ray Liver Oil

Fatty Acid Profile	C#: Dbl. Bonds	Relative Basis %	Fat (B & D) Basis %	Sample Basis %
Myristic	14:0	0.59	0.45	0.18
Myristoleic	14:1	0.08	0.06	0.02
Pentadecanoic	15:0	0.53	0.41	0.16
Palmitic	16:0	18.50	14.11	5.67
Palmitoleic	16:1ω7	8.28	6.32	2.54
Hexadecatetraenoic	16:4	0.88	0.67	0.27
Heptadecanoic	17:0	0.86	0.65	0.26
Stearic	18:0	7.07	5.39	2.17
Oleic	18:1ω9	11.27	8.59	3.45
Oleic	18:1ω7	2.38	1.81	0.73
Linoleic	18:2ω6	0.59	0.45	0.18
Linolenic	18:3ω6	0.90	0.69	0.28
Linolenic	18:3ω3	0.11	0.08	0.03
Octadecatetraenoic	18:4ω3	0.19	0.15	0.06
Arachidic	20:0	0.30	0.23	0.09
Eicosanoic	20:1ω11	2.44	1.86	0.75
Eicosanoic	20:1ω9	1.02	0.78	0.31
Eicosanoic	20:1ω7	2.48	1.89	0.76
Eicosadienoic	20:2ω6	0.92	0.70	0.28
Eicosatrienoic	20:3ω6	0.22	0.17	0.07
Aracidonic	20:4ω6	1.94	1.48	0.60
Aracidonic	20:4ω3	0.09	0.07	0.03
Eicosapentaenoic	20:5ω3	1.28	0.97	0.39
Erucic	22:1ω11	0.12	0.09	0.04
Uncosapentaenoic	21:5ω3	0.44	0.34	0.14
Docosatetraenoic	22:4ω6	1.95	1.48	0.60
Docosapentaenoic	22:5ω6	3.44	2.83	1.06
Docosapentaenoic	22:5ω3	2.86	2.18	0.88
Docosahexaenoic	22:6ω3	21.18	16.14	6.49
Other	n/a	7.08	5.40	2.17
		100.00	76.24	30.66
Total % ω3		26.15	19.94	8.02
Total % ω6		9.95	7.59	3.05

Fatty Acid Profile	C#: Dbl. Bonds	Relative Basis %	Fat (B & D) Basis %	Sample Basis %
Myristic	14:0	2.47	1.99	1.19
Myristoleic	14:1	0.23	0.18	0.11
Pentadecanoic	15:0	0.73	0.59	0.35
Palmitic	16:0	18.26	14.70	8.80
Palmitoleic	16:1ω7	8.76	7.05	4.22
Hexadecadienoic	16:2	0.40	0.32	0.19
Hexadecatrienoic	16:3	0.21	0.17	0.10
Hexadecatetraenoic	16:4	0.86	0.69	0.41
Heptadecanoic	17:0	1.02	0.82	0.49
Stearic	18:0	5.36	4.32	2.58
Oleic	18:1ω9	9.18	7.39	4.42
Oleic	18:1ω7	3.16	2.54	1.52
Linoleic	18:2ω6	1.44	1.16	0.69
Linolenic	18:3ω6	0.55	0.44	0.26
Linolenic	18:3ω3	1.03	0.83	0.50
Octadecatetraenoic	18:4ω3	1.87	1.50	0.90
Arachidic	20:0	0.18	0.14	0.08
Eicosanoic	20:1ω11	1.57	1.26	0.76
Eicosanoic	20:1ω9	0.75	0.60	0.36
Eicosanoic	20:1ω7	1.84	1.48	0.88
Eicosadienoic	20:2ω6	0.62	0.50	0.30
Eicosatrienoic	20:3ω6	0.17	0.14	0.08
Eicosatrienoic	20:3ω3	0.14	0.12	0.07
Aracidonic	20:4ω6	1.47	1.18	0.71
Aracidonic	20:4ω3	0.89	0.72	0.43
Eicosapentaenoic	20:5ω3	6.05	4.87	2.92
Uncosapentaenoic	21:5ω3	0.27	0.21	0.13
Docosatetraenoic	22:4ω6	0.50	0.40	0.24
Docosapentaenoic	22:5ω6	1.54	1.24	0.74
Docosapentaenoic	22:5ω3	2.31	1.86	1.11
Docosahexaenoic	22:6ω3	20.98	16.89	10.11
Nervonic	24:1ω9	0.20	0.16	0.10
Other	n/a	5.02	4.04	2.42
		100.00	80.52	48.18
Total % ω3		33.54	27.00	16.16
Total % ω6		6.28	5.05	3.02

