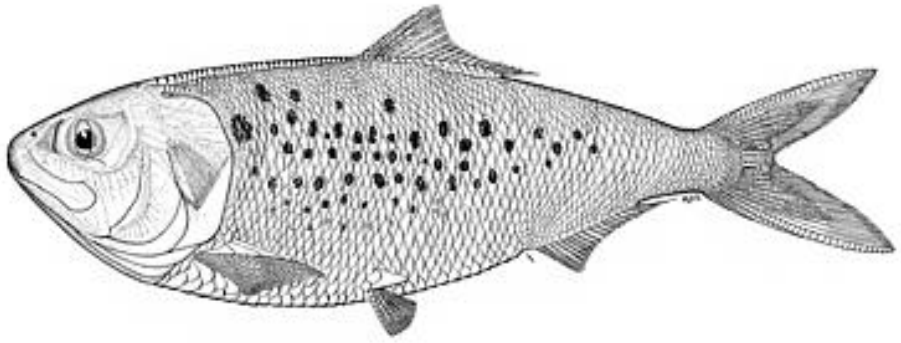
Proceedings of the Menhaden Science and Policy Symposium



A report of a workshop co-sponsored by Rhode Island Department of Environmental Management and Rhode Island Sea Grant.
November 30, 2007
Narragansett, RI

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On behalf of RI DEM, Matt Griffin would like to personally thank those involved with Ark Bait Company, particularly: Gerry, Richard, and Diane Sousa, Richard and Louis Lachance, Antone Butelho and Captain and Pilot Everett Mills, for their dedicated cooperation and their generous hospitality accommodating an observer throughout the 2007 season.

General Introduction

The commercial harvest of the Atlantic menhaden from Narragansett Bay is a recurring issue in Rhode Island. Menhaden are of great ecological, commercial and social value. Due to the small-scale bait fishery in Rhode Island, concern over local depletion exists. Environmentalists have charged the removal of menhaden from Rhode Island waters by commercial activity denies the Bay of the critical ecological and recreational services provided by the existing menhaden stock in Narragansett Bay. This workshop was designed to explore the current information available regarding the science behind menhaden and the menhaden resource, and to provide the opportunity for all stakeholders to discuss their concerns over the resource here in Narragansett Bay. The workshop was free of charge and open to the public.

The following topics were discussed: history of menhaden in Narragansett Bay, menhaden biology and life history, menhaden's ecological role, current coast-wide stock assessment as well as current stock assessment and management of menhaden in Narragansett Bay. A panel discussion involving resource allocation followed the presentations. The panel consisted of stakeholders for the menhaden resource.

Objectives

1. Provide background information on the state of science surrounding the menhaden resource.
2. Gain perspectives of involved stakeholders.
3. Gather information for effective management of the resource in Rhode Island.

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Opening Remarks

Austin Becker, RI Sea Grant Program

- Welcome and introduction to those in attendance.
- We are here today to share information on the state of the science and use of the menhaden stock in the region and to here from you the stakeholders on the issues.
- Overview of the days agenda
    - Hear the state of the science though a series of presentations and short Q&A.
    - During the afternoon we will hear from a panel of stake holders followed by a facilitated discussion

Barry Costa-Pierce, Director, RI Sea Grant Program

- I would like to welcome all of you and we appreciate your time on this Friday to discuss this issue as broadly as we can.
- The stakeholder base we have tried to bring together is very broad, including:
    - Managers
    - Top scientists along the east cost, focused on menhaden research
    - Commercial fishing industry
    - Recreational fishermen
    - Representatives of the different stakeholder organizations
    - Legislators
- This is a very important issue for the future, not only for our marine ecosystem but also for the management of this incredibly important resource.

Sea Grants Role

- Bringing together diverse multi-jurisdictional, multi-disciplinary stakeholders groups like this.
- In today's society we have a different way of looking at scientists and their role, likewise scientists have a different way of looking at fishermen.
- There are two ways of looking at democracy.
    1. Majority Rules - The political process is fundamentally a win loose process.
    2. A new way of looking at democracy - A way of consensus building, a way of convening these types of meetings where we may not all agree but allow opinions to be heard.
- Science plays a small part in the role of decision-making. Scientists do not make policy decisions; what we try to do is lay out all potential options to decision makers and the public to make those decisions for society. The old view of science is linear; scientists thought they knew best for fisheries.
- Today the view of science at Sea Grant is much different. We listen at the outset not as an afterthought. When we formulate our management programs we are listening to you and involving you the best we can from the outset, before the

research proposal. We want you as collaborators in this stakeholder inclusive science.

W. Michael Sullivan, Director, RIDEM

- Thanks to those responsible for the days events: Bob Ballou, Mark Gibson, April Valliere and everyone else on the DEM staff as well as Kathy Castro, Barbara Somers and everyone at RI Sea Grant.
- Thank you Jan Malik for being here. He is integral in the decision-making. We want him as knowledgeable about this fish as he can be.
- "Today from my perspective is about leadership, partnership and knowledge. The more we know about the species and about each other the more we talk, the less emotion that we will see, the less rhetoric that we will hear and the more logical, sane and desirable our decisions will be. I want to thank you all for being here and want to ask you to be part of the leadership, to be part of the partnership and gain knowledge to make wise decisions, policy options and alternatives. This is about a good discussion based on knowledge and fact that helps lead to better decision and policy making. Again thank you all for coming."

Figure 1. Fish spotting 2007. Looking south at Mt Hope Bay and the Sakonnet River.
Photo By: Matt Griffin

Workshop Proceedings

The following are summaries of the presentations followed by a discussion period.

History of Menhaden Fishing in Narragansett Bay

Presented by Dave Beutel, RI Sea Grant

Abstract: Native Americans fished for menhaden before the European settlers arrived in Rhode Island. The primary use of menhaden for the native people as well as the first settlers was as fertilizer. Menhaden were harvested as bait for the growing colonial fishing industry. Menhaden were first used for oil production in Tiverton, RI in 1811. By the 1870's menhaden oil production had surpassed the production of whale oil. Rhode Island was in the area of major menhaden harvest, which included landing 112,580,000 pounds in 1889. Menhaden harvest amounts have fluctuated throughout their history indicating human impact on the resource. Bycatch of food fish in the menhaden purse seine fishery have been and remain minimal.

Advancing Gear in New England

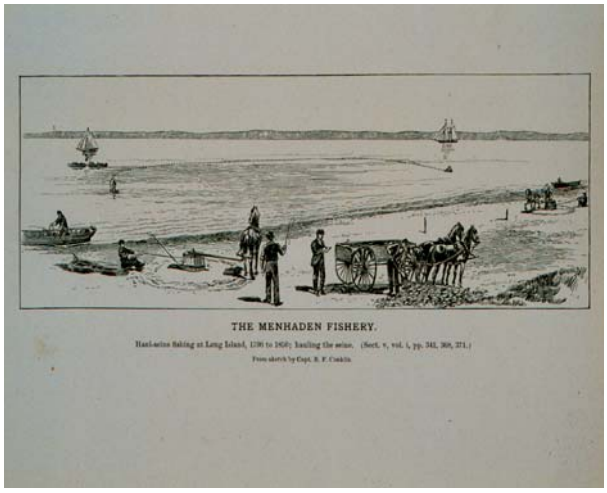


Figure 2. Harvesting menhaden via haul seine fishing. Long Island, 1790-1850. From Sketch by Capt. B.F. Conklin.

Figure 3. Bailing menhaden from a purse seine into a steamer's hold. From Sketch by J.S. Rider.

Historic Concern Over Menhaden Stocks

In the Report of the Commissioner of Fish and Fisheries for 1892 the following statement was made:

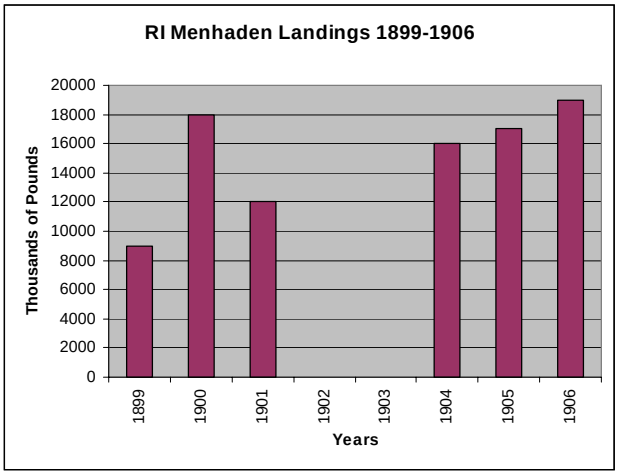
"Since it appears probable that the menhaden fishery will for some years at least be the object of legislative consideration and personal controversy, it seems important to secure and have available for use all information that can possibly be obtained that is calculated to aid in the solution of the very difficult problems involved. It is therefore conceived that valuable material relating to the special point under discussion may be obtained by

placing the field force of the division [of fisheries] on vessels fishing off various parts of the coast, and having the agents make actual records of the results of every seine-haul during a period of two or three months. With this plan would involve a study of a small part of the menhaden fleet; it would nevertheless afford a valuable basis for generalization."

1894 By Catch Study of the Menhaden Fishery, Conducted by U.S. Fish Commission

- 2-fishing vessels made 1078 hauls
- Average haul of 26,030 fish
- Total of 28,060,565 fish
- 27,965,755 or 99.7% menhaden
- 94,810 other fish
- 89,043 alewives and shad
- 5,767 non-herring fish or 1/50th of 1%

Historical Catches of Menhaden in RI



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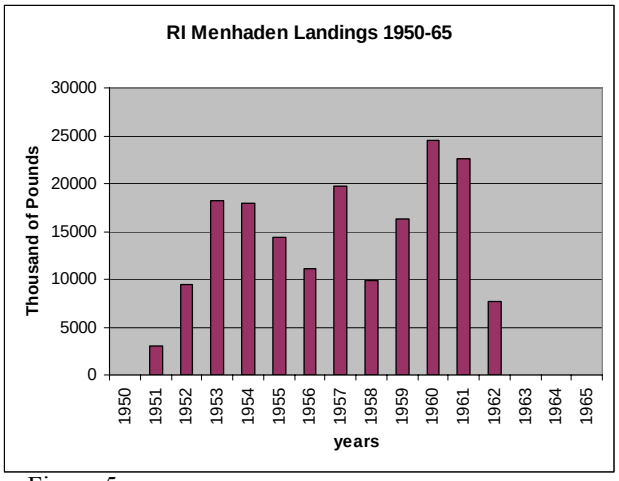

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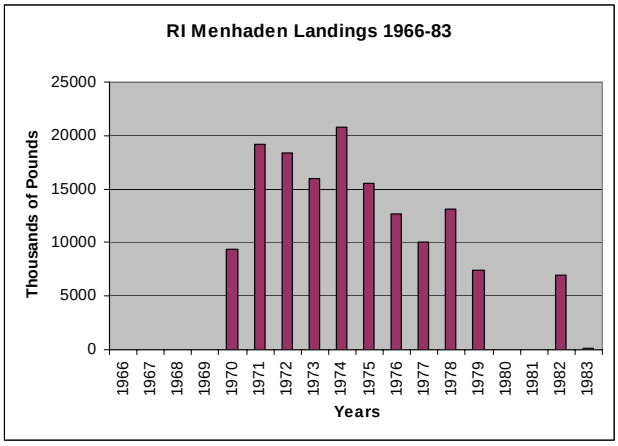

Figure 6.

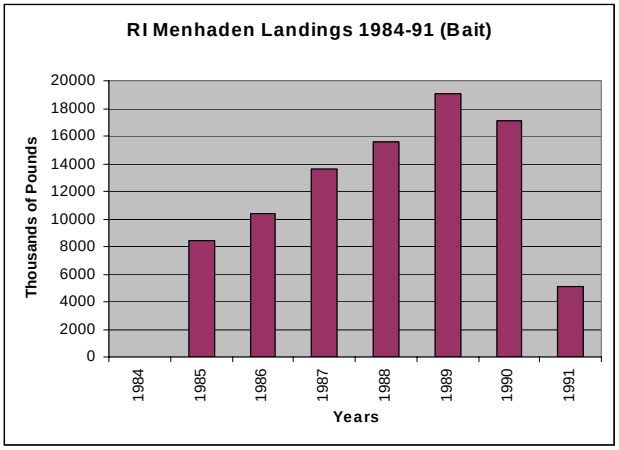

Figure 7.

