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Proceedings of the Atlantic Striped Bass Workshop and Roundtable Discussion

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FOREWORD

The decline of striped bass populations in Chesapeake Bay and along the Atlantic coast during the 1970s prompted Congress to request a study to examine the status of the stocks, identify causes for population declines, and analyze the economic impact of the decline in harvest (the Anadromous Fish Conservation Act amended as Public Law 96-118, 16 U.S.C. 757g). The ensuing study, begun in 1979, was known as the Emergency Striped Bass Study (ESBS, later changed to the Striped Bass Study, (SBS) and was funded annually until 1994.

By the mid-1980s, there was a multitude of studies being conducted with funding from the ESBS. It became apparent that all the researchers studying striped bass would benefit from the opportunity to meet and discuss their latest findings. Consequently, a workshop funded by the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) was convened. These workshops were held annually and resulted in a series of abstracts summarizing the latest research on striped bass.

With the termination of funding for the Striped Bass Study in 1995, the annual workshops were concluded. However, research on striped bass has continued and has included such topics as stock identification, bioenergetics, and stock assessment. In the summer of 1997, personnel from NMFS and ASMFC discussed the wide variety of ongoing research projects and felt that researchers, fishery managers, and the public would benefit from a forum similar to past SBS workshops. Therefore, NMFS provided funding to conduct such a workshop on February 18-19, 1998, near Baltimore, Maryland.

The following pages contain the abstracts from presenters and summaries of discussions on the nature of “quality” striped bass fisheries and communication between the public, scientists, and fishery managers.

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ABSTRACTS

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Striped bass, *Morone saxatilis*, is an important commercial and recreational fish species in the Chesapeake Bay. Since the decline of their population in the 1970's and 1980's, restoration efforts have been successful in improving their numbers. Presently, the striped bass population in the Chesapeake is reaching an all time high. However, their physical condition is poor and it is suggested that these fish are suffering from malnutrition. This may be attributed to decreased prey availability. The effects of the striped bass numbers on its prey are unclear. The goal of this research is to identify the importance of fish predation on the dynamics of other commercially, recreationally and ecologically important species. Population-level estimates of the predatory impact and ecological role of striped bass in the system will be evaluated. Predation on blue crabs, out-migrating juvenile alosids, and other important prey by striped bass in the Chesapeake Bay Estuary is of particular interest. We hope to provide a critical step toward understanding the role of piscine predators in the Chesapeake Bay Estuary.

2. Factors affecting the recent decline of blueback herring and American shad in the Connecticut River

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A dramatic decline in American shad and blueback herring abundance has occurred in the Connecticut River since 1992. Annual losses of over 720,000 shad in 1993 and almost 1.5 million shad from 1994 through 1997 were estimated based on the historic (1966-1992) relationship between shad juvenile production and subsequent adult recruitment. To date, several hypotheses have been offered to explain the alosid stock declines in the Connecticut River. They include: (1) overharvest by natal (inriver) and coastal intercept fisheries, (2) stock displacement or enhanced ocean mortality rates due to colder than normal ocean water temperatures (winter and/or spring), and (3) increased predation mortality on adult and juvenile alosids. The objective of this report was to examine whether one or more of these hypotheses could explain the recent sharp decline in Connecticut River alosid stocks.

The possibility that coastal and inriver overharvest could have caused the recent shad decline was not consistent with trends in inriver and coastal fishing mortality (F) rates from 1980 to 1996. Inriver and coastal F estimates did not rise after 1990 as would be expected if overfishing was the underlying cause of the shad stock decline. The current (1992-96) average total fishing mortality rate (FT) of 0.22 was well below the estimated overfishing definition (F_{30} = 0.43) for

Connecticut River shad based on a recent coastwide stock assessment. Secondly, inriver commercial fishing effort (number of fishing days), as well as inriver and coastal commercial landing of Connecticut River shad have declined steadily from 1992 to 1996. These landings have comprised between 65,000 and 180,000 adult fish from 1993 to 1996. Recent annual harvest of this magnitude would have explained only about 4 to 12% of the 1993-1996 predicted annual losses of about 1.5 million adult shad. Finally, the blueback herring population size in the Connecticut River has declined by about 90% between 1981 and 1996 despite moderate to high juvenile production between 1985 and 1993. This decline cannot be attributed to coastal and inriver fisheries since no directed fisheries currently exist on Connecticut River blueback herring.