May 2007 (39% Fat)

September 2007 (59% Fat)

Ray liver fatty acid profiles

Lipid Class	Weight Percent (%)
Triacylglycerol	98.7
Free Fatty Acid	0.9
Polar Lipids	0.4

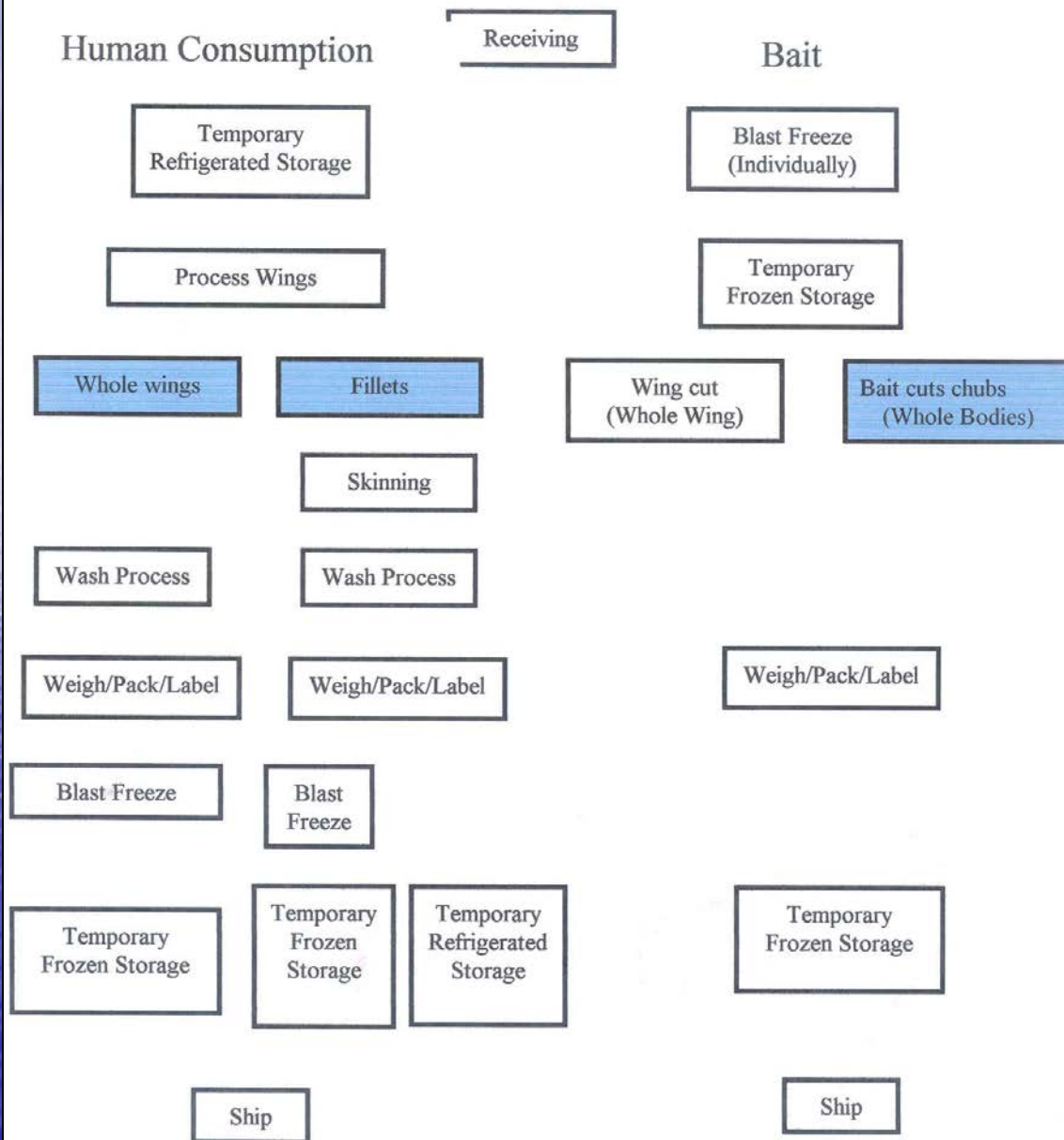
results were positive for lipid content, in that they were all triglyceride