Comments and Questions

Q: Where is the NOAA library?
A: The NOAA photo library is located online.

Q: *Rich Hittinger* - Where there any estimations of the catch or population size of menhaden in Narragansett bay during the 1870's when there were 13 menhaden factories on the shores of the bay?
A: There are no written records that I could find of the catch or population size during that time. In what I was reading it was comparable to the 1889 figure of 112,580,000 lbs caught in RI.

Q: *Peter Lozier* - What is the historical interpretation of the fluctuations in the catch, was it due to the catch or rather to natural fluctuations within the population?
A: The views of the fluctuations of the catch were similar to what they are now. Some say they are just a cyclic fish others say it's over fishing, while some say its pollution that were driving the fish out of Narragansett Bay.

Q: *Art Glowka* – Has anyone looked into the relation between plankton and abundance of menhaden? How many references have you run into about humans eating menhaden?
A: People are now looking into plankton abundance in relation to menhaden although it was not looked at historically. People have historically eaten menhaden as a food fish although how they ate them I cannot say.

Menhaden Biology & Life History; Feeding Practices & Filter Rates of Menhaden
Presented by Kevin Friedland, National Marine Fisheries Service

Abstract: Atlantic menhaden (*Brevoortia tyrannus*) occupy a unique ecological niche in the food webs of estuarine and coastal ecosystems. Menhaden are a schooling species that feed on plankton; what is atypical about menhaden is the size spectra of the food items they consume; menhaden feed directly on nanoplankton. Coupled with the fact that menhaden occur in great numbers, they take on an ecological role in the trophic structure of these ecosystems. The small and fragile nature of their food items has made it difficult to characterize their diet, a problem compounded by the fact that Atlantic menhaden diet changes ontogenetically with changes in the morphology of their mouthparts and branchial basket used to feed. First-feeding Atlantic menhaden larvae feed on individual plankton particles such as large dinoflagellates and zooplankton, and continue to feed in this manner until they metamorphose into juveniles, at which time their branchial baskets and gill rakers adapt to filter-feeding. As juveniles and adults, Atlantic menhaden are omnivorous, feeding on both phytoplankton and zooplankton.

Owing to difficulties in measuring menhaden stomach contents, we must rely on feeding studies to predict what portion of the plankton community menhaden consume. Ontogenetic change in the structure of the gill rakers results in an ontogenetic change in the filtering ability of menhaden over the size spectra of juvenile to adult. Atlantic menhaden filtering efficiency has been measured with two experiments that characterized

particle retention over an ecologically relevant size spectrum of plankton. The study done with large migratory adult Atlantic menhaden (~260 mm fork length, FL) showed that older menhaden had a minimum particle threshold size of 13 μm diameter; however, the clearance rate data for these fish also suggests that significant retention (10% efficiency) does not occur for particles <30 μm in diameter. Adult fish were highly efficient when filtering zooplankton. The second study was done with Atlantic menhaden of a transitional size between juvenile and adult (~14 cm FL), and showed that the menhaden feeding apparatus changes ontogenetically since these fish were able to retain particles as small as 5-7 μm and showed significant retention efficiencies for particles of 7-9 μm. However, these fish filtered some zooplankton at a lower efficiency than phytoplankton, suggesting they have maximum filtration efficiency at a size intermediate between phytoplankton and zooplankton.

The gill rakers of Atlantic menhaden form a physical sieve that retains plankton particles. Menhaden, like other filter-feeding species, show an ontogenetic shift in the physical dimensions of the apertures of the sieve formed by their gill rakers. In Atlantic menhaden, this shift is allometric, adapting various sized menhaden to the habitats they utilize. Menhaden juveniles retain the ability to filter the smallest size fractions of plankton while they reside in estuaries. The transition to larger gill raker apertures coincides with their migration to coastal ocean habitats characterized by plankton communities with lower concentrations of phytoplankton biomass and a general shift to larger sized particles, including higher concentrations of zooplankton.

The relationship between menhaden and plankton is also distributional in nature. Of the suite of physical and biological parameters that control menhaden migration and local movement, the distribution of food resources appears to be of primary importance. The distribution of Atlantic menhaden juveniles is correlated with gradients of plankton biomass reflecting gradient search behavior of the fish. Though not as clearly defined, the meso-scale distribution of adult gulf menhaden in the Gulf of Mexico also appears to be conditioned by similar mechanisms.

Overview of Life History

- Menhaden are diadromous; they use both estuarine and marine resources.
- Spawning occurs offshore; pelagic eggs are transported to coastal areas via currents where they metamorphose to larval forms as they enter estuaries.
- Juveniles grow in estuaries over the summer and then mass migrate out to join the north–south migrating adults.
- Menhaden migrate north in the spring, stratifying according to size and age during summer months. The fish then migrate south in the fall, with most over wintering occurring off Cape Hatteras, North Carolina.
- Spawning occurs year round as the fish move north–south in the spring, and spawn again on the southerly migration in the fall. It is unclear how successful the fall spawn is; this needs more concentrated research.

- Age data is available though analysis of annular increments on scales. Menhaden can live to 10 years of age but exploitation by the fishery results in an age structure dominated by 1, 2 and 3 year olds.

Metamorphosis of Gill Rakers

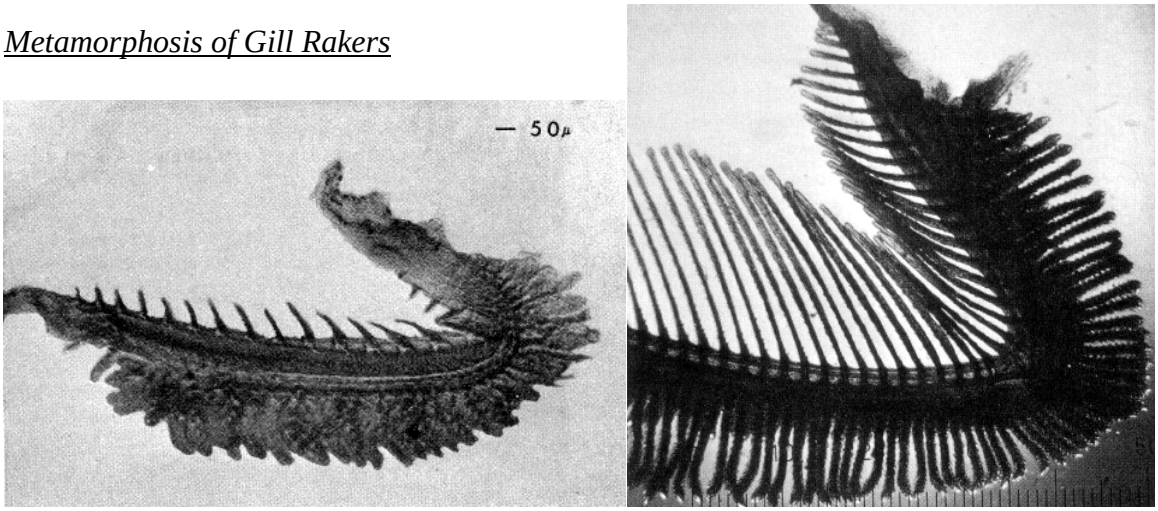

Figure 8. From left to right respectively, juvenile and adult gill arches. Anatomical changes are related to changes in diet. Menhaden have five gill arches, plankton particles are captured by secondary spines (branchiospinules) on the gill rakers.

Summary

- Menhaden ingest everything in the water column including detritus.
- Some phytoplankton are capable of passing through the alimentary canal of menhaden.
- Menhaden distributions are defined by phytoplankton distributions within physical limits and migration behaviors.
- Menhaden juveniles retain the ability to crop small phytoplankton in estuaries during the nursery season.
- Larger, older menhaden filter increasingly larger plankton, but avoid niche overlap with other filter feeding fish.
- Menhaden are consumed by a wide range of predators.

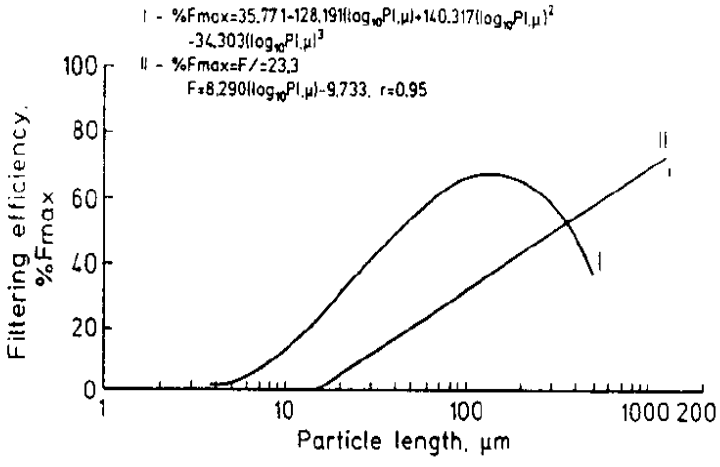

Figure 9. *Brevoorita tyrannus* filtration efficiency versus prey particle length for Atlantic menhaden feeding on phytoplankton and zooplankton. Curve I is a polynomial fit for small menhaden. Curve II is from Durbin and Durbin (1975) for large menhaden.

Comments and Questions

Q: *Caroly Shumway* – Could the recruitment across the shelf be related to the North Atlantic Oscillation?
A: I believe it is. Recruitment in a number of species such as eels and salmon has shown to utilize cross shelf movement. It is unclear if it has formally been worked out with menhaden, but I believe the signal is there.

Q: *Peter Lozier* – Does detritus increase the efficiency of feeding?
A: Yes. Detritus clogs up the pores of the sieve, which helps capture particles that would otherwise pass though by themselves, they instead become part of a larger aggregate that gets retained by the menhaden.

Q: *David Preble* - Phytoplankton contain large oil globules and younger menhaden heavily feed on phytoplankton where larger menhaden feed predominantly on zooplankton. Do juveniles incorporate this oil globule chemically intact, and are therefore of a higher value in terms of forage than older fish?
A: In relation to adult menhaden the juveniles are growing and utilizing a lot more of the energy consumed. They are not known to accumulate as much oil as the adults and juveniles have a higher ratio of muscle and protein to oil than adults.

Q: *Lanny Dellinger* – Does Narragansett Bay have its own spawning stock of menhaden?
A: No, menhaden are considered a single stock along the east coast of the United States.
Q: Do larger menhaden filter or eat larvae of commercially harvested species such as lobster or flounder?
A: It is very problematic to examine stomach contents of Atlantic menhaden but the general wisdom is they filter whatever is in the water. If there is lobster larvae or other commercially important species in the water column it is fair to say they are filtering them.

Q: *Michael Bucko* – Is there any science that suggests at a certain age adult menhaden no longer eat or process phytoplankton and cellulose into growth?
A: All through life menhaden are able to utilize the beneficial portions of phytoplankton regardless of the size of the cellular contents. Studies from both the east and gulf coasts, suggest at low levels there is some breakdown of cellulose occurring; possibly due to their long gut tract, which the menhaden ultimately benefit from. Most of the benefit they are receiving from a phytoplankton cell comes from its cellular contents, the proteins and fats, which are occurring in the cellular matrix as opposed to the cellulose, which is occurring in the cell wall.

Q: *Barry Costa-Pierce* - Would you be willing to say that there is some evidence of spawning stocks of menhaden moving north due to climate change or ocean condition changes, or is that just part of natural variability?
A: The regional survey data for Atlantic menhaden suggested that we have gone through a period where there has been a decline in the recruitment of menhaden to the major nursery grounds of the Chesapeake Bay and North Carolina, but concomitant to that

we did see an up tick of recruitment to northern estuaries. Some studies suggested that there has been a climate shift that favored the recruitment to these more northern estuaries rather than to the southern estuaries.