There is no evidence, statistical or otherwise, that bluefish, weakfish, or dogfish abundance had risen during the recent alosid decline in the Connecticut River. Bluefish and weakfish abundance in Connecticut waters has either remained constant or has declined during the years (1988-1996) when shad and blueback herring abundance in the Connecticut River has declined. By contrast, statistical and food habits evidence is persuasive for the striped bass predation hypothesis. Significant positive correlations existed between striped bass spawning stock biomass (SSB in mt) from Virtual Populations Analysis (VPA) and adult blueback herring and American shad mortality rates from 1982 through 1996.

Published striped bass food habits studies in the Connecticut River and elsewhere showed that alosids were a primary food source of larger (>26 in.) stripers during April and May. Moreover, it was emphasized that striped bass, unlike other marine finfish predators, were rising to very high abundance (from 407,300 to 1,154,000 fish) in the upper (>50 km.) Connecticut River during April and May. This large and ever rising striper population occurred in the upper river coincident with the peak shad blueback herring spawning runs. Finally, the number of larger (>28 in.) stripers in the river during April and May was estimated to have risen from 197,100 fish in 1994 to over 507,700 fish in 1997. These stripers were of sufficient size to have heavily preyed on adult blueback herring and American shad. A striped bass population of this magnitude (between 197,000 and 507,700 stripers) could have easily reduced the Connecticut River shad population by one million or more fish each year since 1992. A combination of evidence including statistical, food habits, striped bass size frequency and population abundance in the Connecticut River strongly suggest a direct linkage between increased striped bass abundance and predation and the recent dramatic drop in shad and blueback herring abundance in the Connecticut River.

3. Factors governing a perceived decline in bluefish abundance along the U.S. East Coast

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The perceived decline in bluefish stocks along the Atlantic coast of the U.S. has been attributed to a variety of factors ranging from competition with other species to dwindling forage species and unusual migratory pathways. On October 8, 1997, Rutgers and the National Marine

Fisheries Service convened a workshop to identify near- and long-term information and research needs to determine the potential factors that govern the population dynamics of bluefish stocks. Results of the workshop provided the framework for a request for proposals to address five primary areas of study that merit investigation. These are recruitment dynamics, predator-prey interactions, stock (genetic) structure and demography, habitat use, and reproductive biology. A total of eight proposals were submitted from a variety of academic investigators. All proposals have been sent out to disciplinary experts for mail review, and a peer review panel will be convened to evaluate and rank proposals. Awards will be announced in late April 1998, projects will commence by summer 1998, and results of investigations will be presented at a symposium scheduled for late 1999.

4. Predation on Striped Bass

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An electronic review of over 20 articles in the literature regarding diets of potential predators (those with motive and opportunity to feed on any life stage) of striped bass (*Morone saxatilis*) revealed that literature has documented relatively few predators of striped bass. Field and laboratory studies of possible predators on eggs and larvae of striped bass showed that copepods, white perch (*M. americana*), shiners (*Notropis spp*.), white catfish (*Ameiurus catus*), channel catfish (*Ictalurus punctatus*) and bay anchovy (*Anchoa mitchilli*) were documented predators on early life stages. Of these, bay anchovy and white perch may be most influential due to their potentially high individual consumption rates and abundance in nursery areas (Monteleone & Houde 1992; McGovern & Olney 1988, 1996). For juvenile striped bass two predation sources were identified: bluefish (*Pomatomus saltatrix*) (Juanes et al. 1993; Buckel & Conover 1997) and cannibalism (Gardinier & Hoff 1982; Manooch 1973). Only very limited diet information exists for animals believed to be potential predators of adult striped bass. None of the few papers found on diets of Atlantic coast marine mammals or Atlantic sharks noted striped bass as a prey item. However, animals anecdotally believed to feed on adult striped bass include various aquatic birds, marine mammals, and potentially large pelagic fishes and sharks. Among the life stages affected and potential predators of striped bass, predators on early life stages such as bay anchovy and white perch may be most important to structuring striped bass populations through predation. Interestingly, despite the large sums of money expended on striped bass research we still know very little about what preys upon them, particularly upon adult striped bass for which no known predators have been documented. Questions raised by this review include (1) Does oceanic predation occur and to what extent? (2) Do egg and larval predators assist in limiting recruitment beyond the scope of environmental conditions? (e.g. Rutherford et al. 1997) and (3) Why does predation on juvenile striped bass appear more pronounced (3 of 4 studies that showed predation) in the Hudson River?

<u>Salient manuscripts</u>:

1. Setzler at al. 1980. Synopsis of biological data in striped bass, *Morone saxatilis* (Walbaum). NOAA Technical Report NMFS Circular 433., Washington, D.C.