Ray Liver Oil Heavy Metals determination (note levels reported in part per billion)

All heavy metals tested were below action levels.

Cadmium	<10 PPB
Arsenic	26600.0 PPB
Lead	<10 PPB
Mercury	11.2 PPB
Selenium	69.7 PPB

Finfish (Non-Scombroid)
Cownose Ray (*Rhinoptera bonasus*)
Hazard Analysis Worksheet



Hazard: Mercury

Large; 0.272 ppm (N=3)

Medium; 0.151ppm (N=3)

Small; <0.043 ppm (N=3)

Pups; <0.039 ppm (N=3*)

Action level 1ppm

Nutrition Facts

Serving Size 3.5 oz (100g)

Servings Per Container

Amount Per Serving

Calories 110 **Calories from Fat 5**

% Daily Value*

Total Fat 0.5g **1%**

Saturated Fat 0g **0%**

Trans Fat 0g

Cholesterol 55mg **18%**

Sodium 90mg **4%**

Total Carbohydrate 0g **0%**

Dietary Fiber 0g **0%**

Sugars 0g

Protein 26g

Vitamin A 0% • Vitamin C 0%

Calcium 0% • Iron 10%

*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

	Calories	2,000	2,500
Total Fat	Less Than	65g	80g
Saturated Fat	Less Than	20g	25g
Cholesterol	Less Than	300mg	300 mg
Sodium	Less Than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:

