

A Comparative Analysis of the Multi-Mode Chesapeake Bay Menhaden Survey

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**An Assessment of the Social and Economic Importance
Of Menhaden (*Brevoortia tyrannus*) (Latrobe, 1802)
In Chesapeake Bay Region**

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NOAA

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Menhaden

- ▶ Atlantic menhaden—*Brevoortia tyrannus*—constitute the largest landings, by volume, along the Atlantic Coast. They rank second in the United States for landings behind only pollock on the West Coast, Alaska.
- ▶ Menhaden are a major source of omega-3 fatty acids, which have been shown to cut risks of heart disease and possibly other diseases, such as Alzheimer's.
- ▶ Menhaden play an important role in the Bay's ecosystem as both a forage fish for striped bass, weakfish, bluefish, and predatory birds such as osprey and eagles as well as serving as a filter feeder because they feed on phytoplankton and zooplankton at various life stages.

Status

Biomass: While the stock of menhaden is not considered overfished, overfishing has occurred in 32 of the past 54 years, but it was not occurring during the previous nine years of assessment data (1999-2007). Based upon the 2008 data, overfishing was occurring.

Biological Reference Points: Established November 2011. The [Atlantic State Marine Fisheries Commission](#) adopted new threshold and target fishing mortality rates based upon Maximum Spawning Potential (MSP). The new threshold and target levels equates to a MSP of 15% and 30%, respectively. With these newly adopted fishing mortality reference points, the fishing mortality threshold is set at $F=1.32$ and the target is set at $F=0.62$.

Overfishing: Based on the revised 2009 Atlantic menhaden stock assessment and the new fishing mortality threshold, overfishing is occurring. Fishing mortality in 2008 (the latest year in the assessment) is estimated at 2.28.

Overfished: Based on the current reference point to evaluate stock condition (fecundity, or FEC), Atlantic menhaden are not considered overfished.



Fish Facts

- ▶ [Blue Crab](#)
- ▶ [Menhaden](#)
- ▶ [Oysters](#)
- ▶ [Striped Bass](#)
- ▶ [Alosines](#)
- ▶ [Invasive Catfish](#)

Related NOAA Resources

- ▶ [FishWatch](#)

Also of Interest

Omega Protein Processing Plant in Reedville, VA



VA Reduction Fishery Industry

industry Commercial Fishing Industry Importance

The Virginia reduction fishery industry employs about 10% of the Northumberland County workforce. In 2008:

The industry had total sales of approximately \$60 million.

Gross earnings by individuals working the boats and the plant were about \$11 million.

Average income for 300 fishermen and plant workers, which includes management, was about \$38,000, compared with average earnings of about \$27,000 per worker in the county.

Expenditures to support harvesting and processing activities, which generate both state and local taxes, were about \$19 million.

This Paper

- “Comparing Contingent Valuation Data from Opt-in Internet and Telephone Samples: Evidence from the Chesapeake Bay Menhaden Survey”
 - Response rates
 - Item nonresponse
 - Sample composition
 - Attitudes
 - **Willingness to pay**

Survey Modes

	Advantages	Disadvantages
Mail	Visual aids	Time, lack of control over skip patterns
Face-to-face	Visual aids, Control over skip patterns	Interviewer effects
Telephone	Control over skip patterns	No visual aids, Interviewer effects
Internet	Visual aids, time, control over skip patterns	Self-selection (opt-in)
Hybrids	All of the above	

Literature

International Review of Environmental and Resource Economics, 2011, 5: 309–351

Using Internet in Stated Preference Surveys: A Review and Comparison of Survey Modes