Summary: Surprisingly little is mentioned regarding predators of striped bass in this comprehensive summary of information on striped bass. It is noted that direct information is lacking, but suggests large bluefish and weakfish probably feed on small striped bass in the Atlantic. White perch are suggested as predators on striped bass larvae.

2. Texas Instruments. 1976. Predation by bluefish in the lower Hudson River. Final Report prepared for Consolidated Edison Company of New York, Inc., New York, NY.

   Summary: During June-September 1974 diets of YOY bluefish were examined in the Hudson River. Striped bass represented 0.8% (percent number) in 15-31 July (Rm 34-48); 1.7-1.9% 1-14 August (Rm 12-48); and 33.3% in lower river and 3.1% in rm34-48 during 15-31 Aug. No SB from June-15 July or in Sept. Overall, SB were 1.6% of the numbers of fish consumed.

   In the pilot study in 1973, 7 YOY bluefish had striped bass in their stomachs (out of 33 BF). In 1974, only 6 SB were recovered from 1,627 BF stomachs. Note, in 1973 SB year-class strength was high, in 1974 y-c strength was low! Results support density-dependent predation on SB by BF.

3. Chao, L. N., and J. A. Musick. 1977. Life history, feeding habits, and functional morphology of juvenile sciaenid fishes in the York River Estuary, Virginia. Fish. Bull. 75:657-702.

   Summary: Looked at diets of weakfish (*Cynoscion regalis*); silver perch (*Bairdiella chrysoura*), spot (*Leiostomus xanthyrus*); and Atlantic croaker (*Micropogonias undulatus*) in the York River, VA. Here, Table 10 compares diet s of 34 WF (70-183 mm TL) collected from June-August 1973 with some other studies. Among the fish, no striped bass were recorded as prey of weakfish. None of the other 3 sciaenid species ate striped bass either.

4. Homer, M. and W. R. Boynton. 1978. Stomach analysis of fish collected in the Calvert Cliffs region, Chesapeake Bay - 1977. University of Maryland, Chesapeake Biological Laboratory, Solomons. UMCEES Ref. No. 78-154-CBL.

   Summary: Bluefish (N=20) collected in gillnets off Calvert Cliffs were examined for food contents. No striped bass were found in the stomachs. For N=16 weakfish from gillnets there were also no striped bass in stomachs.

5. Stickney, R. R., G. L. Taylor, and D. B. White. 1975. Food habits of five species of young southeastern United States estuarine Sciaenidae. Ches. Sci. 16:104-114.

   Summary: Diets of weakfish, spot, silver perch, and Atlantic croaker were examined from South Carolina to Northern Florida. For N=161 silver perch (30-150 mm); N=120 weakfish (30-170 mm); N=196 croakers (30 - >180 mm); N=126 spot (50-150 mm); no striped bass were found in the stomachs.

6. Richards, S. W. 1976. Age, growth and food of bluefish (*Pomatomus saltatrix*) from East-central Long Island Sound from July through November 1975. Trans. Amer. Fish. Soc. 103:523-525.

   Summary: Looked at stomachs of 67 bluefish from LIS during July-November 1975. Fish were 440-750 mm FLs. Some cannibalism (juvenile BF) reported, but NO striped bass.

7. Gardinier, M. C., and T. B. Hoff. 1982. Diet of striped bass in the Hudson River Estuary. NY Fish & Game J. 29:154-165.

   Summary: SB collected in Hudson River from April-Nov. 1974 and Apr-May 1976, 1977. NEVER were large fish cannibalistic. Striped bass of 151-200mm TL DID eat other SB (25% frequency, ie. 1 of 4) during October. This was the only incidence of cannibalism reported for N=894 stomachs.

8. Schaefer, R. H. 1970. Feeding habits of striped bass from the surf waters of Long Island. NY Game & Fish J. 17:1-17.

   Summary: SB were collected in a 1300-foot commercial haul seine between 27 April and 24 November 1964. SB diets were pooled by size: small (<400 mm); medium (400-599 mm) and large (>= 600 mm). A total of 367 stomach were examined: 61 small; 183 medium; and 123 large fishes. Cannibalism was NEVER REPORTED.

9. Manooch, C. S., III. 1973. Food habits of yearling and adult striped bass, *Morone saxatilis* (Walbaum), from Albemarle Sound, North Carolina. Ches. Sci. 14:73-86.

   Summary: Between July 1970 and August 1971, 1094 striped bass (125-714 mm) were collected by hook & line, gillnets, seine, and purse seine. Data were grouped as < 300 mm and > 300 mm fish. Of the 1094 fish, only 2 small (<300 mm) striped bass were cannibals. So, 2/845 fish had SB in their stomachs. MINOR CANNIBALISM by SB < 300 mm TL.