Fat 9 • Carbohydrate 4 • Protein 4

Nutrient	Per Svg	Per 100g	Nutrient	Per Svg	Per 100g
Fat (g)	0.5500	0.5500	18:2 - Linoleic (g)	0.0721	0.0721
Vitamin A - Carotenoid RE (--	--	18:1 - Oleic (g)	0.1084	0.1084
Vitamin A - RE (RE)	--	--	16:1 - Palmitol (g)	0.1496	0.1496
Vitamin A - IU (IU)	0	0	14:1 - Myristol (g)	0.0022	0.0022
Vitamin C (mg)	0	0	Trans Fatty Acid (g)	0	0
Total Sugars (g)	0.0250	0.0250	Cholesterol (mg)	56.3000	56.3000
Fructose (g)	--	--	Potassium (mg)	--	--
Glucose (g)	0.0250	0.0250	Caffeine (mg)	--	--
Lactose (g)	--	--	Iodine (mcg)	--	--
Maltose (g)	--	--	Magnesium (mg)	--	--
Sucrose (g)	--	--	Phosphorus (mg)	--	--
Carbohydrates (g)	0	0	Zinc (mg)	--	--
Calories (kcal)	107.250	107.250	Copper (mg)	--	--
Protein (g)	25.6000	25.6000	Manganese (mg)	--	--
Calcium (mg)	6.6500	6.6500	Vitamin B1 - Thiamin (m	--	--
Sodium (mg)	87.5000	87.5000	Vitamin B2 - Riboflavin (--	--
Iron (mg)	1.7700	1.7700	Vitamin B3 - Niacin (mg)	--	--
Dietary Fiber (g)	0	0	Vitamin B6 (mg)	--	--
Calories from Fat (kcal)	4.9500	4.9500	Biotin (mcg)	--	--
Water (g)	72.5300	72.5300	Vitamin D - IU (IU)	--	--
Ash (g)	1.3900	1.3900	Vitamin E - IU (IU)	--	--
Saturated Fat (g)	0.0666	0.0666	Pantothenic Acid (mg)	--	--
24:0 - Tetracos (g)	0	0	Folic Acid (mcg)	--	--
22:0 - Behenate (g)	0	0	Alanine (g)	--	--
20:0 - Arachidic (g)	0.0534	0.0534	Isoleucine (g)	--	--
18:0 - Stearic (g)	0.0116	0.0116	Methionine (g)	--	--
16:0 - Palmitic (g)	0.0017	0.0017	Serine (g)	--	--
14:0 - Myristic (g)	0	0	Leucine (g)	--	--
12:0 - Lauric (g)	0	0	Tryptophan (g)	--	--
10:0 - Capric (g)	0	0	Valine (g)	--	--
8:0 - Caprylic (g)	0	0	Cystine (g)	--	--
6:0 - Caprioc (g)	0	0	Glycine (g)	--	--
Poly Fat (g)	0.2244	0.2244	Histidine (g)	--	--
Mono Fat (g)	0.2585	0.2585	Tyrosine (g)	--	--
24:1 - Nervonic (g)	0	0	Arginine (g)	--	--
22:6 - DHA (g)	0.1309	0.1309	Lysine (g)	--	--
22:1 - Erucic (g)	0	0	Phenylalanine (g)	--	--
20:5 - EPA (g)	0.0127	0.0127	Proline (g)	--	--
20:4 - Arachidon (g)	0	0	Threonine (g)	--	--
20:3 - Eicosatrienoic (g)	0.0044	0.0044	Vitamin B12 (mcg)	--	--
20:1 - Eicosen (g)	0.0017	0.0017	Vitamin K (mcg)	--	--
18:3 - Linolenic (g)	0.0028	0.0028			

