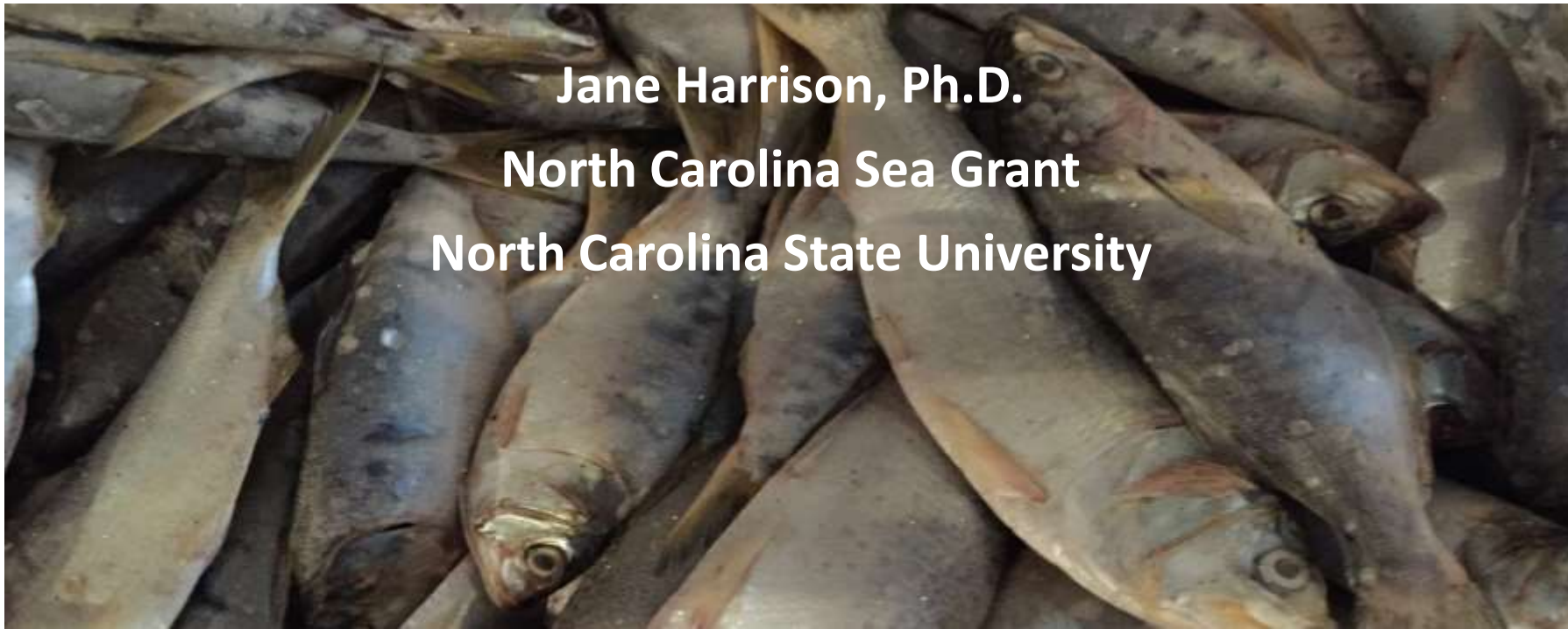


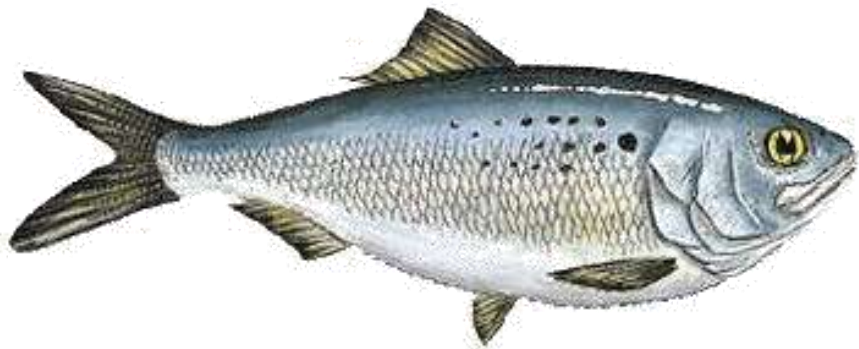
# When Ecosystem Service Flows Break Down: Barriers to Application in Fisheries Management



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**North Carolina State University**