10. Markle, D. F., and G. C. Grant. 1970. The summer food habits of young-of-the-year striped bass in three Virginia Rivers. Ches. Sci. 11:50-54.

   Summary: Study looked at food items of SB < 70 mm FL and those larger than 70 mm FL. Fish were collected from seines between July-October 1967. A total of 331 fish were examined (297 of which had food). All fish were YOY SBY. YOY SB were NEVER cannibalistic.

11. Rulifson, R. A., and S. A. McKenna. 1987. Food of striped bass in the Upper Bay of Fundy, Canada. Trans. Amer. Fish. Soc. 116:119-122.

   Summary: Examined diet of 81 SB from commercial catches in summer-fall 1985. Fish ranging from 69-520 mm FL NEVER were cannibalistic.

12. Friedland, K. D., G. C. Garman, A. J. Bejda, A. L. Studholme, and B. Olla. 1988. Interannual variation in diet and condition in juvenile bluefish during estuarine residency. Trans. Amer. Fish. Soc. 117:474-479.

Summary: Looked at diets of YOY BF from Sandy Hook, NJ during 1981, 1983, and 1984. Of 193, 296, and 589 fish examined each year (total = 1078), respectively, none EVER ate striped bass (did occasionally eat WF).

13. McGovern, J. C., and J. E. Olney. 1988. Potential predation by fish and invertebrates on early life history stages of striped bass in the Pamunkey River, Virginia. Trans. Amer. Fish. Soc. 117:152-161.

Summary: This study collected fish in trawls and looked for predation on SB eggs and larvae. They were unable to detect these forms in field stomachs (it would be difficult due to very short residence times in stomachs). In the lab they quantified predation by the invertebrate *Acanthocyclops vernalis* a cyclopoid copepod, satinfin shiner, spottail shiner, tessellated darter, white perch, striped bass, bluegill, pumpkinseed sunfish, channel catfish and white catfish, all of which overlaps spatially with SB young and eggs. All fish ate yolk-sac larvae under lab conditions. For spottail and satinfin shiners C increased with larval density up to 150 and 81 larvae/predator hour, respectively. At ambient Pamunky River SB larval densities of 10-100 larvae/m^3, consumption was only 0-5 larvae/predator hour. Of note, they did not experiment with BAY ANCHOVY as egg/larval predators even though BA were 17-61% of the numerical catch composition in MWTsCbay anchovy could be significant predators, but it was not studied, probably due to difficulties in handling BA.

Of note, small (15-18 mm) striped bass were cannibalistic, eating 2-7 larvae per individual predator. Among potential invertebrate predators (Leptadora, Gammarus, *Acanthocyclops vernalis*, watermites) only A. vernalis showed ANY predatory behavior towards SB larvae. Examination of 235 stomachs of 14 species of fish showed no evidence of field predation on SB eggs or larvae.

14. Buckel, J. A. and D. O. Conover. 1997. Movements, feeding periods, and daily ration of piscivorous young-of-the-year bluefish, *Pomatomus saltatrix* in the Hudson River Estuary. Fish. Bull. 95:655-679.

Summary: YOY BF were collected during summers of 1992-93 in the Hudson River. Striped bass were a significant prey in 1992 for spring-spawned age-0 BF, comprising (by weight) 24.4%, 3.9%, 23.7%, 39.0%, and 9.5% (mean 19.6%) of the mid-July, late July, mid-August, late-August, and mid-Sept. diets, from beach seines, respectively. A total of 439 BF with prey were analyzed in 1992 beach seines. Striped bass were also a significant prey in 1993. 1993 beach seine diets represented 67.8%, 41.2%, 37.0%, 13.8%, 28.9% and 23.9% (mean 32.2%) striped bass for the 6 sample intervals between 7-8 July and 11-12 Sept. 1993. For gillnet and surface trawl caught bluefish in 1993, striped bass represented 20.4% in mid-July, 47.6% in late July, 33.9% in 11-12 August, and 33.3% in 18-19 August diets. YOY Bluefish in the HUDSON RIVER ARE SIGNIFICANT predators on YOY striped bass!

15. Rutherford, E. S., E. D. Houde, and R. N. Nyman. 1997. Relationship of larval-stage growth and mortality to recruitment of striped bass, *Morone saxatilis*, in Chesapeake Bay. Estuaries 20:174-198.