Nutrient	Per Svg	Per 100g	Nutrient	Per Svg	Per 100g
Fat (g)	0.6400	0.6400	18:2 - Linoleic (g)	0.0813	0.0813
Vitamin A - Carotenoid RE (--	--	18:1 - Oleic (g)	0.1158	0.1158
Vitamin A - RE (RE)	--	--	16:1 - Palmitol (g)	0.2195	0.2195
Vitamin A - IU (IU)	0	0	14:1 - Myristol (g)	0.0032	0.0032
Vitamin C (mg)	0	0	Trans Fatty Acid (g)	0	0
Total Sugars (g)	0.0590	0.0590	Cholesterol (mg)	69.8000	69.8000
Fructose (g)	0.0130	0.0130	Potassium (mg)	--	--
Glucose (g)	0.0270	0.0270	Caffeine (mg)	--	--
Lactose (g)	0	0	Iodine (mcg)	--	--
Maltose (g)	0.0190	0.0190	Magnesium (mg)	--	--
Sucrose (g)	0	0	Phosphorus (mg)	--	--
Carbohydrates (g)	0.1700	0.1700	Zinc (mg)	--	--
Calories (kcal)	107.560	107.560	Copper (mg)	--	--
Protein (g)	25.2800	25.2800	Manganese (mg)	--	--
Calcium (mg)	6.1700	6.1700	Vitamin B1 - Thiamin (m	--	--
Sodium (mg)	92.4000	92.4000	Vitamin B2 - Riboflavin (--	--
Iron (mg)	1.7500	1.7500	Vitamin B3 - Niacin (mg)	--	--
Dietary Fiber (g)	0	0	Vitamin B6 (mg)	--	--
Calories from Fat (kcal)	5.7600	5.7600	Biotin (mcg)	--	--
Water (g)	72.6600	72.6600	Vitamin D - IU (IU)	--	--
Ash (g)	1.2500	1.2500	Vitamin E - IU (IU)	--	--
Saturated Fat (g)	0.0909	0.0909	Pantothenic Acid (mg)	--	--
24:0 - Tetracos (g)	0	0	Folic Acid (mcg)	--	--
22:0 - Behenate (g)	0	0	Alanine (g)	--	--
20:0 - Arachidic (g)	0.0518	0.0518	Isoleucine (g)	--	--
18:0 - Stearic (g)	0.0083	0.0083	Methionine (g)	--	--
16:0 - Palmitic (g)	0.0237	0.0237	Serine (g)	--	--
14:0 - Myristic (g)	0	0	Leucine (g)	--	--
12:0 - Lauric (g)	0.0019	0.0019	Tryptophan (g)	--	--
10:0 - Capric (g)	0.0051	0.0051	Valine (g)	--	--
8:0 - Caprylic (g)	0	0	Cystine (g)	--	--
6:0 - Caprioc (g)	0	0	Glycine (g)	--	--
Poly Fat (g)	0.2106	0.2106	Histidine (g)	--	--
Mono Fat (g)	0.3386	0.3386	Tyrosine (g)	--	--
24:1 - Nervonic (g)	0	0	Arginine (g)	--	--
22:6 - DHA (g)	0.1152	0.1152	Lysine (g)	--	--
22:1 - Erucic (g)	0	0	Phenylalanine (g)	--	--
20:5 - EPA (g)	0.0134	0.0134	Proline (g)	--	--
20:4 - Arachidon (g)	0	0	Threonine (g)	--	--
20:3 - Eicosatrienoic (g)	0	0	Vitamin B12 (mcg)	--	--
20:1 - Eicosen (g)	0	0	Vitamin K (mcg)	--	--
18:3 - Linolenic (g)	0	0			

May 2007

September2007

Ray Meat Nutritional profiles

Fresh Ray meat shelf life

Sample		Sensory <u>Evaluation</u>	APC@35°C <u>cfu/g</u>	Total Coliform <u>cfu/g</u>	E. coli <u>cfu/g</u>		Sensory <u>Evaluation</u>	APC@35°C <u>cfu/g</u>	Total Coliform <u>cfu/g</u>	E. coli <u>cfu/g</u>
Initial Quality:	a	fresh, no off odors	4,100	< 2	< 2					
	b	good red color	3,600	< 2	< 2					
2 Days storage:	40 a	fresh, no off odors	4,600	4	< 2	45 a	fresh, no off odors	7,400	4	4
	40 b	good red color	4,800	4	< 2	45 b	good red color	4,200	2	2
	40 c	No Ammonia	2,300	4	< 2	45 c	No Ammonia	3,300	8	< 2
5 Days storage	40 a	fresh, no off odors	1,900	4	< 2	45 a	fresh, no off odors	17,000	380	< 2
	40 b	good red color	1,300	8	< 2	45 b	good red color	46,000	48	< 2
	40 c	No Ammonia	3,700	14	6	45 c	No Ammonia	10,000	160	< 2
7 Days storage:	40 a	fresh, no off odors	4,600	4	< 2	45 a	slight sour	500,000	> 5,000	> 5,000
	40 b	good red color	2,100	24	< 2	45 b	OK, no Ammonia	580,000	> 5,000	> 5,000
	40 c	No Ammonia	8,300	44	< 2	45 c	OK, no Ammonia	140,000	260	< 10
9 Days storage:	40 a	no off odors	12,000	28	< 2	45 a	slightly sour	9,400,000	45,000	1,000
	40 b	color good	19,000	8	< 2	45 b	brownish meat	2,000,000	> 50,000	< 10
	40 c	No Ammonia	27,000	44	< 2	45 c	slightly mushy	1,400,000	4,000	< 10
12 Days storage:	40 a	sl. fecal odor, brown	500,000	910	750	45 a	sour, mushy			
	40 b	OK, no Ammonia	900,000	80	< 10	45 b	brown meat			
	40 c	OK odor, brown	120,000	280	140	45 c	all discarded as spoiled			