Nutrient Cycling, Bioenergetics & Menhaden's Role in the Ecosystem of Narragansett Bay – *Presented by Ted Durbin, URI Graduate School of Oceanography*

Abstract: The effects of adult menhaden grazing on plankton populations in Narragansett Bay is estimated from their feeding behavior, bioenergetics models, measurements of their growth rates and abundance, and measurements of abundance of small and large phytoplankton and zooplankton. Narragansett Bay is a rich feeding ground for menhaden. In situ abundances of large phytoplankton and zooplankton allow the menhaden to easily obtain the food necessary to support their observed growth rates on all but three dates. Effects of observed population sizes of menhaden grazing on small <20 μm phytoplankton in upper Narragansett Bay would be negligible because of their low filtration efficiency on these small-sized particles. The same population sizes of menhaden feeding on larger phytoplankton would be sufficient to result in a reduction in the in situ growth rates of these phytoplankton, but they would still be positive. Effects on zooplankton will be greatest reducing their abundance. This in turn will release zooplankton grazing pressure on phytoplankton allowing blooms to occur. Menhaden excrete about 62% of the nitrogen they ingest in their food and this nutrient release will enhance local phytoplankton growth. The effects of menhaden grazing on larger phytoplankton and zooplankton and their nutrient release, will favor the growth of smaller phytoplankton.

Feeding of Menhaden

- Adults are 60–70% efficient in filtering zooplankton, 20% for phytoplankton.
- Menhaden are obligate filter feeders.
- Fine gill rakers on gill arches permit them to strain phytoplankton and zooplankton from the water.
- Filtration efficacy increases with increasing particle size.
- Feeding is energetically expensive, metabolic rates increase with swimming speed.
- Menhaden are optimal foragers; they adjust their swimming speed while feeding on different concentrations of food such that their growth rate is maximized.
- Feeding on phytoplankton or zooplankton alone cannot fully support menhaden growth rates, but when coupled can.
- As food levels drop, they leave the estuaries and bays in the fall.

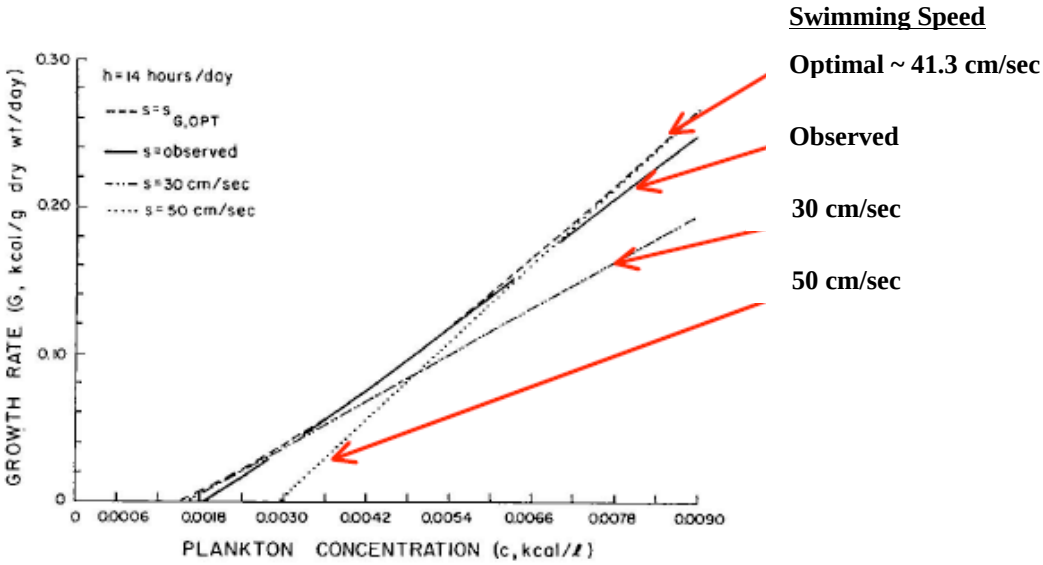

Figure 10. A comparison of the growth of the Atlantic menhaden at different concentrations of plankton, when the fish swim according to their actual voluntary speeds; and constant speed of 30 and 50 cm/s. Foraging time is 14 h/day.

- Menhaden adults have to feed approximately 5 hours per day to achieve the growth rates observed in Narragansett Bay.
- Menhaden populations can significantly reduce zooplankton populations, especially in the presence of ctenophores, which fosters the potential for phytoplankton blooms. Nutrient releases by the menhaden further foster phytoplankton blooms as well; so large concentrations of menhaden in an estuary promote bloom conditions.

Imports and Exports of Nitrogen From Narragansett Bay associated with menhaden

- Imports of nitrogen though migration of menhaden into Narragansett Bay:
  2.0×10^6 kg N
- Exports of nitrogen though menhaden harvested and migration out of the Bay:
  2.8×10^6 kg N
- Net export of nitrogen:
  0.8×10^6 kg N
- Menhaden net nitrogen export from Narragansett Bay is 6 – 12 % of advect export of nitrogen.
- You cannot control the nitrogen dynamics in Narragansett Bay by controlling the menhaden population.

Comments and Questions

Q: What effects do juvenile menhaden have on the export of Nitrogen from Narragansett Bay?

A: This was not directly addressed in the study, but I would guess due to their smaller size the juvenile biomass is substantially less than that of the adults in Narragansett Bay. I would assume the nitrogen export due to the emigration of juvenile menhaden would be substantially less than that of adults.

Q: *Dennis Ingram* - When menhaden are feeding they have an elevated level of oxygen consumption. Could this result in an accelerated rate of oxygen depletion in large schools of feeding menhaden?

A: Yes, when actively feeding menhaden's metabolic rates increase five to seven times higher than when not feeding. This would certainly have a greater effect on oxygen concentrations in the surrounding water.

Q: How fast do menhaden process food, from ingestion to excretion?

A: They are similar to a conveyor belt and have a long thin intestine, not a large stomach that a predatory fish would have. They are processing their prey all the time and quite rapidly. During feeding experiments nitrogen levels and exertion rates increased within a couple of hours after food was introduced.

Q: *Dick Pastore* - If mass is neither created nor destroyed I am wondering about your comment in reference to phytoplankton blooms resulting from the excretion of ammonia. Ammonia is present in organic nitrogen, yes?

A: That is correct.

Q: Your statement implies that we ought to get rid of all the menhaden in the Bay because otherwise their presence is going to initiate phytoplankton blooms, when in fact they are reducing some of the nitrogen from the organic form then excreting the ammonia. There is a conversion there so there must be a net loss of nitrogen, correct?

A: The portion of the ingested food they are retaining is around 40%, which they are using in growth, the remaining 60% of the ingested food is being excreted. So yes some nitrogen is being retained in the biomass of the menhaden and some is being recycled from the zooplankton and being placed back into the water, which can be utilized by the phytoplankton.

Q: Do you think that ultimately there would be a breakdown and release of organic nitrogen from zooplankton that would turn into phytoplankton, regardless of the dynamics of menhaden?

A: Well yes. Zooplankton in the bay have very rapid growth rates and high mortality rates during the summer. They grow from an egg to maturity in 7-10 days.

Q: So, there is a net removal of nitrogen because of the cog in the wheel that menhaden have in this entire nitrogen cycle.

A: That's correct and that's what I try to estimate in the second to last slide, which is the net loss of nitrogen from Narragansett Bay brought out by menhaden. So what we are looking at is the effects of how much nitrogen is being taken out of the Bay, through fishing and the out migration in the fall, which is pretty significant.

Q: Did your paper also indicate that there was some grazing on phytoplankton but due to filtration it was not as efficient with respect to that of zooplankton?

A: That is correct. The efficiency of removal of phytoplankton is less than that of zooplankton but because phytoplankton has a much larger biomass than that of zooplankton menhaden can still obtain a substantial amount of nutrition form it. Although alone phytoplankton is not enough to support their mean annual growth rate. They need both prey types, phytoplankton and zooplankton, to obtain their observed annual growth rate.

Q: *Lanny Dellinger* – Essentially what you are saying is the greatest amount of nitrogen removal occurs after the menhaden have consumed phytoplankton and zooplankton and are then harvested?

A: Yes, and also from out migration. The net removal of nitrogen due to menhaden is a small portion of the fluxes of nitrogen in and out of the bay. You are not going to control nitrogen dynamics in Narragansett Bay by controlling menhaden populations.

Q: *Rich Hittinger* – Did you try to incorporate into the nitrogen balance the effect of the predator fish, the bass and blues, moving out of the bay in the fall?

A: No we did not. It would be very difficult to do for we do not have good estimates of their population sizes in the bay. There has been some discussion of placing a series of acoustic sources across the bay and monitoring fish migrations in and out of the bay acoustically.

Q: You had data that showed the 2 year olds leaving the bay were heavier than the 3 year olds coming in the following season. Did they loose that weight?

A: Some of the lost weight could be due to spawning losses. They spawn in the early spring using some of the energy they gained during the summer period as 2 year olds. Also the populations in Narragansett Bay are a small part of the overall migratory population, so you might have different size classes coming into the bay the following year.

Coast-wide Stock Assessment of Atlantic Menhaden

Presented by Brad Spear, Atlantic States Marine Fisheries Commission

Abstract **-** The Atlantic States Marine Fisheries Commission (ASMFC) oversees management of 22 species or species groups including Atlantic menhaden. Currently, the status of Atlantic menhaden is assessed as a single coastwide stock. The most recent assessment, an internal update, took place in 2006. The next assessment peer review is scheduled for the Southeast Data and Assessment Review (SEDAR) for early 2010. The conclusion of stock status from the 2006 assessment is Atlantic menhaden is not overfished and overfishing is not occurring. Stock status is determined by using two biological reference points: fishing mortality rate (F) and fecundity. The current F (as of 2006) is approximately 56% of the threshold established in Addendum I to Amendment 1 of the Interstate Fishery Management Plan for Atlantic Menhaden. The current fecundity is over 300% of the threshold set in Addendum I. The 2006 assessment also reported low

recruitment that was mainly due to a decline in juveniles seen in Chesapeake Bay. However, since the assessment, the 2005-year class is showing up in surveys and the fishery in very large numbers along the coast including Narragansett Bay. The 2006 assessment is limited in scope in that it is not able to determine stock status on a scale smaller than coastwide and it is not capable of answering questions of multispecies interactions. The ASMFC Atlantic Menhaden Technical Committee is planning to incorporate into the next assessment a spatial component that can inform managers of status on a more regional level. In addition, the ASMFC Multispecies Technical Committee is continuing to improve its multispecies modeling efforts using menhaden as the primary prey species.

Biological reference points of menhaden

- Fishing Mortality Rate (F) target = 0.75
- F threshold = 1.18

* Current F = 56 % of threshold

- Fecundity target = 26.6 trillion eggs
- Fecundity threshold = 13.3 trillion eggs

* Current fecundity threshold = 317% of threshold

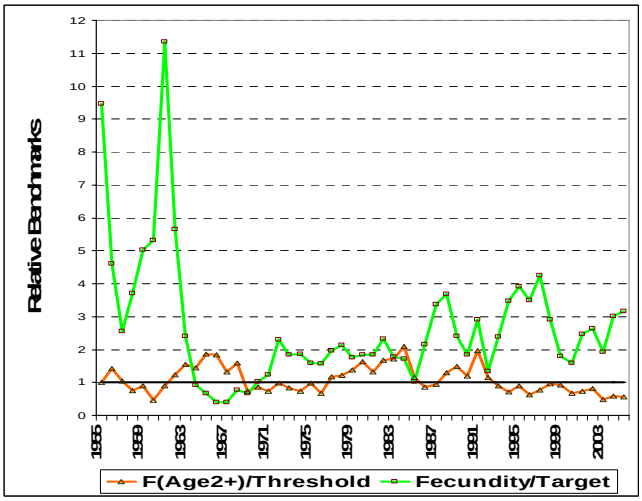

Figure 11. Historical F and Fecundity

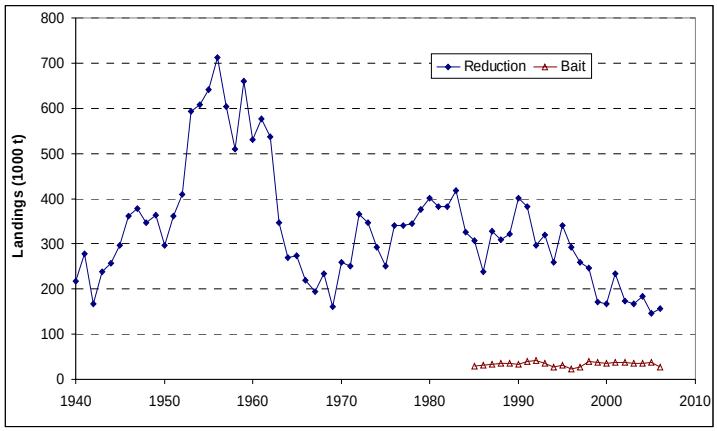

Figure 12. Historical menhaden landings. Measured in metric tons.