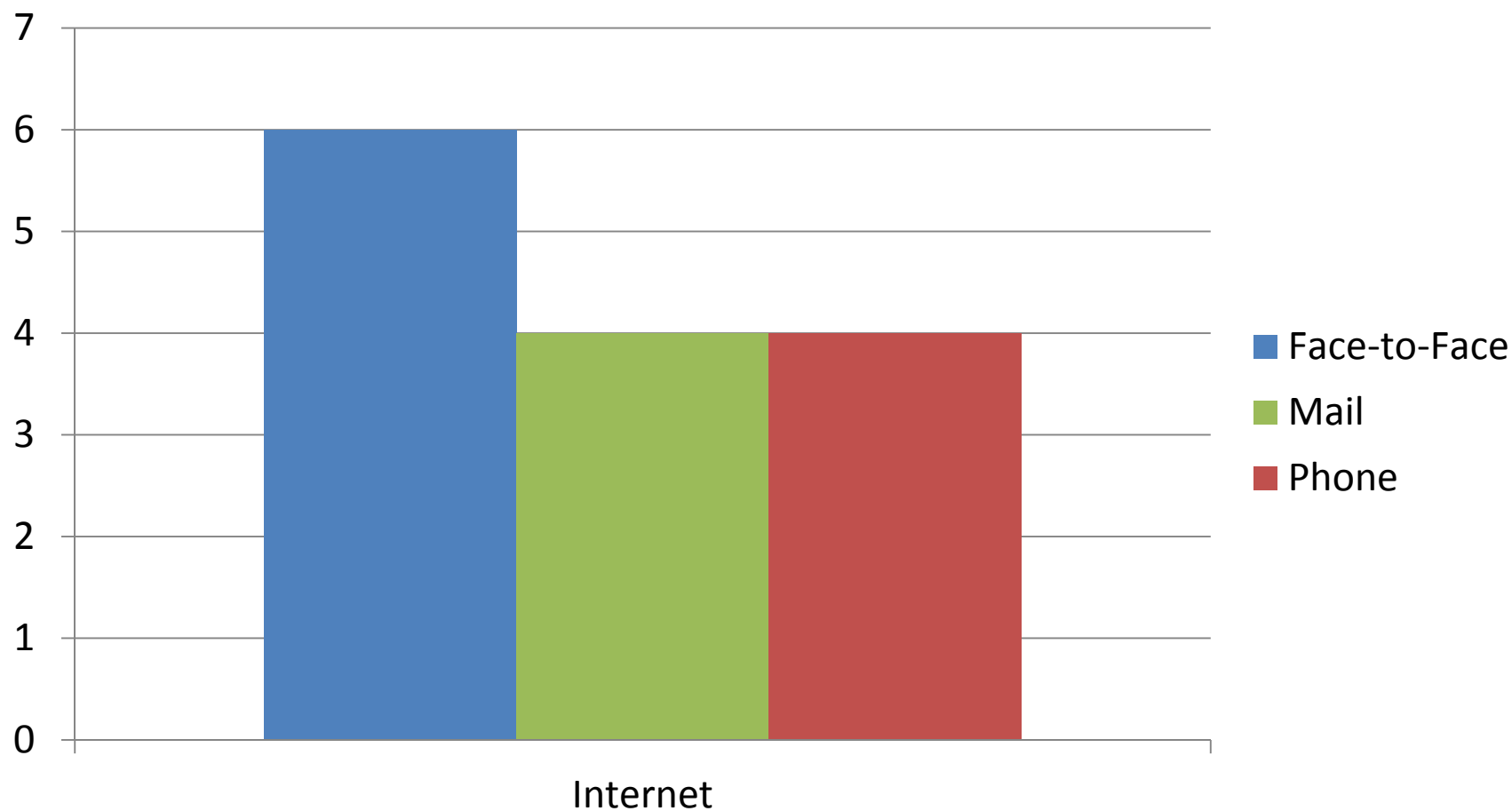
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17 Studies, 14 WTP comparisons



Literature: Internet vs. Phone

- Phone surveys are more likely to suffer from satisficing and social desirability bias
 - Satisficing: higher prevalence of “don’t know responses”
 - Social desirability bias: higher WTP
- Little evidence of either in the SP literature
 - Existing studies use probability based panels

Menhaden Survey: Data Collection

- “tailored design method” where the budget allowed (Dillman, Smyth and Melani, 2008).
- Samples: Maryland and Virginia
- Time in the field
 - Mail: 4 months
 - Telephone: 52 days
 - Internet: 4 days

Survey Response

Mode	Response Rate	Item Nonresponse Rate	Sample Size
Mail	10%	57%	434
Telephone	36%	50%	766
Internet	---	22%	831

Nonresponse Bias (VA)

	Census	Combined	Mail	Phone	Internet
Persons 65 years old and over, 2009	12%	11%	14%	11%	8%
Female persons, 2009	51%	50%	71%	46%	44%
High school graduates, age 25+, 2000	82%	91%	96%	92%	88%
Bachelor's degree or higher, age 25+, 2000	30%	29%	39%	32%	22%
Median household income, 2008	\$61.2	\$62.5	\$62.5	\$42.5	\$62.5

Experimental Design

- 3 scenarios
 - Decrease harvest by 10%
 - Decrease harvest by 50%
 - “Maintenance” (avoid a 10% decrease)
- 4 tax amounts
 - \$10, \$30, \$60, \$90

Decrease Version

=====

economy (Decrease version) Concerned About Virginia Economy

=====

Now I'm going to describe a management approach to decrease the harvest of the commercial menhaden fishing industry by 10% (50%) in the Chesapeake Bay.