fresh ray meat has a shelf-life of 6 days at 45°F and 11 days at 40°F

The organoleptic spoilage indicators produced by the ray meat were ammonia and slight fecal odors, and flesh browning (oxidation). APC counts (cfu/g) for 45° held meat averaged 4M at shelf-life termination (day 9), and 500,000 for 40° at 12 days.



Education component:

- Working with over 50 chefs
54 restaurants participated, 35 had positive responses, 12 had negative responses. .. 41 chefs were interested in attending a seminar on menuing, plate presentation and training wait staff to sell ray
- Cooking demonstrations
- Media interactions
- Scientific species information
- Regional workshop



Healthy choices / Healthy Kids



Oyster Industry Media Day



Marine Science Day



Chef Symposium at VIMS



Virginia Marine Products Board Marketing Chesapeake Bay ray

domestically and internationally for the past 6 years with the help of grant monies from the Virginia Marine Resources Commission.

sampled it at trade shows domestically and internationally with some interest in Asia and Europe

Wegman's Supermarkets ; repeat sales of ray fillets

Europe there is some interest but with it being a short harvest season in the Chesapeake Bay it makes it difficult to supply year round in volume

lack of knowledge of the product and how to prepare it.

NOW SERVING: CHESAPEAKE RAY

If you can't beat 'em, eat 'em. It's a philosophy adopted by the Virginia Marine Products Board about the cownose ray, a voracious but tasty bottom feeder that is depleting the Chesapeake Bay's oyster population.

by Lisa Hinton-Valdrighi

Every summer, the rays move up the coast from South America to New England. With wing spans of four-feet, the often 50-plus pound creatures devour oysters, clams and destroy vegetation.

A relative of the shark, ray males average about 35 inches in width and weigh about 26 pounds. The females average 38 inches in width and 34 pounds. A school of rays have been known to eat 60,000 oysters in a single

For years, sought to rid species, some discarded by a practice the change, said. kating species Marine Produ

"A lot of p been calling n Cardwell, wh time in the ps cownose ray ray" to resta



A ray of hope for oysters?

While some advise caution, the cownose ray may be coming to a plate near you.

BY PATRICK LYNCH

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NEWPORT NEWS — If you're in the right spot at the right time on the Chesapeake Bay, you could spot cownose rays swimming in schools of thousands.

Shirley Estes, who promotes Virginia seafood for a living, would rather

DAILY PRESS EXCLUSIVE

have you see the rays somewhere else. Specifically, on a plate. Maybe sauteed in a wine sauce with lemon and capers.

Despite a large population in the bay, the cownose ray has never been commercially fished for food. It has a leathery skin, tastes more like red meat than fish, and there has always

Please see **PLATE OF RAY/AS**

Good eating?

Virginia seafood promoters are trying to develop a commercial market for what they're calling the "Chesapeake Ray."