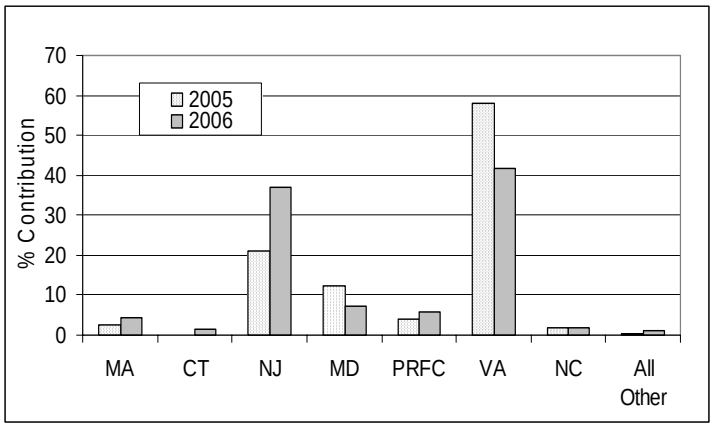

Figure 13. Menhaden bait landings by state. Measured in percentage of total bait landings per year.

Comments and Questions

Q: *Greg Geritt* – In the last 10 years populations of menhaden in downtown Providence River have been variable, but they have always been small size classes, maybe 2-3

inches. This year there are full size adult fish in downtown Providence. Is that a reflection of a larger recruitment class of 3-5 year old fish, and is there any way to prove this?

A: One possibility is a large recruitment class that came into the region. Historically speaking there is tremendous variation in the populations of menhaden, in the sizes, where they show up and when they show up. This may be a case of one of those outlier events.

Q: *Jeff Kaelin* – You said the assessment is not capable of answering questions of multi-species interactions. In the 2006 when in internal review of the assessment was made the data from the experimental multi-species virtual population model was used to tune and double check the estimates of mortality of menhaden due to predation. How does the assessment not accurately estimate the amount of natural mortality due to predation?

A: The assessment of the model provides estimates of menhaden abundance and mortality. It does not inform for example, how many striped bass a specific number of menhaden can support. The multi-species model produces an age specific natural mortality number for menhaden. This number was used in the menhaden assessment to help produce a more accurate fishing mortality rate. This model is more advanced than those of other species but it still cannot provide information about what kind of populations a given menhaden population can support.

Q: *Michael Bucko* – Species such as summer flounder, stripped bass and bluefish are being restored to historical biomass levels and prey species like menhaden are not. Should fisheries management create a relationship between predator-prey in order to restore fish biomass in a uniform fashion?

A: It's basically a matter of allocation and trade offs of which species you would rather see more of. It's a major issue that is upon us but the management system does not have a mechanism to balance these trade offs explicitly.

Q: *Lanny Dellinger* – It was estimated that we had a stock of 12,000,000 lbs of adult menhaden in Narragansett Bay this year. If the entire 12 million lbs had been harvested, what effect would that have on the coast wide population of menhaden?

A: *Joe Smith* – In terms of the coast wide stock it would have a negligible effect.

A: *Brad Spear* – This answer is from coast wide standpoint. Its not implying what effects it might have on a regional scale.

Rhode Island Management of Menhaden

Presented by Mark Gibson, RI Department of Environmental Management

Abstract: Adult Atlantic menhaden (*Brevoortia tyrannus*) entered Narragansett Bay in large numbers in the summer of 2007 and were subject to an active purse-seine fishery. Out of concern for escalating effort, RIDEM implemented a daily possession limit and rigorous reporting requirements in the fishery. In view of the ecological and social value of menhaden, an interim management policy was set that restricts fishery removals to

50% of the amount of adult menhaden that enter the Bay. In support of that policy, a depletion model for open populations was developed to estimate Bay abundance and track exploitation rates relative to management targets. The model used the spotter pilot observations as an index of abundance. Daily purse seine landings constituted the absolute, depletion quantity in the model. Additional fishery data from floating traps was used to index movement of menhaden in and out of the Bay to account for the recruitment effect. Regular biological samples were taken from both the purse seine and floating trap catches. Adult menhaden entered the Bay in May and were largely gone by August. Model estimates indicate that from an initial population of 4.52 million pounds in May, abundance increased to 9.13 million by July 10. Total exploitable abundance for the season was estimated at 12.39 million pounds. The purse seiners ceased fishing in early August when abundance dropped to unprofitable levels. The limit exploitation rate was not reached in 2007, that is less than 50% of the exploitable biomass was removed by purse seine. Over 6,800 fish were sampled for biological attributes. Mean length and weight were 282 mm and 400 grams respectively. Weight-length data indicated that adult fish remaining in the Bay late in the season had degraded body condition and insufficient food resources to sustain them. Real time abundance estimation and management of limit exploitation rates is expensive. It requires observers, analysts, managers, and deployment of enforcement assets. It will be challenging for the Department to sustain this level of activity in the current budget climate.

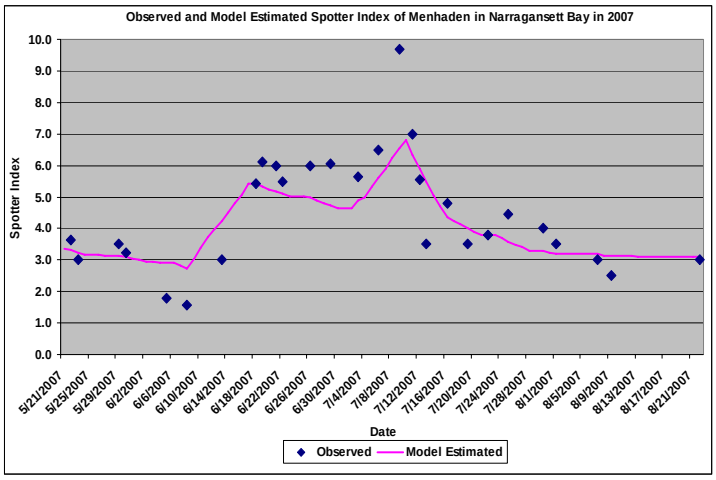

Figure 14. Observed and modeled estimated spotter index of menhaden in Narragansett Bay 2007.

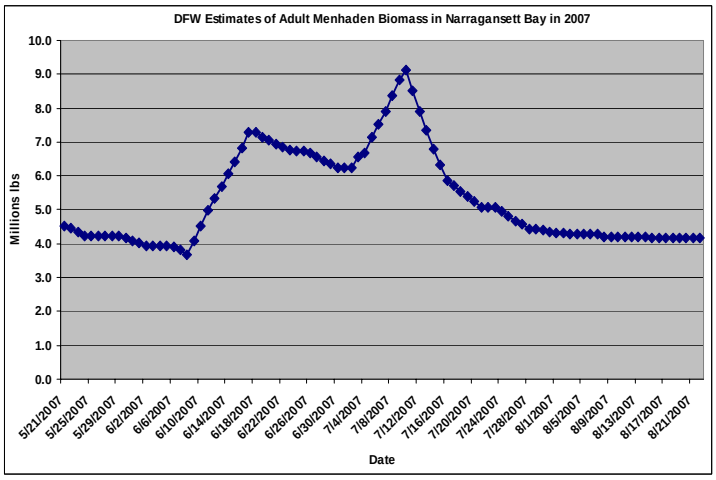

Figure 15. DFW Estimates of adult menhaden biomass in Narragansett Bay 2007.

Conclusions

- Adult menhaden abundance was higher in 2007 than in the recent past but not as high as in the 1970's.
- Fish entered the Bay in May and abundance peaked in July. Total biomass was estimated at 12.4 million pounds.
- Purse seine landings did not reach the 50% exploitation limit set by RIDEM.

- Most adult fish were in the 260 to 305 mm range and most likely fish age 3-5 years.
- Fish remaining in the upper Bay late in the year had degraded body condition relative to those sampled earlier during the spring and summer.
- Real time monitoring and assessment of menhaden in the Bay is possible using a suite of fishery dependant data and the depletion model.
- The model needs to be refined in several areas including linking the recruitment term to fixed gear catches and more experiments on spotter plane efficiency
- It is expensive and places heavy demands on the agency. It may be difficult to continue in the current budget climate.

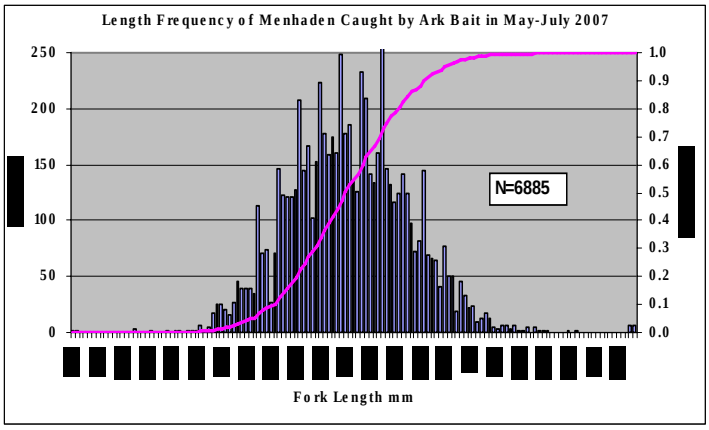

Figure 16. Length frequency of Menhaden caught by Ark Bait during May – July 2007. Mean length=282 mm.

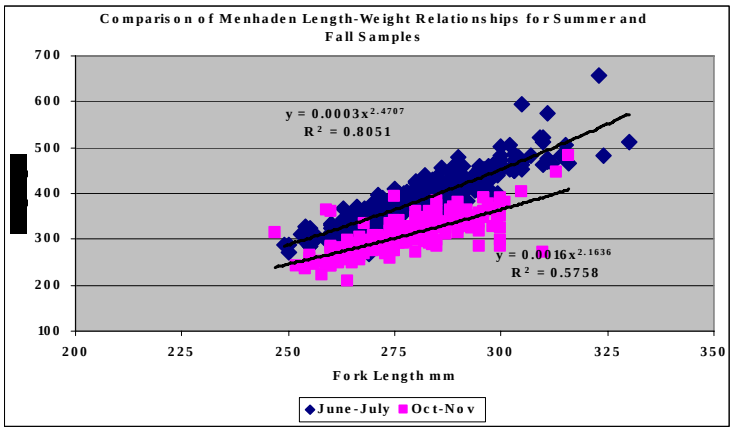

Figure 17. Length weight relationship of menhaden during summer and fall of 2007. Slope of regressions indicate a degraded body condition in the fall samples.

Comments and Questions

George Allen - I would like to state my opinion of the observer. The job he did was extremely important and the value cannot be understated. I am aware that there are funding constraints right now that may cause his contract to end in 2008. To me it is extremely important that the money be found to fund him in the coming years.

Q: *Peter Lozier* – What are your thoughts on the idea that menhaden in Narragansett Bay are starving?

A: The average size of the fish in Narragansett Bay this summer was larger than any reported in Dr. Friedland's filtering efficiency studies. It seems to me if the large fish stay too long there isn't the plankton population, particularly the larger zooplankton population, to sustain them. Why they would stay up in the providence river so late could be related to being trapped by predators. The main body of fish leaves in late July and August, I believe this is in response to their food supply.

Q: *Rich Fuka* – Is it possible that the fish with reduced body mass were fish migrating from the north in October and lost mass due to their southern migration?

A: The fish with low body weight were sampled directly from the providence river and were not likely to be part of the group that came in during October. I believe the fish that came into Narragansett Bay during October were most likely southern migrants and were unrelated to the main body that came into the bay early this year.

Q: *Denny Ingram* – What sort of by-catch levels did you see through the observer coverage?

A: In the course of several million pounds of fish that were observed coming on board the purse seine vessels, there were an average of 10 striped bass 7 bluefish and a handful of other fish. It is hard to see the entire mass of fish, but it looked to us the by-catch of other species was exceedingly small.

Q: *Michael Bucko* – In the biological sampling you conducted, did you come across any females with eggs?

A: Matt was looking into the gonad condition of the fish. And yes, there were fish that had large gonads for their particular body weight and others that were particular small, suggesting they had already spawned. There was some indication that the fish were generating another batch of eggs, perhaps for another spawn but we need to look into this matter more closely.