Summary: This study suggests that recruitment level for SB may be set at the larval stage in Chesapeake Bay. Thus, egg and larval predation may be important in understanding fluctuations in SB recruitment. However, these authors state that magnitude and timing of egg production and it's relationship with environmental variables and zooplankton (food) densities, and NOT PREDATION, appear to be what determines year-class success in SB. Thus, predation on eggs & larvae is probably not important!

16. Merriner, J. V. 1975. Food habits of the weakfish, *Cynoscion regalis*, in North Carolina waters. Ches. Sci. 16:74-76.

Summary: This study examined 817 WF stomachs from NC waters between 1967-1970. Striped bass were not reported in the diets of these WF for age groups 0-4.

17. Juanes, F., R. E. Marks, K. A. McKown, and D. O. Conover. 1993. Predation by age-0 bluefish on age-0 anadromous fishes in the Hudson River Estuary. Trans. Amer. Fish. Soc. 122:348-356.

Summary: A total of 374 age-0 bluefish (47-278 mm TL) were collected in July to October 1989 in the Hudson River. Striped bass represented an average of 8.8% (by weight) of diet. By size group, SB represented 16.6% of 78-100 mm BF; 14.5% of 101-120 mm BF; 16.5% of 121-150 mm BF: and 7.9% of 150-278 mm BF diets. Striped bass were not selected for, but were eaten in proportion to their abundance.

18. Hartman, K. J., and S. B. Brandt. 1995. Trophic resource partitioning, diets and growth of sympatric estuarine predators. Trans. Amer. Fish. Soc. 124:520-537.

Summary: In the Chesapeake Bay, examination of diets of N=293 age-0, N=445 age-1, N=273 age-2, and N=211 age-3+ striped bass failed to detect ANY cannibalism in striped bass. Examination of N=564 age-0, N=353 age-1, and N=54 age-2+ weakfish showed no incidence of striped bass in the stomachs of WF. Examination of N=100 age-0, N=132 age-1, and N=71 age-2+ bluefish also failed to detect any striped bass in the diets of bluefish in Chesapeake Bay.

19. Monteleone, D. M., and E. D. Houde. 1992. Vulnerability of striped *bass Morone saxatilis* Waldbaum eggs and larvae to predation by juvenile white *perch Morone americana* Gmelin. Exp. Mar. Biol. Ecol. 158:93-104.

Summary: This laboratory study showed that small white perch (58-65 mm TL), which would be abundant in spawning areas for SB in most estuaries, are quite capable predators of early life stages of SB. In the lab, WP 1.7 eggs/15 min, 7.3 yolk sac larvae/15 min, and peaked on 12-day posthatch larvae (13.1 larvae/15 min). Overall, highest rates were on larvae of 7.0-7.9 mm SL. The authors state that predation on SB by WP is potentially significant, but requires further lab and field experiments.

20. McGovern, J. C. and J. E. Olney. 1996. Factors affecting survival of early life stages and subsequent recruitment of striped bass on the Pamunkey River, Virginia. Can. J. Fish. Aq. Sci. 53:1713-1726.

Summary: This study evaluated environmental (temperature) factors, potential predator density on spawning grounds, and egg densities over time in relation to hatch dates of surviving SB larvae. It was a follow up to their earlier study. Here, they evaluated bay anchovy and menhaden as predators in the lab and found them to be capable predators of eggs and larvae in the lab (an omission from work in their earlier paper). In the field they found some evidence of selection by bay anchovy (the most abundant pot. Predator in the spawning areas) for feeding on eggs and larvae of SB. The authors check two years of differing recruitment and conclude that in the one year (1988) that lower water temps and reduced food densities combined to prolong development of SB eggs & larvae making them more susceptible to elevated predator densities.

5. The use of known-age, hatchery recaptures, for validation of aging Atlantic striped bass by examination of otoliths and scales

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Introduction

Several authors have commented on the need for fisheries researchers to validate the means by which they estimate the age of fish among their respective sampling programs (Beamish and McFarlane, 1983). More recently, the SARC report on the review of the striped bass virtual population analysis (December, 1997) identified the use of scales, rather than otoliths, as a source of uncertainty and recommended that Afurther study be done on the discrepancy in ages between scale ages and otolith based ages.

Beamish and McFarlane (1983), who likened validation of the aging technique to the calibration of instruments in other fields of science, distinguished two basic types of validation methodologies. The first apply to all age groups and include the use of mark-recapture studies or the capture of known-age fish. The second, which applies to only the youngest life stage (i.e., fastest growing) of a species, include analysis of length frequency, the comparison of multiple structures (i.e., otoliths, scales, fin rays), back-calculation of length, as well as others.

This report will discuss the capture of known-age fish for validation of aging Atlantic striped bass by examination of otoliths and scales.