To decrease the harvest of the menhaden “reduction” fishery in the Bay by 10% will require more rigorous monitoring. This approach could decrease the total sales of menhaden by about \$6 million, wages and salaries paid to fishermen and processor employees by about \$1.1 million, employment by 30 individuals, and taxes paid to Virginia by approximately \$340,000. The impact on the Maryland economy would be minimal. How concerned are you about the decrease of menhaden harvest on the Virginia economy?

- (1) Very concerned
- (2) Somewhat concerned
- (3) Not too concerned
- (4) Not at all concerned
- (Missing) Don't Know / Refused

Economy2 x Mode

```
--> CROSSTAB; Lhs=economy2; Rhs=phone$
```

```
+-----+
| Cross Tabulation
| Row variable is ECONOMY2 (Out of range 0-49:      0)
| Number of Rows = 2      (ECONOMY2 = 0 to 1)
| Col variable is PHONE   (Out of range 0-49:      0)
| Number of Cols = 2      (PHONE = 0 to 1)
| Chi-squared independence tests:
| Chi-squared[ 1] = 1.66248 Prob value = .19727
| G-squared [ 1] = 1.65873 Prob value = .19777
+-----+
| Joint Frequencies for Row Variable ECONOMY2 Column Variable PHONE
+-----+
| ECONOMY2 | Total | 0 | 1 |
+-----+
| 0 | 351 | 193 | 158 |
| 1 | 652 | 386 | 266 |
+-----+
| Total | 1003 | 579 | 424 |
+-----+
```


Decrease Version

=====

improve (Decrease version) Likelihood of Improving Ecosystem

=====

There is some chance that a decrease in allowable Chesapeake Bay harvest will increase the stocks of game fish, bring an increase in sea birds and possibly improve the overall health of the ecosystem. How likely do you think it is that this outcome will be achieved?

- (1) Very likely
- (2) Somewhat likely
- (3) Not too likely
- (4) Not at all likely
- (Missing) Don't Know / Refused

Improve2 x Mode

```
--> CROSSTAB; Lhs=IMPROVE2; Rhs=phone$
```

Cross Tabulation			
Row variable is IMPROVE2 (Out of range 0-49: 0)			
Number of Rows = 2 (IMPROVE2 = 0 to 1)			
Col variable is PHONE (Out of range 0-49: 0)			
Number of Cols = 2 (PHONE = 0 to 1)			
Chi-squared independence tests:			
Chi-squared[1] = 5.83193 Prob value = .01574			
G-squared [1] = 5.85069 Prob value = .01557			
Joint Frequencies for Row Variable IMPROVE2 Column Variable PHONE			
IMPROVE2	Total	0	1
0	437	271	166
1	566	308	258
Total	1003	579	424

CVM: Payment vehicle

- The program for enforcing the restriction on catch and monitoring is costly and will require additional state taxes. We estimate that a typical Virginia and Maryland household would pay about \$10 in higher state taxes each year for the next 10 years.

CVM: Referendum Vote

- Suppose that the proposal is put to a referendum vote. If a majority of all households in Virginia and in Maryland voted for the proposal it would pass, the menhaden harvest would be decreased and you would have about \$10 less to spend each year for the next 10 years.

CVM: Referendum Vote

- If a majority of all households in Virginia and Maryland voted against the proposal then it would fail, commercial fishing of menhaden would remain at current levels and it would cost you nothing.