Q: *Rich Fuka* – Do you anticipate DEM's budget as a major obstacle in the future of menhaden management?

A: Yes, not only for menhaden but also for all programs. In 21st century management, particularly if you want to start ecosystem management, you have to put people in boats and planes, where the fish are and the catching operations are. You also have to staff people within in lab. Absolutely, we are going to be limited. We are going to be prevented from growing in accordance with the needs of modern fishery management.

Q: Is the state reaching or looking out further for co-management, is that what the state is expecting? Is this what we are working ourselves toward or does DEM Fish and Wildlife have a conjunctive plan?

A: In short, yes that is where we want to be. We don't have a specific plan but the director has convened an initial stage of a round table meeting. We are hopeful that will put us in direct contact with the industry to understand what their issues and problems are and let them know what our problems and limitations are as well. The more management authority you can devote into industry the better off we will all be.

Questions for the Panel of Presenters

The following were questions directed to the entire panel of presenters.

Q: *Lanny Dellinger* – Is the harvest cap of menhaden in the Chesapeake strictly for the reduction fleet or does it include bait fishing as well?

A: *Mark Gibson* – It is for the reduction fishery operating in Virginia waters.

Q: *Lanny Dellinger* – Are you planning on having your population model peer reviewed by ASMFC?

A: *Mark Gibson* – Yes, certainly we want input on this work. ASMFC is also working on similar types of programs using light detection and ranging technology (LIDAR). Everybody is interested in cooperating with industry, particularly with air born assets, to try and estimate menhaden abundance.

Q: *Joseph Ingoldsby* – The oceans are becoming more acidic as a result of raising levels of carbon dioxide. How is this going to effect phytoplankton and in turn how will this effect the fisheries in New England?

A: *Kevin Friedland* - This is a very hot topic in regards to climate change research which I am not an expert with. I don't know what the time scales are or what the projections might be.

Q: *Bryan Oakley* – The high populations of menhaden in the 70's may have been related to the water quality and increased nutrients. Today these historic populations might not be possible with the amount of nutrients available and could be detrimental to other species in the Bay. Could you comment on this?

A: *Kevin Friedland* – There is an unpublished report from a scientist by the name of Bob Wood which looks into long term trends in atmospheric weather patterns. It appeared to have a fair amount of explanatory power of how winds and weather systems transport larvae into estuaries. So to me the more logical explanation is related to climate.

A: *Mark Gibson* – I feel we have to think about what the recruitment patterns and year classes looked like that would have supported those large populations in Narragansett Bay during the 70's.

A: *Joe Smith* – The large populations in the 50's was probably a snap shot of peak population size. Over the decades the population has fluctuated. Recruitment and landings went down in the 60's and the stock started to rebuild in the 70's, then recruitment went down once again in the 90's. I think what you are seeing now is a rebuilding of the stock. Rhode Island is at the northern range of this species. When we have consecutive good years of recruitment we see robustness in the stock and more fish north of Long Island Sound. We have had good recruitment for the past five years and the 2005 years class is an exceptionally good year class, hence the fish you've seen in the bay in 2007. I suspect in 2008 this year class is likely to return.

Q: *Chris Deacutis* – Dr. Barbara Sullivan has been looking at gelatinous zooplankton and she found there was a radical decrease in ctenophores this summer. Has anyone been looking at the inshore menhaden population related to ctenophore abundance?

A: *Mark Gibson* – I don't believe so, but we have an extensive Bay-monitoring program. In particular the mariner shuttle, which quantifies plankton abundance. When we get this data along with the spotter pilot's observations where fish were in space and time we may learn something about the distribution of menhaden relative to the distribution and size composition of plankton.

A: *Grace Klein-McPhee* – I have ctenophore data going back five or six years. Barbara has a student whom is trying to relate it to larval fish abundance. Maybe some one can do something with it relating to menhaden.

Q: *Joeseph Ingoldsby* – Do you use satellite imagery in determining phytoplankton populations, and to help establish where the populations of menhaden will migrate?
A: *Ted Durbin* – Not on a small spatial scale such as Narragansett Bay or near shore waters.

Q: *Rich Hittinger* – What is the future of the 50% exploitation rate regulation? Is this going to be continued or reevaluated?
A: *Mark Gibson* – The exploitation limit rate policy is pretty much here to stay. The 50% number may change as ecosystem science evolves and as the states fishery policy evolves. It could go up or down. For example, if we were to determine the production of juveniles in Narragansett Bay is dependant on how many adults come into the Bay, we may move the number down. If we were to conclude adult menhaden taken in the commercial fishery do not have much impact on the water quality of the Bay and juvenile recruitment in the Bay is independent of the local adult population, the number may go up. It will be reviewed every time new information comes to the board.

Q: *Greg Gerritt* - Are you taking into account the fish eating birds, such as ospreys, as part of ecosystem management?
A: *Mark Gibson* – Not at this point. We are certainly aware of the value of menhaden to predators other than piscavores. We expect that all these kind of considerations will work their way into the system; we will continue to evolve our policy accordingly.
A: *Kevin Friedland* – The modeling we are doing on the northeast shelf explicitly includes birds and mammals, the full spectrum of predators of menhaden.

Q: *Michael Bucko* – How does the filtration rate change from juvenile menhaden to adult menhaden?
A: *Kevin Friedland* – Juveniles are processing a lower volume of water than adults. Their mouth opening is smaller and they are swimming at a lower speed than adults. I can't give you a specific answer without working out the calculations.

People, Prospective, and their Importance in Fisheries Management
Presented by Flaxen Conway, Oregon State Sea Grant

Why are we talking about people at a Menhaden science and policy symposium?
- *Audience Response:* Because people are involved.
- Fisheries management is about managing the interface between the resource and the people who impact the resource.

There are both natural and human dimensions to fisheries management

- *Natural dimension*: encompasses much of the biology, which we herd about this morning.
- *Human dimension*: generally involves the socio-economics surrounding the fishery.

- Most often considered is the economics of the fishery: landings data, cost of operation, number of participants or fishing effort.
- The social aspect is less emphasized. To me this is about the connection between the fisherman, the fisherman and the communities and how knowledge travels through the community. How is the commercial fishing community linked to the recreational fishing community and how will management policies affect the two?
- We need to focus on the role the resource has or will play in the lives of the families and individuals that the fishing community encompasses and how policy will affect this role.

Questions managers should be considering

- Who should be involved in the management and how?
- Should we manage for ecosystem impacts, economic impacts or all?
- What will be the impact of new policy across the entire realm of the fishing community, both socially and economically?
- Is allocation equal across the board? What parts of the natural system do you allocate for and what part of the social system do you allocate for?

Comments and Questions

Q: *Rich Fuka* - On the west coast do you see definitive social and socio-economic negativity as a result of fishery regulations that are in place, or do you see a destructive social atmosphere?

A: It depends on which types of management, the species, how much the communities want them in place, and what interests have been involved in influencing the policy.

Listening and Sharing: A Facilitated Presentation and Dialog

The following are presentations from the panel followed by a discussion
Moderator, Flaxen Conway

Setting the Stage – Legislative Perspectives

Susan Sosnowski, Chair, Senate Committee for Environment and Agriculture

I would like to thank the Department of Environmental Management for inviting me today and organizing this event. I think this symposium is a fantastic idea and hope there are more in the future. I have three major points I would like to cover.

- I have a long history of working on fisheries issues and many here have worked with me on those issues. We all know how complex the nature of fisheries management has been in Narragansett Bay and will continue to be. My colleagues

and I have worked hard to establish the Rhode Island Freedom to Fish and Marine Conservation Act. This important law established clear findings that have to be present in order for a fishery to be closed. This act also requires stakeholder input and advice from the Marine Fishery Council; both are critical to making fisheries management decisions.

- I am here today to gain advice and information on the condition of the menhaden fishery. I feel our best scientific data is generated at URI Graduate School of Oceanography as well as by the regulators of the resource and the fisherman.

- I am committed to staying involved and listening to all the points made. It is very important to consider all aspects of fisheries management before making decisions that will impact people's lively hood. I firmly believe regulators should be allowed to do their work as the generally assembly established in fisheries laws. The fisheries laws that have been enacted provide a clear record that allows for stakeholder input and utilizes the best scientific data available. This is not a process or system that can be easily replicated within the general assembly. I will continue to be engaged in this process as the menhaden fishery is reviewed and discussed and I believe it is critical to continue dialog, such as we have here today, in order to provide the regulators the best information available to manage our resources.

Jan Malik, Chair, House of Representatives Committee for Environment

We are here today to bring this issue of menhaden to the forefront. I would like to congratulate and thank DEM director Mr. Sullivan and Mark Gibson. They did this year what I feel DEM is supposed to do, manage a system. I thought this year they did a marvelous job. I have herd from many aspects of the industry including recreational fishermen and lobstermen. I couldn't get the correct answer from either one. This is all about learning more about the topic. I hope in this year's session we can learn what will make it best for the state of Rhode Island. That is what politicians are interested in, not making the best decisions for one user group but the best decisions for the state as a whole. I hope when we leave the session in 2008 we put something in place that is going to benefit all of us here in the state of Rhode Island.

Comments and questions for the legislative panel

Q: *Rich Hittinger* – How can the legislature help assure there is adequate funding to continue this type of management such as putting observers with the industry?

A: *Jan Malik* – It is something that we need to find a balance with. There are so many agencies within the state looking for money. I will personally do everything in my power to see this continues.

A: *Susan Sosnowski* – The money situation is dire in Rhode Island. I think it is important to have some dialog with the department and the fishermen and possibly implement a recreational fishing license fee.

Q: *Jim O'Grady* - The department of the state and the director usually make all of our fisheries laws which all the experts are involved in. How do legislators get involved in the Fisheries Management Council and how does it get to the point when decisions come before the legislators?

A: *Susan Sosnowski* – The job of the generally assembly is to make sure there are councils that have the expertise to make the decisions and enact legislation when the Department of Environmental Management needs it in place. We are there to make changes in laws as needed and act as a strong roll of over sight.

A: *Jan Malik* – I would rather see these decisions stay with the Rhode Island Marine Fisheries. I felt the bill this year should have been left up to the Rhode Island Fisheries, the people who manage the bay. When it comes to the bay leave it up to the experts and give the facts back to the legislators and let us decide if we have to.

Q: *Brian Loftes* - As politicians do you plan to keep the Rhode Island waters as a free and open access to the people of Rhode Island and support those who use it without privatizing the industry.

A: *Susan Sosnowski and Jan Malik* – Yes, we have taken an oath to uphold the constitution.

Setting the Stage – Stakeholders Perspective

Questions for the Panel

1. If you were a menhaden what would you tell us about management and why?
2. What is the role of biological science and social science in the decision-making?
3. What does Rhode Island need to do?
4. What is the best way to do this?
5. Who is part of the decision making process?

Rhode Island Saltwater Anglers Association - Rich Hittinger

Atlantic menhaden occupy a unique niche in the estuaries of the Atlantic seaboard. They are the estuarine equivalent to the buffalo that occupy the American plains. They graze the floating grass of the estuaries. ASMFC documents in Special Report number 83, that menhaden serve an important ecological role in terms of forage as well as a unique role transforming primary productivity directly into fish biomass. Many authors have shown menhaden filter estuarine waters indiscriminately removing larger phytoplankton smaller zooplankton and detritus and they themselves are eaten by nearly every predator in the ocean from marine birds to marine mammals and many fish species. But yet because of their schooling behavior they are particularly easy to harvest using the purse seine. According to ASMFC, the abundance of Atlantic menhaden has dropped dramatically since the early 1980's. In Rhode Island alone we have spent over one billion dollars to upgrade the waste treatment systems in order to reduce discharges of nitrogen and

particulates to Narragansett Bay, yet the harvest of menhaden, which has shown to subsist primarily on microscopic plants and detritus has largely been unregulated. One major reason for controlling the nitrogen and particulate output from sewer treatment plants is to reduce the potential risk of algal blooms, which can result in hypoxic and anoxic conditions. It seems we may be shooting ourselves in the foot by allowing the wholesale removal of one of the major natural filtering mechanisms in the Bay, the menhaden.