Methods

1. Hatchery Stocking Programs

Between 1983 and 1995 approximately 11.2 million juvenile (Age 0) hatchery striped bass were released adjacent to coastal areas of New York, Maryland, Virginia and Delaware. (EA Engineering, Science and Technology, 1996; Jorgen Skjeveland, pers. comm.). All striped bass were tagged with binary coded, magnetic, wire tags (CWT) prior to release. The binary coding on each wire tag permits identification of the yearclass and origin of the recaptured fish. In the field, wire tags are detected by passing fish through a box-type scanner or by passing a wand type scanner, developed for larger fish, over the left side of the head, as coded wire tags are placed in the left cheek muscle by convention. Typically, scanning for the presence of coded wire tags is accomplished by State or Federal biologists in the course of their stock assessment fieldwork or in their monitoring of striped bass fisheries. The tags are removed and returned to the U.S.F.W.S. Maryland Fisheries Research office for identification. Because the cheek must be removed to retrieve the CWT, suspect CWT recaptures must be sacrificed.

2. Otolith Based Aging

Secor et al. (1995) published findings relative to the validation of otolith based aging of striped bass recaptured bearing CWT. Thirty-seven striped bass were collected between a fishery independent survey off the coast of North Carolina (24) and commercial monitoring surveys in upper Chesapeake Bay (13) during 1992 and 1993. Otoliths were extracted and prepared by cutting and polishing transverse sections of the otolith taken through the otolith core (Secor et al., 1991). The otolith sections were examined under a light microscope, and annuli assigned by two independent readers. The assigned ages were compared between readers and with the known age from the CWT.

3. Scale Based Aging

Striped bass aging by scale method has been validated for fish up to age 3 (Merriman 1941; Humphreys and Kornegay 1985). The subject of aging striped bass by scales has also been discussed at workshops convened by the Emergency Striped Bass Study, ASMFC (Boreman1981; Hill 1991), as well as others (Park et al.1987). Vecchio and Greco (1997) have discussed findings relative to the validation of the scale based aging of striped bass recaptured bearing CWT. Two hundred and thirty four CWT recaptures were collected in a fishery independent survey conducted off the Atlantic coast of Long Island, NY, between 1991 and 1996. Scales were removed and prepared by pressing several scales from each specimen into GG grade, 0.05 inch, clear extruded acetate (Laird Plastics), using a Carver (Model C) electrically heated laboratory press. The acetate plate is pressed at fifteen to twenty thousand pounds pressure for five minutes in the press, which has been preheated to 170 degrees Fahrenheit. Scale impressions were examined on microfiche viewers by two independent readers and assigned ages compared for agreement. After resolution of aging conflicts between the two readers, scale ages were compared to the known ages from the CWT.

Results

Secor et al. (1995) found 100% agreement, for both readers, between the otolith samples collected in the commercial monitoring surveys of upper Chesapeake Bay (13) and the known age (CWT). Among the coastal recaptures, percent agreement between the otolith samples and the known ages were 79% and 87% for the two readers. Errors within the coastal samples were all within one year of the known age of the specimen. The Chesapeake Bay samples ranged in age from three to seven, whereas the coastal samples ranged in age from four to seven.

Based upon their success with the use of otoliths, from CWT recaptures ranging in age from three to seven, the authors sought to examine the accuracy of ages determined from scales by comparing the scales versus otoliths of large striped bass captured during the Maryland spring trophy season (ie., >91 cm TL). Their research concluded that scales provided ages that were not significantly different from those of otoliths for striped bass less than 110 cm total length, which they report was for fish aged five to eleven years old. The research also concluded that scales tend to under-age otoliths by an average of nine years, for striped bass greater than 120 cm total length, which they report are fish greater than twenty years old.

Vecchio and Greco (1997) found 90% agreement between the scales and known ages of 234 CWT recaptures collected between 1991 and 1996 (Figure 1). Of the 24 errors, 22 (92%) were all within one year of the known age of the specimen. One, aged four CWT, was under-aged by two years and one, age six CWT, was under-aged by three years. CWT ages ranged from two to twelve, although there were no age eleven CWT recaptures among the samples. Total length of these fish ranged from 36.7 cm to 100.3 cm. Errors in aging were restricted to ages three through seven. No errors were found for scales from hatchery recaptures age 2, 8, 9, 10 and 12 although very few age 8 through 12 CWT recaptures were collected. The mean C.V. for age, determined by scales for ages 2 through 7, was 8% (Figure 2).