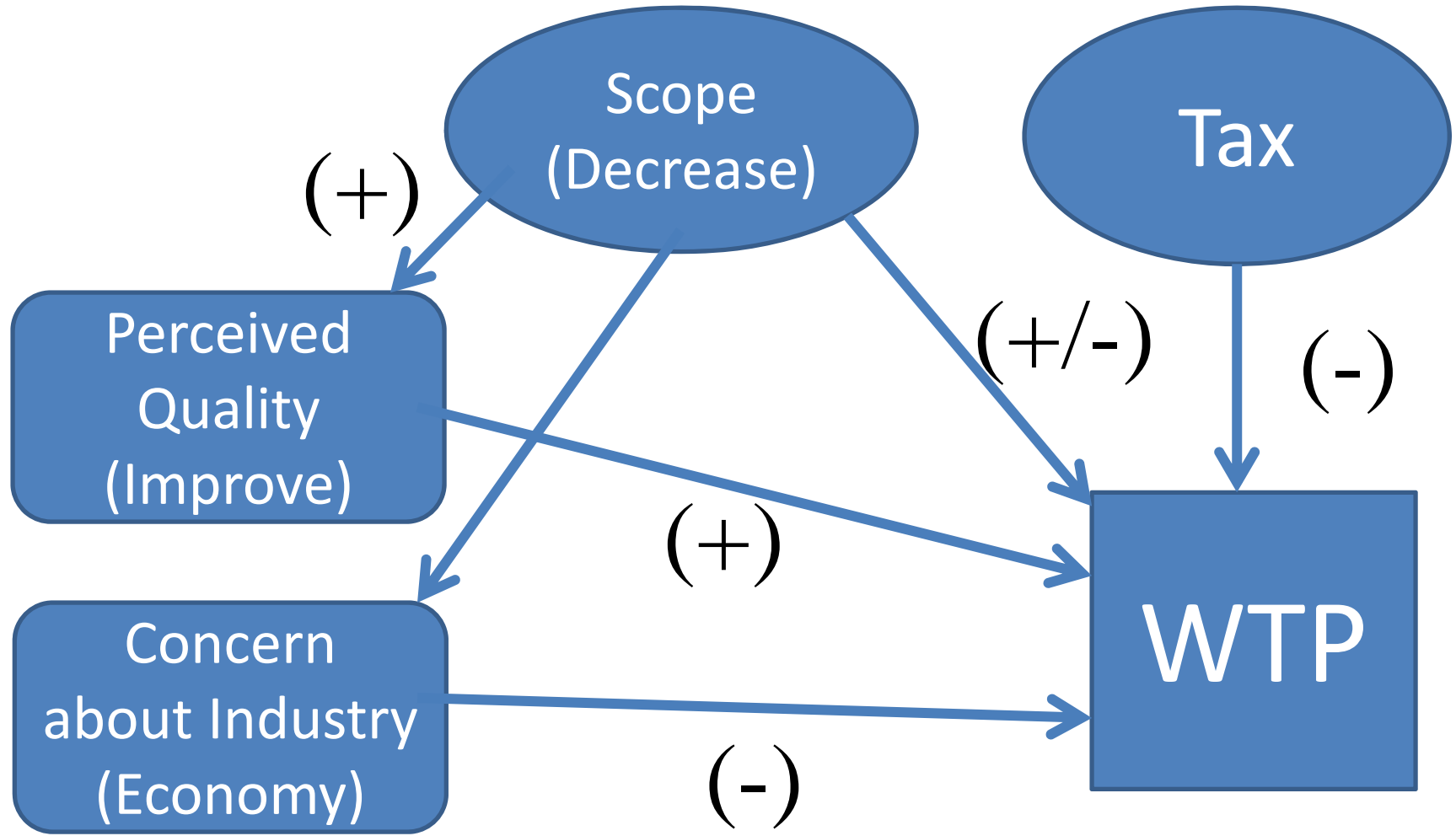
If the vote were held today would you vote for or against the proposal?

	Phone	Internet
For	51%	31%
Against	39%	31%
Don't Know	10%	37%

How sure are you about your vote on the proposal?

	Phone	Internet
Very sure	57%	32%
Somewhat sure	28%	30%
Not too sure	11%	18%
Not at all sure	4%	20%

Model



OLS Models: Attitudes

	Improve2		Economy2	
	Coeff.	t-stat	Coeff.	t-stat
Constant	0.496	11.097	0.636	15.035
DECREASE	-0.002	-0.065	0.062	2.112
VISITED	0.144	4.365	-0.015	-0.463
DOLLARS	0.000	-0.885	-0.001	-3.279
MISSINC	-0.076	-1.371	-0.166	-3.152
PHONE	0.068	1.998	-0.017	-0.541
VA	-0.039	-1.234	0.166	5.555