I am here representing the recreational anglers community. We would like to see the menhaden species preserved as food for many of the sport fish we have in the Bay. Through fisheries management some of these predator species, such as striped bass, have made significant recovery and fisheries managers are attempting to bring back other species as well. As these predator populations recover they are going to need significant forage. Many of the traditional forage species are either subject to commercial fishing pressure such as herring, squid and menhaden, or are showing signs of decline such as the American eel. This will not only result in less vigorous predator populations but will also push predators to eat more of the less desirable food in their environment, such as crustaceans. There is no question that the quality of our wastewater discharges to our rivers and bays has dramatically improved over the past 30 years, nor is their any question that the menhaden populations have decreased over that same period of time. However, even with improved wastewater discharges we are observing hypoxic conditions in the upper reaches of Narragansett Bay. Although the ASMFC is tasked with protecting the biomass of menhaden populations they do not currently have the capability of assessing the ecological role of menhaden as forage or as natural water filters. Until we understand more about the unique role that menhaden play in this nutrient and oxygen balance, RISSA believes the preponderance of scientific evidence indicates that state policy makers need to continue to protect menhaden in order to assure a healthy menhaden stock as both a forage fish and as a natural bay filter.

Rhode Island Lobsterman's Association - Lanny Dellinger

The management of coastal pollution and habitat degradation in Narragansett Bay is the most important additional management measure that could be implemented to protect the ecosystem health of Atlantic menhaden that frequent Narragansett Bay. With the support of Rhode Island's wastewater management districts and the Clean Water Finance Agency Rhode Islanders need to support and find a way to fund RI DEM's ongoing efforts to reduce the flow of nitrogen into local waters by restricting coastal runoff from outdated septic systems and other sources. High temperature discharges into Mount Hope Bay from the Brayton Point power plant are another threat to the survival of larval and juvenile menhaden that may be found nearby.

The Atlantic States Marine Fisheries Commission's interstate fisheries management process, with the ongoing involvement of RI DEM, is working well to protect Atlantic menhaden from overfishing and ensure that important recreational fish stocks that prey

on menhaden will also remain healthy. This is evident with the increase of juvenile menhaden abundance and the resurgence of adult menhaden in Narragansett Bay.

The Rhode Island lobster and bait industry supports sound management of the migratory Atlantic menhaden resource, based upon sound science. Biological science must come first and must be rigorously applied to make sure there is a healthy menhaden resource, and fishery, for future generations. Social science, particularly policies that support the continuation of commercial fishing on a fair and sustainable basis, are also important but this consideration can sometimes be nothing more than a political discussion about who will be allocated the fish regardless of what the science may say.

We fully support the effort of RI DEM to step forward this spring and summer to monitor the commercial menhaden bait fishery in Narragansett Bay. While we are concerned that the daily limits were established without sufficient regard for certain market conditions, we appreciate the collaborative research approach DEM has taken; working with and sampling commercial fishing operations in Narragansett Bay, including aerial surveys by commercial spotter pilots. This has proven to be very effective and beneficial in giving RI DEM information they need to ensure that the Atlantic menhaden population is not overfished.

We would like to see RI DEM continue to work with the commercial and recreational fisheries here in Rhode Island and with other interested coastal states, through the existing ASMFC fishery management process. This is the same process that we use to manage our regional lobster fishery.

The commercial menhaden and lobster industries support accurate reporting of catches with serious consequences to those who do not report accurately. The use of observers in the fishery should convince a concerned public that we can continue to use menhaden to harvest lobster and protect the fisheries ecosystem at the same time.

We would like to see the RI DEM monitoring program and depletion model for open populations peer-reviewed by the ASMFC Technical Committee this winter, to determine if they have an application to harvesting the migratory Atlantic menhaden for lobster bait in both Narragansett Bay and other areas of the Northeast in the future. We would like to see access to the menhaden resource in Rhode Island waters limited in some way to ensure a profitable fishery for those who are participating in it and a consistent supply of bait for the Rhode Island lobster industry. For example Entry to the fishery could be based upon historical participation during the past 5 years. Finally, we look forward to this fishery continuing to be managed based upon the best available science and not continuously interrupted by calls for a moratorium even though the resource is plentiful and being managed in a sustainable manner. We look forward to being part of this process.

The best way to do this would be working with RI DEM, the commercial menhaden industry, sport fishermen, interested legislators and interested members of the public to develop a reasonable framework for a continued menhaden fishery in Narragansett Bay.

A broadly supported program should be developed before a plan is taken to the General Assembly for implementation. This plan should limit access to the menhaden resource in Rhode Island waters in some way to ensure a profitable fishery for those who are participating in it, based upon historical participation.

The commercial menhaden, bait and lobster fisheries, sport fishermen, interested legislators and interested members of the public should fully engage with the existing interstate fisheries management program for Atlantic menhaden, through the leadership of RI DEM**.**

Rhode Island Fisherman's Alliance - Rich Fuka

I would like to take this venue of opportunity to make sure everybody here understands and knows something about the Rhode Island Fisherman's Alliance. We are an extremely large commercial fishing organization. What we have accomplished or done differently than other associations in the past is gear this alliance more in a fisheries direction. When we first implemented, or sat down and talked about what our representation needed to be, it was more or less a nurture to management and it grew from there. From my own prospective and keeping the theme of social science, I have learned so much about what Rhode Island really is and what the fishing industry means to it. The process of implementing the Fishermen's Alliance started out with the approach of getting our name out to the people to help them understand who we are and what we wanted to represent. What happened from there was a massive blossom, of what turned out to be the social core of the commercial fishing industry, through word of mouth. We are the new kids on the block when it comes to fisheries associations, but we have grown extremely rapidly. I didn't realize how big the infrastructure is in the State of Rhode Island when it comes to the fishing industry and what it means to so many different sectors of other industries. For the Fisherman's Alliance, social science is the most important aspect or heart of our organization, as it should be for the state as well. The fishing industry being such a large industry to the state of Rhode Island has that social core of what the commercial fishing industry brings to New England and more importantly the Ocean State. I underestimated how big the infrastructure turned out to be. It encompasses: marine services, or the lack of, the fuel companies, the insurance companies, the accounting firms, the lawyers, the net companies, just the overwhelming infrastructure that relies so heavily socio-economically on fishing. The social aspect of what the fishing industry means to the state of Rhode Island has been implemented over generations.

The biological material, which was discussed today, was out of this world. In my mind, the effects different species of fish have on the State socio-economically is always understated and never completely addressed. I can comfortably say the Fishermen's Alliance brings an extremely broad range of infrastructure to the table, which needs to be there when it comes to management decisions and policy making; in this case with menhaden. The Alliance's core base is comprised of about 75% licensed commercial fishermen but it also hosts just about every variety of commercially licensed business in the State. It is important for this to be brought to the table. Once you figure out what the

science is and what these fish mean to certain estuaries, bays or oceans; what do you do with it? What does it mean to the people? The Fisherman's Alliance is without a doubt the biggest stakeholder in bringing these questions to the table.

We currently have a low number of harvesters in the state and they are in dire straits. Managers need to understand that taxpayers have a huge stake as part of the decision making process. I think the most important thing Rhode Island can do, especially in its economic state today, is ask itself definitively, does it want a commercial fishing industry or not? It's a simple yes or no question. There is without a doubt in my mind, yes Rhode Islanders want a commercial fishing industry. So what is the best way to do this? Well, we are doing it, bringing all the stakeholders to the table. What we are doing is great and we need to keep this up to insure sound management.

RI Commercial Fisherman's Association - Chris Brown

If I were a menhaden, I would first insist that you refer to me as a pogy, we are friends are we not? Menhaden is far too formal, I feel, and is only how I am known in the business or political world, but never among friends, you see. So pogy it is, and, in light of the enormous complexity of what it is you have asked me and that I am generally thought of as being well schooled, given that I do not have a brain capable of processing thought and, yet, it is my full intention to offer you a well developed opinion that is both honest and enlightening, I will first go for a short swim, filter some water for food and then poop. You see, this is how a pogy deals with inquiries of this sort. This is how a pogy responds to everything for that matter. In fact that is all we do. I am certain that there will be legions of testimony to this effect throughout the day, with only a minority opinion holding out hope against all odds that we are capable of doing a great deal more than the facts will reveal. Swim… eat… poop… No more, no less. Sorry.

The role of biological science in any fishery is to be able to define the stock in terms of abundance, age at length, growth and spawning potential, age structure, natural mortality, as well as range and distribution of the stock. Menhaden are no exception. In this role, science defines the extent to which we can harvest without doing lasting harm to the resource. The role of social science is to assist management in determining the effects to people, families, businesses, and communities that will result from a particular management decision.

Menhaden represent a distinct challenge to the authorities in Rhode Island given the diversity of the stakeholders and expectations that they have come to represent. Any attempt to manage this fish for harvest must strictly adhere to all of the guiding, mathematical principals of fisheries management. We should strive to complement the current sustainability of the fishery through responsible stewardship of the resource for the duration of its stay in our waters. Given the current health of the stock, it seems only logical to assume that the theory of surplus production would do anything but support a modest, well regulated fishery in state waters. The notion that menhaden are of greater importance than any other fish is one that should not be given any credence. This is, in our opinion, inconsistent with our understanding of biodiversity. No one fish should have

a greater man established value than any other. Our goal should be to ensure an overall balance and survival of all species without establishing favor for one over another based on our own perceptions of need and value. It is easy to determine the market value and the amount of fish that can be safely removed once the biomass is determined. It becomes increasingly more complicated when the interests of a user group can only be quantified in the value of fish not removed for harvest. The very harvesting of any fish under these circumstances is perceived as a threat to the recreational community. Under our current system, one group benefits only from the harvest and one group has poised itself to be perceived as a beneficiary of the natural abundance of menhaden, only if they go un harvested. What Rhode Island needs to do is realize that to completely ignore the needs of one established group over the other is irresponsible and unfair. Establishing winners and losers over this would serve neither group well in the long run. We see the states role as one of facilitator, rather than regulator. The state needs to openly acknowledge the value of a robust recreational fishery and equally understand the great dependence that the lobster industry has on the menhaden resource as bait, insisting that both will flourish. The complexity of this situation and the importance of a fair out come, requires that it should not be turned into a legislative popularity contest. Government is incapable of solving what it did not cause and is grossly unfamiliar with. We are fools to even ask that they solve this one for us in the form of a legislative act that is in no way mutually beneficial to both groups. A lasting solution to the menhaden problem can only rise out of a mutual respect between stakeholders. The menhaden fishery is one that could benefit from a system of community co-management. Anything less than a win – win is unacceptable. If we are to expect a greater and long lasting solution to the age-old allocation battle between commercial and recreational interests in Narragansett Bay, then it is only logical that we will both have to act in ways that are not guided by the mistakes of those who came before us.

We first need to define the stakeholders and then select representatives to engage in a process of negotiated regulation. To agree in principal to participate will be to agree and abide by the outcome. The state defines the biological parameters of sustainability and the stakeholders develop the details of engagement that will allow both to survive successfully. A points system based on latitude or proximity to hot spots could be considered. In this way harvesters would be ensured access to fish and recreational interests would be served by the reluctance of harvesters to set repeatedly in zones of higher point value.

The flow chart of decision-making should start with stakeholders, community representative leadership, AP, council and then be advanced to the director.

Ark Bait Company - Diane Souza

I don't know much about the science of the menhaden fishery, but I can tell you about Ark Bait and its' history. Over 30 years ago these same five guys gave up good jobs, because they had an idea that would provide a much needed service to the fishing community and keep them where they always wanted to be, out on the water.

All five were born and brought up in Swansea, MA, and their love and respect for the ocean and its creatures grew with them. Two of the guys were original founding members of the East Bay Anglers fishing club, two of them and their uncles helped build the bridges that cross over the Mount Hope and Narragansett Bay, but all of them spent as much time as they could fishing out on the bay and the islands. These are fishermen who have remained friends and working partners, each with their own unique talent to contribute to the business. Fishermen who became stronger in their bond with each other through tragedy, illness, financial hardship and the ever present condemnations of a different fishery user group.

Thirty years ago, these guys had friends who were lobster fishermen, who spent most of their down time trying to find bait. Sometimes it would take several trips a week to the fish houses, to get what they needed. All this running around cut into what little time they had to spend with their families. Many of the larger offshore lobster boats could afford to buy a dump truck full of menhaden from Harold Loftus' or Charlie Folletts reduction boats and then their crew would salt it down. But not the day boats, it meant much longer workdays for them. A lot of the younger lobstermen today, don't know about shacking bait, waiting in lines for jury in New Bedford, salting down, or the time it added to their already long workday, but guys like Tom Hall, Denny Ingram, Russ Wallis, Skip Scott, Steve Salamon, the Mataronas boys and a lot of others know what I'm talking about.