Discussion

The results of the two studies mentioned indicate that otolith and scale aging of striped bass is valid for ages three through seven and two through twelve, respectively. These results are generally consistent with the literature suggesting that scales provide ages which are adequate up to age 10 or 11, but otoliths tend to be more precise, particularly with increasing size (Heidinger and Clodfelter 1987; Welch et al. 1993; Secor et al. 1995).

In their comparison of otoliths versus scales, Secor et al. (1995) suggest that scales under-estimate age in striped bass greater than 120 cm total length. In addition, evidence was presented at the striped bass technical/stock assessment committee meeting in 1997 which indicated a marked decrease in precision and accuracy with the use of scales over otoliths (Secor, unpubl. data).

In the first instance, the authors applied their success with otoliths from known age striped bass aged three to seven against much older, and larger, specimens. Beamish and McFarlane (1983) advise against extrapolation beyond the maximum age validated and suggest that extrapolation of any sort, even to other populations within the same species, is dangerous.

In the second case, it was not clear how scale impressions were prepared for the known age samples collected in Virginia, which seemed to refute the validity of scale based aging. After further discussion, it was revealed that the samples were prepared by pressing with a cold roller press, contrary to the recommended method of pressing by heated, flat, hydraulic press (Boreman 1981, Park et al.1987, Hill 1991). Since sample preparation and experience with aging are of paramount importance in the interpretation of growth zones or annuli, comparative validation studies should strive to use the most widely accepted methodologies in order to reduce bias to an absolute minimum.

Bearing these results in mind, the following are offered as suggestions for areas which need further improvement and research.

1. The spawning contribution by larger and older striped bass among the population cannot be left incompletely understood. Additional research should be conducted to validate annulus formation in very large (i.e., >120 cm) striped bass. If possible, a marking study could provide proof that annuli are produced with the same frequency and characteristics as observed for younger striped bass. Such direct evidence might relieve some of the concern over extrapolating otolith aging results well beyond the oldest validated age from the recapture of known age specimens.

2. Researchers have been using mostly scales to age their fisheries samples, although otoliths tend to exhibit greater precision (Heidinger and Clodfelter 1987; Welch et al. 1993). Studies should be conducted to determine the best structure and methods of preparation for striped bass age determination (scales, otoliths, fin rays) with attention given to the potential for environmental regime or latitudinal differences in, and between, these structures (Taubert and Tranquilli, 1982). For example, it may be possible that scales are sufficient for aging coastal fish from northern latitudes but otoliths must be used for aging estuarine fish of southern origin. Attention should also be given to different methods of otolith preparation, specifically related to whether they are cut and polished or broken and burned, as has been observed for other species (Chilton and Stocker 1987).

3. Striped bass research has been given a tremendous gift in the form of millions of hatchery stocked striped bass marked with coded wire tags (CWT). These fish have the potential to provide research with an increased level of understanding of the resource. 1997 was the first year that age 14 hatchery fish, coinciding with the oldest age group in the striped bass VPA, became available. Special attention should be given to the recovery of large, CWT bearing, striped bass. To that end, it is recommended that the USFWS be provided the means to augment and improve its inventory of CWT detectors. The current inventory is in need of repair or replacement and is far too inadequate to take advantage of the unique opportunity that exists for striped bass.

4. Researchers receiving Federal Grants for fisheries projects that encounter striped bass should be provided with CWT detectors and be strongly encouraged to scan for and sacrifice such recaptures due to their unique value to the management of the species.

Perhaps the MRFSS port samplers could also be provided with tag detectors and a small reward paid to those fishers who provide samples (ie. cheek, scales, otoliths, length, weight, etc.) from striped bass found to be CWT recaptures (similar to the reward for floy internal anchor tag returns). This may also be an opportunity to involve sportfishing groups as benefactors and as collectors of CWT striped bass (Boat U.S., etc.).

5. The effort to obtain and distribute CWT detectors, collect information, disseminate body parts for analysis and coordinate research efforts needs to be organized under the control of some key agency. Ideally, the CWT coordinator, which was housed at the USFWS Maryland Fisheries Research office, would have been the ideal person to perform such a task. Perhaps the funding and staffing of such a person could use another look.