CVM Dependent Variable = Vote + Certainty Scale

4 = For – very sure

3 = For – somewhat sure, not too sure, not sure at all

2 = Don't know

1 = Against – somewhat sure, not too sure, not sure at all

0 = Against – very sure

Votescx x Mode

```
--> crosstab; lhs=votescx; rhs=phone$
```

Cross Tabulation			
Row variable is VOTESCX	(Out of range 0-49:	0)	
Number of Rows = 5	(VOTESCX = 0 to 4)		
Col variable is PHONE	(Out of range 0-49:	0)	
Number of Cols = 2	(PHONE = 0 to 1)		
Chi-squared independence tests:			
Chi-squared[4]	= 187.06673	Prob value =	.00000
G-squared [4]	= 225.29086	Prob value =	.00000
Joint Frequencies for Row Variable VOTESCX Column Variable PHONE			
VOTESCX	Total	0	1
0	196	82	114
1	188	106	82
2	231	220	11
3	167	83	84
4	221	88	133
Total	1003	579	424

Ordered Logit

	Phone		Internet	
	Coeff.	t-stat	Coeff.	t-stat
Constant	0.801	3.811	1.244	7.491
TAX	-0.004	-2.473	-0.004	-2.726
INCOME	0.000	0.165	0.000	-0.006
MISSINC	0.038	0.242	-0.480	-1.895
TRAVCOST	-0.001	-1.490	0.000	0.041
SCOPE	0.000	0.135	-0.002	-0.886
ECONOMY2	-0.294	-2.506	-0.180	-1.893
IMPROVE2	0.345	3.121	0.675	7.488
VA	0.079	0.687	-0.139	-1.479
$\chi^2 = 246$ (df = 9)				

Marginal Willingness to Pay*

	Phone		Internet	
	Coeff.	t-stat	Coeff.	t-stat
ECONOMY2	-41.80	-1.73	-29.93	-1.58
IMPROVE2	47.42	1.90	88.55	2.58

*MWTP = $-X(\beta_x/\beta_{tax})$

Pooled Model: No difference in total WTP

Ordered Probability Model								
Cell frequencies for outcomes								
Y	Count	Freq	Y	Count	Freq	Y	Count	Freq
0	196	.195	1	188	.187	2	231	.230
3	167	.166	4	221	.220			

Variable	Coefficient	Standard Error	b/St.Er.	P[Z >z]	Mean of X
-----+Index function for probability					
Constant	1.02910764	.12877498	7.992	.0000	
TAX	-.00428687	.00112695	-3.804	.0001	47.3579262
DOLLARS	.00015977	.00072359	.221	.8252	66.9192423
MISSINC	-.01609844	.12242855	-.131	.8954	.13160518
TRAVCOST	-.00034392	.00030709	-1.120	.2627	86.3031466
SCOPE	-.00110238	.00168951	-.652	.5141	30.4985045
ECONOMY2	-.22330214	.07273242	-3.070	.0021	.65004985
IMPROVE2	.48565902	.06862902	7.077	.0000	.56430708
VA	-.02472567	.07186325	-.344	.7308	.53539382
PHONE	.01826069	.07431083	.246	.8059	.42273180
-----+Threshold parameters for index					
Mu(1)	.57398083	.03287094	17.462	.0000	
Mu(2)	1.18717824	.03843380	30.889	.0000	
Mu(3)	1.70383458	.04658266	36.577	.0000	

Conclusions

- We find differences in:
 - Response rates
 - Item nonresponse
 - Sample composition
 - Attitudes
 - Marginal Willingness to pay
- Combined modes reduce sample bias

Conclusions

- Satisficing
 - More item-nonresponse with phone
 - More “don’t knows” on WTP with internet
 - Less “certain” about WTP with internet
- Some evidence of social desirability bias with phone survey
 - More “for” votes, more “certain,” more likely to “improve” with phone
 - No difference in WTP

General Results

- Some support for the indirect scope effects model
 - No scope effects from split sample test but this is not unexpected
 - No scope effects for “improve” but this is not unexpected
 - Attitudinal scope effects
- WTP = passive use value
 - Evidence of altruistic values for the industry

Next Steps

- Sample weighting
- Follow-up WTP questions (for internet, phone modes)
- Improved modeling of attitude variables
 - Additional attitudes
 - Respondent characteristics (i.e., work in fishing industry)