When we started we only had a 24 ft Penn Yan, a net and an old double-ended coast guard lifeboat nicknamed " The Ark". No bank would give us a loan, because they all said a five way partnership, wasn't going to last. The reduction seiners, both local and the big ones, from down south referred to us as the "snapper rig" and joked about us on their radios. Some days they would tell their spotter pilot to put "the snapper rig" on a set. Those were the easy days. Back then we used CB's to communicate, and more often than not it was a commercial fisherman or a sports fisherman who would contact us and tell us where they had seen a school of pogies. The very same sports fishermen who are trying to get us out of the bay helped and supported us at the very beginning. They had a readily available bait supply and we gave bait freely to many of the fishing clubs. Even today Ark Bait still supplies bait to the sports fishermen and their families out on the bay at no cost to them. This takes time and is expensive. Since we have been the only menhaden seiner in the Bay for a number of years now, and there have been others who tried but didn't stick with it, we have felt that this is how we respect and share with other fishermen who use this country's resources, whether it be for pleasure or for their choice of work. We took one day at a time; we were convinced we could make a go of it. We're still hoping and thinking that same way. The past thirty years have seen a lot of changes in the fishing rules and regulations. Changes that took place during the years when there were several reduction boats fishing in the bays.

In 1978 Narragansett Bay was designated a Menhaden Management Area which created closed areas. Then in 1984, a 1 million pound per day catch was established, which would close off additional areas of the Bay. In the mid to late eighties seasons were

established and then modified. Then in 1991 and 1994 the trigger closure areas were increased and the trigger catch was reduced to ½ million pounds. From 1995 to 2003 various closure areas and seasonal closures were altered to alleviate increased user group conflict. Finally in 2003 the taking of menhaden for reduction in Rhode Island waters was banned.

If I were a Menhaden, I would tell you that I go through cycles like everything else on this planet. I would tell you that because I am a migratory species and I travel north and south along the coast, that I need to be managed in a supportive and equal effort by all of the coastal states. I would also say that because I am in the food chain it doesn't make any difference to me if I get put on the end of a rod, get eaten by a bass or a blue and then end up on somebody's plate, or if I get eaten by a lobster in a trap, that also will end up on someone's plate. I will still end up as the bait. That's what most of this fuss is about, but its masked in ecological and environmental terms.

Because of the migratory nature of this fish our business had to evolve to the point that we often have to leave Narragansett and Mount Hope Bay. We've gone north to Maine and we've gone south to New Jersey, not by choice, but by necessity, so we can continue to provide a quality, consistent and reliable bait supply to the lobster fishermen and bait and tackle shops throughout the area. Fishing outside of the coastal areas on the ocean, which has been suggested, is not feasible for us because menhaden are difficult to see in the rougher ocean waters and it is far too dangerous for our seining operation. We are an inshore net seining operation, not an ocean seiner.

In past years Ark Bait has always negotiated in good faith and fully cooperated with DEM and sports fishermen, and as a result, has compromised by losing prime fishing areas in the Bay, more to satisfy different user groups, than to substantiate any factual scientific data. Biological science and social science should be interactive in the decision making process Before this can happen both sides need to be educated about the roles that each play, and then develop specific strategies that will result in appropriate decision making techniques. This has been a recurring problem over the years with regard to the menhaden fishery in Narragansett Bay. Social or popular issues (the wants of specific groups) have usually taken precedence and most important scientific facts from the experts continue to be completely disregarded or misinterpreted.

We know that DEM had no alternative this past season when an emergency daily quota was set in place, because of a lot of pressure by many people. But that quota caused a serious financial hardship to our business, since we fish on an order only basis. We provide and supply the majority of bait to the Rhode Island and Massachusetts lobster industry as well as charter boats and bait shops, which supply much of the sports-fishing bait.

This year DEM was finally able to put an observer and fish sampler on board our vessel, as well as in the airplane that spots for the fish. Utilizing both the airplane, vessel observations and their own survey methods has proven to be beneficial and effective in giving the DEM the information that they need to support the ASMFC's statement that

the Atlantic menhaden population is not being over fished. It is our hope that the observer program will continue in the future along with further research and studies about the migration, age classes, population and information from the newer reporting SAFIS system to continue to allow DEM to obtain the information needed to support ASMFC's findings. We feel that Rhode Island has the advantage of having assets such as URI and the Sea Grant Program that offers a multitude of resources and expertise. Rhode Island has already taken an initial step in the right direction. As a result of these programs they have initiated, along with this symposium they have given opportunity of having the prospect for comprehensive scientific education and enlightenment on all sides of the issue. Continued research and studies by Rhode Island and the involvement, cooperation and coordination of all of the coastal states needs to be addressed.

This should not be a political decision making process, or a majority by numbers rule decision. It should rather be a consensus of all those involved, the scientists, biologist, and stakeholders who are provided with the ability to identify and address the problems and take into consideration the entire process as a result of the ongoing research and studies that have been conducted. With this knowledge we can then make appropriate decisions regarding the sustainability of the fisheries for the future. Hopefully with this symposium taking place and open-minded communication we can all be further educated about this "most important fish of the sea."

Save The Bay - John Torgan

I want to thank the conference organizers and particularly Kathy Castro for making this happen. This conference represents a giant leap forward in the state of our understanding of this important resource. Thanks for giving us this excellent forum and these great presenters.

The scientific presentations added greatly to what we know about the ecological importance of menhaden in estuaries like Narragansett Bay. Clearly, they play a critical role in the food web, and perform important natural services in the environment. New approaches like inter-species and ecosystem-based management are leading policy makers to consider each species as part of a larger whole.

Menhaden are also important to people and to commercial and recreational fisheries. They are an important source of bait in the lobster industry. The large schools that entered the Providence River this past year became major public attractions to fishermen and the public alike.

Rhode Island banned reduction boats from state waters in 2003. Most of the regional and national dialogue about menhaden management and conservation seems to be focused on the reduction industry around the Chesapeake Bay. In Rhode Island, the discussion has been focused on the bait industry and user conflicts.

Because they are managed on a coast-wide basis, local historical stock data on menhaden has been limited. According to information from RIDEM and ASMFC, the stock is not overfished, but numbers of juveniles have been trailing off and numbers of both adults and juveniles in the Bay are down significantly from historic levels. Observational data from 2005-2007 suggest they are trending upward again, which is good news to everyone.

Save The Bay's hope is to help these stakeholders find the right balance, one that allows a sustainable commercial fishery and provides better conservation and monitoring of menhaden in Rhode Island waters. We also want to better understand their role in the Bay. Monitoring is key because real data inform good decision making at the agency and council levels.

I don't know where that elusive balance lies exactly, but we are pleased that the RI Department Of Environmental Management has shown itself to be responsive to the public's concern by enacting emergency regulations last summer, and by stepping up monitoring and enforcement efforts. DEM is certainly the appropriate lead agency on this issue, and a strong regulatory approach that achieves an equitable and fair resolution to the user conflict is also good for the long-term future of the Bay.

National Marine Fisheries Service - Joseph W. Smith

Atlantic menhaden, *Brevoortia tyrannus*, range from the coast of central Florida to the Gulf of Maine. Based primarily on tagging efforts by scientists at the NMFS Beaufort Laboratory during the 1960s and 1970s, the menhaden population on the Atlantic coast is considered a unit stock. Analyses of length frequencies of fish in the commercial catches as well as tagging data indicate extensive coastal migrations; Atlantic menhaden stratify by size and age in spring and summer with older and larger individuals moving farther north. Typical age profiles of the commercial catch consist of age-1 and age-2 fish in Chesapeake Bay, age-2, -3, and -4 fish off New Jersey, and age-3 and age-4+ fish off southern New England. Most Atlantic menhaden become sexually mature as they approach their third birthday. Major spawning events occur in spring as adults move north, in fall as they move south, and as they over winter off the Carolinas. The most recent coastwide stock assessment for Atlantic menhaden was performed in 2006 and determined that the coastal stock is not overfished, nor is overfishing occurring.

The history of the menhaden fisheries in New England is chronicled remarkably well in such seminal studies as Bigelow and Schroeder (1953: Fishes of the Gulf of Maine) and Goode et al (1887: The fisheries and fisheries industries of the U.S.). Few fisheries in the U.S. can match such well-documented and long-term observations on species abundance and seasonality in a specific region than the menhaden accounts in these tomes. The message delivered by these authors is that from year-to-year, the abundance of Atlantic menhaden in New England waters is one of boom or bust. This theme is best summed up by Bigelow and Schroeder (p. 116), "Perhaps the most interesting aspect of the occurrence of the menhaden in Gulf of Maine is that it fluctuates tremendously in

abundance there from year to year, periods of great plenty alternating with periods of scarcity or entire absence from our waters." Bigelow and Schroeder (pp. 116-117) go on to cite specific examples over almost 75 years: "They were extremely abundant…every summer for some years prior to 1875; very few were taken in 1877; they were so scarce along the coast of Maine for the next six years that it caused comment when an occasional one was caught; they were so numerous in 1890 that four fertilizer factories were established; this period of abundance was short lived; rare north of Cape Cod from 1904 to 1921; they reappeared in such abundance again…in the summer of 1922; not enough menhaden …to be of any commercial importance from the middle 1920's to the middle 1940's; there were a good many in 1948…more still in 1949."

This pattern of abundance, followed by scarcity, continues into contemporary times. The 1950s was the peak decade for commercial menhaden landings along the Atlantic coast. Menhaden reduction factories in New England operated until about the early 1960s at Pt. Judith (RI), Gloucester (MA), and Portland (ME). Menhaden were scarce north of the Middle Atlantic coast through the 1960s, and most reduction plants north of Chesapeake Bay closed. Fish were again abundant in the northern half of their range beginning in the early 1970s through the 1980s. Factories re-opened in New England as far north as Rockland (ME), with two plants in the Canadian Maritimes receiving fish from vessels fishing along the southern coast of Maine. By the mid-1990s menhaden again were scarce in New England waters, and commercial reduction facilities ceased operation after summer 1993. This scarcity of fish lasted over a decade. However, over the past three summers, 2005-2007, menhaden have again become increasingly more abundant in southern New England waters.

Biologists at NMFS Beaufort Laboratory suspect that the abundance of Atlantic menhaden in the northern half of their range, that is New England waters, is linked to good annual recruitment of young fish to the coastwide stock. Consecutive years of above average coastwide recruitment tends to increase robustness of the stock; population numbers increase, species' range expands northward, and age profile of the stock broadens. Consecutive years of below average coastwide recruitment tends to decrease robustness of the stock – population numbers decrease, species' range contracts southward, and age profile becomes truncated. For example, the 1950s was a decade of exceptional recruitment [the 1958 year class may have been the best on record in historical times]; the stock expanded, landings increased, reduction factories in New England reopened. The 1960s was a decade of poor or below average recruitment; the stock contracted, landings declined, and factories in New England closed. Recruitment improved during the 1970s and 1980s, the stock expanded again, and reduction facilities reopened in New England. The 1990s were much like the 1960s in that recruitment was generally below average - once again the stock contracted and fish were scarce in New England waters.

The re-appearance of Atlantic menhaden in southern New England waters in good abundance during the past three summers, 2005-2007, suggests the beginning of another period of stock expansion. Coastwide recruitment has been relatively good during odd years since 1999; the 2005 year class may be the best of these four year classes. Age-2

menhaden in 2007 [the 2005 year class] were exceptionally abundant in commercial catches in the Chesapeake Bay and Middle Atlantic fishing areas this past summer. It is suspected that the 2005 year class of Atlantic menhaden will be abundant in New England waters in summer 2008 as age-3 fish.

The contemporary reduction fishery for Atlantic menhaden consists of a single reduction factory in Reedville, VA, with a fleet of 10 purse-seine vessels (ca. 160-200 ft long); processed products include fish meal, fish oil, and fish solubles. The Virginia fleet ranges from Cape Hatteras, NC, to the coast of central New Jersey, although most fishing effort is concentrated in Virginia waters. Landings of Atlantic menhaden for reduction in the past five years have averaged about 166,000 metric tons. A small menhaden reduction factory with two vessels in North Carolina closed in early 2005.