# Atlantic Menhaden (*Brevoortia tyrannus*)

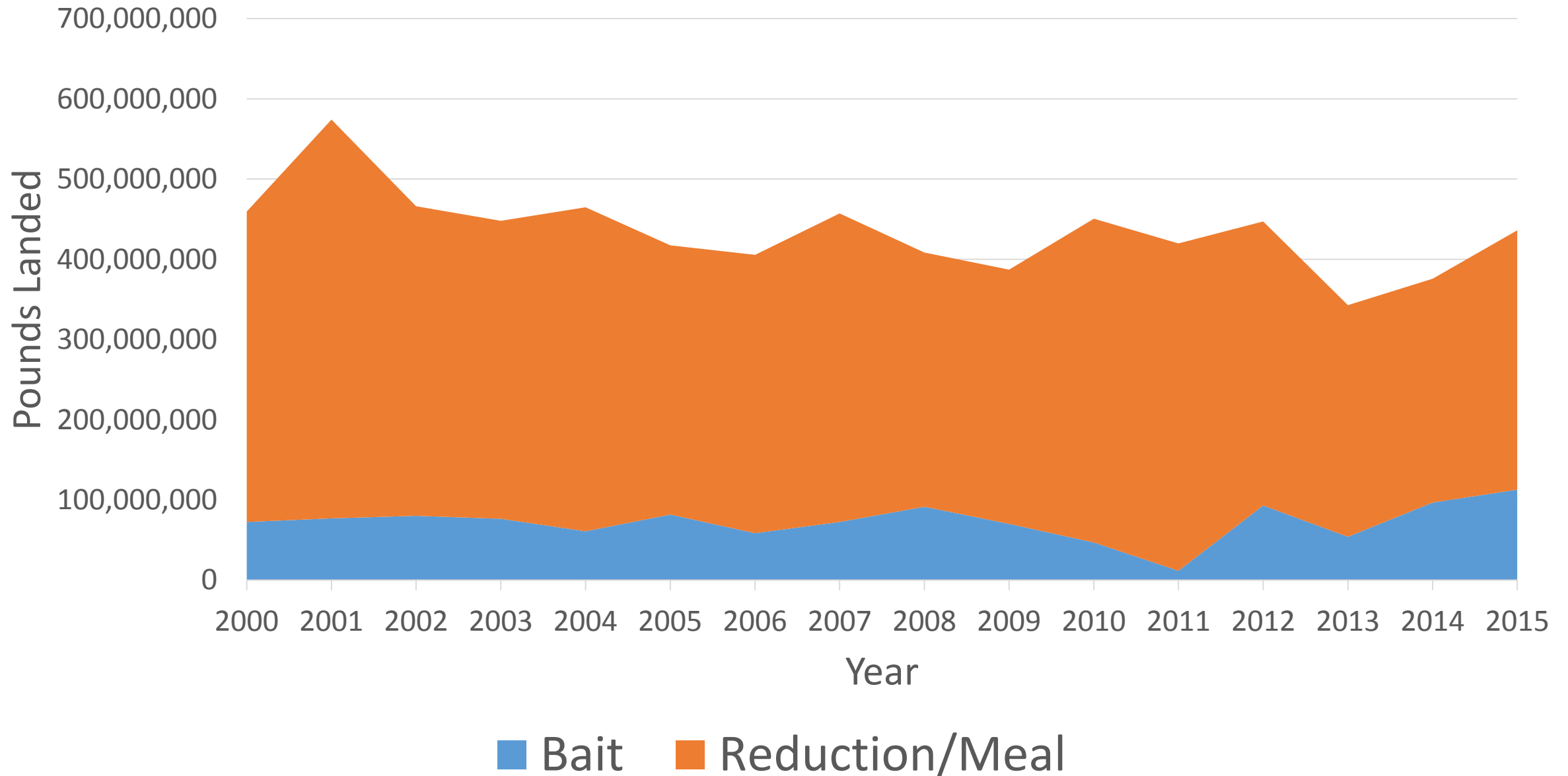
- Occupies estuaries and nearshore ocean waters from northern Florida to Nova Scotia
- Adult and juvenile menhaden form large, near-surface schools
- Important component of the food chain
  - Links primary production and higher organisms by consuming plankton and providing forage for species like striped bass, bluefish, and weakfish



# Atlantic Menhaden Fishery – Mgmt Highlights

- Managed under Amendment 2, approved in 2012 (170,800 mt total allowable catch that began in 2013, a 25% reduction from 2011 landings)
- Stock Assessment reversed in 2013 – menhaden not overfished
- 10% Increase in allowable landings in 2015
- New stock assessment and socioeconomic analysis underway to inform Amendment 3 in 2017
  - Socioeconomic analysis gathers data on menhaden industry stakeholders (reduction, bait) and general public in Atlantic states

# Menhaden Pounds Landed 2000 - 2015



# State Allocations

State	Percentage of Total Allowable Catch
Virginia	85.3%
New Jersey	11.2%
Maryland	1.4%
Massachusetts	0.8%
Potomac River Fisheries Commission	0.6%
North Carolina	0.5%

# Barriers to Applying Ecosystem Services Approach

- Lack of interdisciplinary research teams
- Mismatched time and spatial scales between research products and management decisions
  - Example: October 2016: TAC increased to 200,000 mt for 2017 fishing season, a 6.45% increase
- Stakeholder power dynamics

## Question for Discussion

- Whose ecosystem service values should inform management?