Color

Brown with a white belly

Size

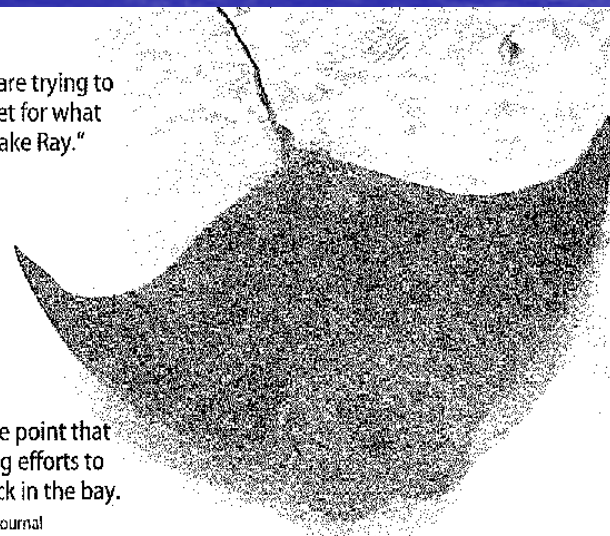
■ Adult males: About 35 inches wide, 26 pounds

■ Adult females: About 38 inches wide, 34 pounds

Eating habits

Eats clams and oysters, to the point that the ray population is harming efforts to stimulate an oyster comeback in the bay.

Sources: Chesapeake Bay Program; Bay Journal





Hosting International Buyers



Cownose ray as "mystery meat" in Capitol Food Fight competition
(Reagan Center, Washington, DC)



High profile , expensive event; Great product exposure



World renowned chefs moderating
event.....still they called it "skate"



Ray Specie Constraints

- Elasmobranch.....K-species
 - Age at sexual maturity..male 6-7, female 7-8
 - Long gestation...10-11 month
 - Low fecundity...one "pup" per female per year
- Few predators....near-shore sharks, Humans
- Near-shore shark experience....."caution"
- Brazilian effect...High fishing pressure in seine and pair trawl fisheries in Brazil have resulted in very large declines in the cownose ray (*Rhinoptera brasiliensis*) which is currently listed by the World Conservation Union's Redlist of Threatened Species as "Endangered"

Ray Market Constraints

- Ray is not skate (all levels of product handling)
- Consumer skepticism...unfamiliar..."beef-of-the-sea"demand low
- Wholesalers and distributors reluctance
- Ray processing...Labor intense (irregular shape)
 - Bait market; low value, unstable
 - Human consumption market; need to create value, high waste volume

Initiating a ray fishery

The Good.....

The Bad.....

The Ugly.....



The Good.....

- Reduce pressure on natural and cultured shellfish (?)
- Enhance restoration efforts (?)
- Supplemental fishery for waterman
- New culinary opportunity
- Focus on the species....develop pop est., environmental req., social behavior

The Bad.....

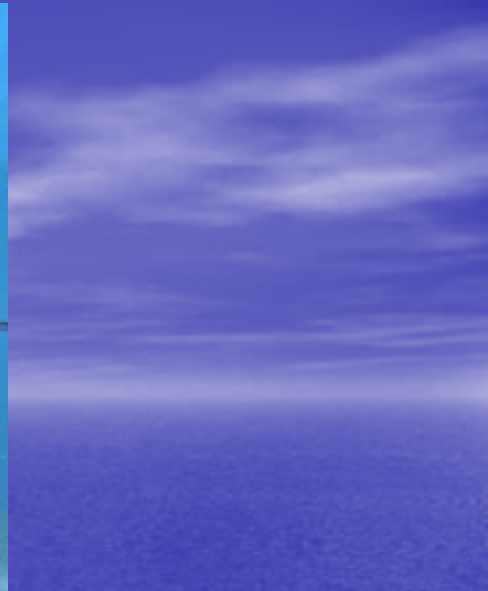
- K-species....potential for over-exploitation
 - no ray population estimates...fishery without science??? (sustainability)
- Public perception...segment of pop against
- Marketing "red meat" seafood item
 - success lies in an extensive education component



The Ugly.....



Not Really.....



The Ugly.....low priority to those outside the shellfish industry and elasmobranch ecologist communities...public largely does not care....well at least until videos go viral of unethical treatment of rays in fishing tournaments