The contemporary bait fishery for Atlantic menhaden is concentrated in three states - Virginia, New Jersey, and Rhode Island. Bait purse-seine vessels are smaller than the reduction fleet, and are generally less than 100 ft long with significantly smaller hold capacities. In 2007, three purse-seine-for-bait vessels operated in Virginia, five or six vessels operated in New Jersey, and two vessels operated in Rhode Island. Total Atlantic menhaden-for-bait landings (all gears) over the past five years have been relatively stable and have averaged about 34,400 mt; most of these landings come from purse-seine gear. As coastwide menhaden-for-reduction landings have declined in recent years, the proportion of bait to total menhaden landings (reduction and bait combined) has increased to an average of about 17% during 2002-2006.

Since only one or two menhaden-for-bait companies with purse-seine vessels operate in Narragansett Bay, their individual landings are no doubt confidential. Nevertheless, the landings are probably on the order of several million pounds annually. Catches of this magnitude have a negligible effect on the coastwide stock of Atlantic menhaden.

Rhode Island Department of Environmental Management (RI DEM) has taken the correct approach to the "menhaden question" in Narragansett Bay. In essence, they are repeating the Oviatt study in Narragansett Bay of the early 1970s. The Oviatt experiment, by the way was an exceptional, and mostly unheralded, attempt to answer similar "menhaden questions" in Narragansett Bay (the forage base issue), although at the time the antagonists were the larger and more numerous menhaden-for-reduction vessels. Management of menhaden in Rhode Island should evolve from RI DEM's efforts to employ a depletion model to estimate abundance of menhaden in Narragansett Bay.

A word of caution regarding menhaden management in Rhode Island proceeding down legislative or social science paths versus the biological science route. In November 1994 circumventing traditional fisheries management conventions and agencies, the state of Florida passed a general referendum to ban most commercial fishing net gear in state waters. Prior to the "net ban", Florida had a number of thriving purse-seine fisheries for bait fishes (menhaden, sardines, thread herring, cigar minnows, etc) on its east coast and the Panhandle. Most purse-seine gear was banned by the referendum, and most Florida bait fisheries ceased to exist. Prices for bait (commercially for crab pots, or

recreationally for anglers as cut bait or chum) often doubled as most bait had to be imported from other states. Purse-seine-for-bait vessels in Narragansett Bay supply much needed bait for local lobster pot fisheries, as well as bait or chum to sport fisheries. Without this source of menhaden landings, bait will necessarily need to be imported from elsewhere at presumably higher prices.

Panel – Audience Discussion

Greg Garrett – The cycles of menhaden in the northern terminus of Narragansett Bay have been very interesting and sporadic. How are we going to get a handle on these cycles? Is there any way of figuring out how these cycles work?

Chris Brown – I don't think you will ever be able to manage menhaden with 100% certainty that they will make it up to where the water turns brackish. It has nothing to do with abundance, it has to do with conditions they find favorable or not favorable.

Greg Garrett – How do we get a handle on recruitment? What factors influence their reproductive success each year?

Joe Smith – What intrigues me is Bob Wood's work, looking at the North Atlantic Oscillation explaining cross shelf transport. What you saw up in the river could be due to the salt wedge traveling further up the river caused by a drought year.

Lanny Dellinger - I think Jan explained it well earlier by saying, "we can control a lot of things but one thing we can't control is Mother Nature".

Rich Hittinger – I think the only practical way to manage menhaden is by doing what DEM did this year, looking at real time information and making population estimates.

Joe Smith – There is a signal, I have watched for it, and that is the incoming year class. This can be seen in the 2005-year class. They have made up over 70% of the catches in the Chesapeake Bay this year and over 50% the previous year. Being at the northern end of their range they will most likely show up in Rhode Island next year as 3 year olds. So there are signals you can watch for.

Harold Loftes Jr. – I fished for menhaden in Narragansett Bay from 1949 until the 1980's. There were fish in the bay from 1949 to 1963 then they disappeared. They came back in 1970 in higher abundances than I had ever seen. You can't depend on these fish being here year after year. They are going to come and go like they have for the last couple of hundred years. The little bit that is taken from Narragansett Bay will not effect the coast-wide population, so I don't understand what this is all about. I feel there aught to be effort focused on the pollution of Narragansett Bay.

Susan Sosnowski – I agree with the problem of pollution but there have been great steps made by the general assembly and the DEM dealing with pollution in the Bay.

Russ Wallis – What is happening today should have happened a long time ago, this is absolutely terrific. I want to personally thank senator Sosnowski and representative Malik for saying, wait a minute let gets the real story before we jump into this vigilante type of mode that we were in.

Mark Gibson – My issue concerns the adequacy of the local management process. Here in Rhode Island we have two management modes. We have the Marine Fisheries Management Council that has statutory obligation to advise the director. If that doesn't work to the majority of people's liking they can then take the problem to the general assembly. It seems to me that in the history of menhaden management neither of those processes has been adequate up to this point. Does the stakeholder process need to be broadened or modified in some way?

Rich Fuka – I agree with you. Round table discussions should be a pretty good start on a direction. It seems the council in its present forum as an advisory board has become politically diluted. As we go through the process there are already preempted ideas on what may or may not happen and it is very short on what there may or may not be for stakeholders.

Rich Hittinger – This is a different case than many other fisheries issues. We are not looking at allocation for only for the commercial and recreational fisheries. Instead we are looking at the commercial sector taking a certain portion and then a certain portion being preserved for multiple reasons; for a forage reason as well as a potential filtration reason. I think this is why it makes perfect sense to broaden the stakeholder group and bring in people like Save The Bay, who really are not representing either the commercial industry or the recreation industry. Including both the recreational and commercial industry is also critical.

Jan Malik – As a politician I personally feel we should not be involved in this.

Susan Sosnowski – If you want the Marine Fisheries Council to change as far as its scope or if something needs to be done legislatively then we would look to the department and the stakeholders for advice.

Chris Brown – I am a great advocate of community management but with all due respect I am reluctant to empower Save The Bay to be in a position as a power broker in fisheries issues. I don't think it is consistent with their charter and feel it is best left to fishermen and other stakeholders such as recreational anglers.

Joel Hovanesian – User groups fighting against each other is not a good thing. Ultimately everyone ends up with nothing. Another thing that is not being considered is the quantity of menhaden being consumed by predators. We have to move onto managing the fishery not just the fishermen. The fisherman are just part of the equation.

Greg Garret – Where does the advocate for the ecosystem fit into this? We have various aspects of the fishing industry on the Fishery Management Council. If we are looking at the entire ecosystem and the fish are just one part of it, should there be some voice for that larger ecosystem in these discussions of how many fish to remove from it?

Susan Sosnowski – I view the department as an advocate for the environment not just the fishery. That is their constitutional duty and that is why they are in place.

Chris Brown – When I suggest that I do not wish to engage Save The Bay as an equal with regard to fisheries issues, please do not interpret that as not having any regard for the ecosystem. As fishermen we are more dependant on clean water and healthy ecosystems than anyone in this state. We fully recognize the need to monitor the system and that is where Save The Bay has a greater value to the industry. We are

entirely dependant upon people to take care of the ecosystem as far as water purity and things of that nature.

Jim O'Grady – There is no greater conservationist than fishermen themselves.

Flaxen Conway – I have herd this countless times on the west coast and can not agree more.

Ted Durbin – It is quite possible there are discrete sub populations of menhaden, not just one coastwide population which has been suggested many times. These sub populations could include a group that spawns in the spring in Narragansett Bay and another group that spawns offshore in the south during the fall and winter. There are a number of recent studies that show certain species where populations intermingle in the ocean and then return to discrete areas to spawn. It has also been shown that individuals that have been spawned in a certain area return to that same location as adults.

ASMFC Representative – I do not agree with this what so ever. We need to pay attention to one of the longest time series of data we have dealing with fisheries. We have tagged millions of menhaden in the 60's and 70's. This was the largest tagging program that has occurred in the United States. To ignore this information is absurd. There is no evidence showing there are discrete populations of menhaden here in Rhode Island or in the Chesapeake Bay.

Ted Durbin – There are no genetic, biochemical or otolith studies, which demonstrate they are a single population.

Ames Colt – We need to recognize that the recreational fishers and commercial fishers need to get along and work together. As a state we want both commercial and recreational fisheries. The two Communities need to get together and articulate what they can do and want. If they don't the interest of a healthy marine ecosystem will not be represented strongly enough in larger public policy debates.

Lanny Dellinger – I would like to work with the recreational sector. A Common goal would be to do things for Narragansett Bay that will entice more menhaden to be here, simple things such as stopping the use of chemical fertilizers around the watershed of the Bay. Everyone here is fighting for the same thing; we want more fish. If you want more fish you need a better environment to support those fish.

Rich Fuka – It is very encouraging to see all these stakeholders coming together and working on these extremely contentious issues dealing with allocation of menhaden. The more we fight over something the more split and divided we become. The more you converse and educate, the more each sector learns about each other.

Rich Hittinger – As for the recreational sector we agree 100%, we need to work together on this. We have basically the same interests, clean water, an abundance of fish and a commercial and recreational industry that continues. Along with the commercial fishing industry there are hundreds of families in Rhode Island that are supported 100% by recreational fishing interests whether it be charter business, building and servicing of boats or bait shops. Both sectors have their livelihood depending on healthy sustained fish populations.

Michael Bucko – What would be the ecological and socioeconomic cog if DEM had taken the precautionary approach by restricting purse fishing of menhaden in Narragansett Bay?

Lanny Dellinger – We rely very heavily on menhaden now that many of our other bait sources have been restricted. This is one species in which the lobster industry relies on that has been deemed healthy not overfished. All the science says we have a healthy resource here. If this resource were cut off to us we would be in trouble.

Joel Hovanesain? – The precautionary approach that you are referring to is an arbitrary number. The government uses this principle as a way to handcuff the fisheries. This approach will only work if you know what the proper numbers are and no one knows what they are.

Closing Remarks

Michael Sullivan – As a precautionary approach I would say at this point and ten months ago we took a tentative action at DEM that we thought was a way to mediate an ever-increasing conflict. One potential solution in the general assembly was a complete closure. It was easy to recognize the fishery consequence of that and the lack of the demonstrative environmental benefit from it. One of the things you will see myself and my staff continue to work for is a regulatory program which is flexible and scientifically based. Flexible in the standpoint of; was the 75,000 pound trip limit an absolute precision. It wasn't, but we asked and listened to the stakeholders to get an idea of what they could operate with. I will commit to trying to keep options open for flexibility that may empower DEM and others with a responsibility and authority when necessary, but to define the when necessary. In one week we are launching a fisheries round table meeting, which we hope continues this dialog. I have learned that anecdotal evidence at times is inaccurate but at times it is very valuable. You may not understand it; we may not understand it, but if we all can talk and jointly share concerns we will all be better off. I would like to ask you all to stay engaged as we struggle to keep doors open rather than close doors. I would rather keep options open rather than close options.

Jan Malik – What I would like to see happen this year in 2008 is for the recreational sector and commercial sector to come to us with legislation that both of you can support to make this a better place for all of us.

Mark Gibson – I feel Dave Beutel did a great job of identifying the history of menhaden. Dr. Durbin and Dr. Friedland certainly showed how complicated and remarkable this fish can be. Particularly speaking it goes through a rather remarkable set of adaptations as it grows in size, its gill raker assembly is changing so it can inhabit a wide geographic range. Due to this, juveniles can take advantage of plankton spectra in estuarine waters. The adults have a different feeding morphology, which enables them to feed in offshore waters during their elaborate migrations. Ted showed how menhaden have a remarkable ability to adjust their swimming speed to maximize the energy they take in versus the energy they expend. Clearly these fish play a role in nutrient cycling, although perhaps not as much as people would have expected. Their

effect to the nitrogen budget is rather small relative the overall flux of Narragansett Bay. Brad did a great job in identifying the status of the coastwise resource. It was clear to all of us that the coast wide assessment doesn't tell us much about what is going on in the respective estuaries. Although admittedly technically challenging, I hope that I showed there is way to assess the resource in Narragansett Bay in a real-time basis. One of my conclusions from this is we need a broader range of stakeholder input than the current Fisheries Council encompasses.

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