# Social In Addition to an Economic Approach

- Social Approach Methods:
  - Apply qualitative and quantitative social science research methods
  - Value ecosystem services in non-monetary terms (perceptions)
  - Explicitly make stakeholders the focal point of the research
- Social Approach Benefits:
  - Help to value cultural services
  - Facilitate understanding of complex socio-ecological systems
  - Increase social relevance of the ecosystem service assessment process
  - Strengthen policy relevance of the assessment

# Industry Survey Data

- Contacted 2000 or so potential menhaden fishermen and bait dealers

State	Menhaden Fishermen	Bait Dealers	Totals
Maine	9	14	23
Maryland	85	6	91
New Jersey	37	19	56
New York	8	4	12
North Carolina	15	5	20
Rhode Island	5	3	8
Virginia	22	5	27
Totals	181	56	237



# % Menhaden fishermen who catch other species

State	% Fishermen	Other Species Caught
Maine	11%	Herring
Maryland	7%	Striped bass , bluefish , hard head, flounder , weakfish, butterfish, spadefish , cobia , black drum , red drum , herring American shad , gizzard shad , hickory shad , sturgeon , speckled trout , carp, white perch, Spanish mackerel, pompano , jack crevalle , spot mullet tautog sheephead triple tail , bull sharks
New Jersey	49%	Perch, croaker, blue fish, mackerel, bonita, monk fish, thresher shark, fluke, squid, welk
New York	75%	Bluefish, weakfish, striped bass, porgies (scup), fluke, dogfish, blowfish (northern puffers), searobins, butterfish, cod, skate, triggerfish, eel
North Carolina	73%	Flounder, Spanish mackerel, shrimp, crab, spot hogfish mullet, blue fish trout grey speckled, king mackerel, red drum, sea mullet
Rhode Island	80%	Striped bass, fluke, sea bass, butterfish, scup, blue runner, mackerel, bluefish, black fish, squid, skate
Virginia	59%	Butterfish, croaker, blue fish, spot, striped bass, flounder, sugar toad, mackerel, mullet, perch

# Reasons for Increases & Decreases of Menhaden Landings 2010-2015

<b>Causes of 25% Increase in Menhaden Landings</b>	<b>Causes of 25% Decrease in Menhaden Landings</b>
1. Stock Availability	1. State Regulation Changes
2. State Regulation Changes	2. Fuel Prices
3. Fuel Prices	3. Menhaden Price
4. Weather	4. Overabundance of Menhaden
5. Crab and Lobster Markets Up	5. Hurricane Damage
6. Regulations on Substitutes (i.e., herring)	6. Weather

# Interview Data

- 46 Interviews with menhaden industry members
- 7 states: Maine, Maryland, New Jersey, New York, North Carolina, Rhode Island, Virginia



# Provisioning Ecosystem Services

## Interviewee #10

- Manager of menhaden reduction oil facility
- Reedville, Virginia



Omega 3 Health Supplements



Fish Meal (Input in Animal Feeds)



Omega 3 Enhanced Salad Dressing

# Cultural Ecosystem Services

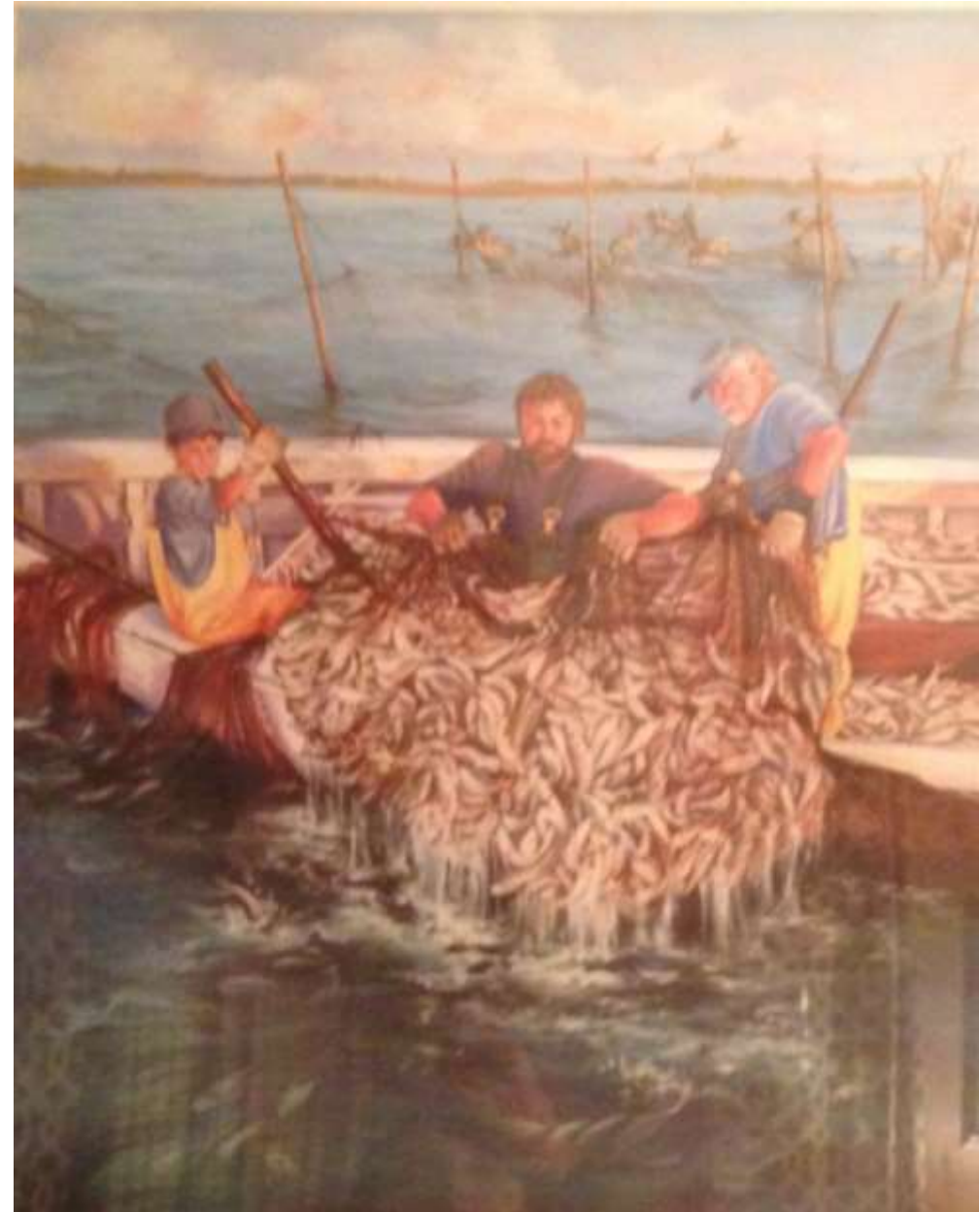
## Interviewee #17

- Catches menhaden for personal use – conch and dogfish
- Cape May, New Jersey



## Interviewee #33

- Bait dealer – sells menhaden to lobster fishermen
- Portland, Maine



# Public Survey Data

- Referendum on support of increase or decrease in menhaden quota (akin to contingent valuation)
- 2022 respondents from Florida, Maine, Maryland, New Jersey, New York, North Carolina, Rhode Island, Virginia via Survey Sampling International
- Random effects logit model used to estimate factors that lead a respondent to support quota increase or decrease

# Referendum Votes

Quota Change	Vote Yes	Vote No	Don't Know
10% Increase	44%	41%	15%
20% Increase	43%	41%	16%
30% Increase	45%	39%	16%
10% Decrease	41%	42%	18%
20% Decrease	42%	40%	18%
30% Decrease	40%	40%	20%

# Significant Variables (99% Confidence) in Quota Increase Scenario

- Water (-), Fish (-), Birds (-): Water quality, Fish population (menhaden predators), bird population decline
- Order (+): Quota increase scenarios asked prior to quota decreases
- First (+): Within quota increase scenario cluster, more likely to choose yes to first quota increase option
- Member (+): Member of recreational or environmental group
- Industry (+): Employed by the commercial fishing industry
- Angler (+): Respondent is recreational angler
- Age (-): Respondent's age



# Significant Variables (99% Confidence) in Quota Decrease Scenario

- Jobs (-): Job losses in menhaden industry
- Water (+), Fish (+), Birds (+): Water quality, fish population, bird population increases
- First (+): Within quota decrease scenario cluster, more likely to choose yes to first quota decrease option
- Second (+): Within quota decrease scenario cluster, more likely to choose yes to second quota decrease option
- Overfishing (+): Concerned about overfishing
- Member (+): Member of recreational or environmental group
- Industry (+): Employed by the commercial fishing industry
- Age (-): Respondent's age
- Female (-): Respondent is female

# Question for Discussion

- Whose ecosystem service values should inform management?

## Contact

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