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6. Genetic stock identification of striped bass: three case histories

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During the last three decades, considerable effort has been directed at genetic stock identification of striped bass. Three issues were addressed: (1) stock discrimination of Hudson River and Chesapeake Bay striped bass and estimations of the relative contributions of these stocks to mixed coastal fisheries; (2) genetic distinctiveness of Gulf of Mexico (Gulf) and southeast Atlantic coast striped bass and an evaluation of the extent of introgression of Atlantic coast genes in Gulf populations; and (3) stock discrimination of striped bass in the Bay of Fundy and Gulf of St. Lawrence and determination of the stock origin of fish in Bay of Fundy rivers. Allozyme, mitochondrial DNA (mtDNA), single copy nuclear DNA, multi-locus DNA fingerprinting, and microsatellite analyses were used to address these questions. All DNA-based approaches proved informative in addressing all or a subset of these problems. For example, mtDNA and single copy nuclear DNA analyses were used to discriminate Hudson River and Chesapeake Bay striped bass and to estimate relative contributions of these stocks to eastern Long Island, NY coastal harvests. For striped bass collected in the fall of 1989, mtDNA analysis suggested that approximately 73% of fish were of Hudson River origin. For fish collected in the fall of 1991, analyses of a combination of mtDNA and single copy nuclear DNA suggested that the contribution of the Hudson had declined to about 52%, a result that was consistent with increased recruitment of Chesapeake Bay fish into the coastal migratory stock. All techniques demonstrated the genetic distinctiveness of striped bass in the Apalachicola River, FL system (Gulf) and analysis of an mtDNA polymorphism in formalin-preserved museum collections of “pure” Gulf striped bass showed little introgression of maternally derived Atlantic mtDNA in the Apalachicola River, FL population. Analysis of mtDNA showed that striped bass in Gulf of St. Lawrence rivers and the Shubenacadie River, NS were highly genetically distinct from each other and the US coastal migratory stock. Additionally, mixed stock analysis of adult striped bass in the St. John River (NB), Annapolis River (NS), and the Schubenacadie River (NS) showed that most adult striped bass in the St. John River, NB and Annapolis River are of US origin and most adult fish in the Schubenacadie are spawned there. Current and investigations include the development of additional microsatellite markers to provide added resolution in addressing these problems and in determining the stock origin of wintertime aggregations of striped bass off the North Carolina coast, Delaware Bay, and the New Jersey coast.

7. An evaluation of six internal anchor tags for marking phase II striped bass

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Commercially available internal anchor tags were compared for retention, legibility, and durability in tagging phase II striped bass. The study was conducted in two phases; the first trial (1992-93) was conducted in ponds and evaluated 6 types of tags, the second (1993-94) was done in tanks and compared 3 tags.

In the first trial, hatchery-reared striped bass (120-200 mm total length) were tagged with specifically coded wire tags and one of six types of internal anchor tags (500 fish each tag type and two groups of controls). The types of tags were: Floy streamer FM-84 (currently in use by the USFWS); Floy streamer with protective sheath (modified FM-84); Floy streamer with a monofilament leader and sheath (FM-89SL); modified Hallprint T687; Hallprint monofilament IEX WAD; and Hallprint T-bar IEX NOR. The Hallprint T-bar IEX NOR and the Floy FM-84 tags caused significantly higher 2-week and 6-month mortality. Fish growth was different among tag types and tagger groups, however, final fish size was not correlated with either variable after adjusting for initial fish size. Tags mounted on PVC pipes were exposed to fresh, brackish, and salt water environments for one year, and individual tags subjected to abrasion in a sand/rock mixture. Both tag types with monofilament leaders between the anchor and streamer broke easily. The brackish water environment was harsher than either fresh- or salt water, with a greater density of fouling organisms. Legibility was poor for the Floy streamer, and Floy tag sheaths sometimes moved and obscured the printing. Failure rates for the Floy tags (36%) were about six times higher than the Hallprint tags (6%). An analysis of 369 anchor tags returned from striped bass fishermen indicated the tag was illegible when more than 43 printed characters were lost and that illegibility increased over time.

The first study maintained tagged fish in ponds, so an exact temporal failure rate could not be estimated due to the difficulty of determining exactly when a fish died or shed a tag. The second trial attempted to improve on these findings by maintaining the fish in a closed recirculating tank system so tag loss and mortality could be closely observed. We compared the original Floy tag (model FM-84) currently in use by the USFWS, a redesigned Floy tag with a sheath, a hybrid anchor tag made from a Hallprint streamer manually attached to an oblong anchor, and a group of controls.

The project tank system consisted of ten 2340- L circular fiberglass tanks connected to a biofilter. Each tank received 80 fish/treatment, totaling 320 fish/tank. Each tag type was applied to 800 fish; initial estimates of sample size indicated that a minimum of 755 fish/treatment would be needed to detect a difference in retention between tag types at a=0.1. Fish were also fin-clipped to identify tag groups if the tag was shed.

Three professional biologists applied the tags onto the fish on 25 February 1994 . They were experienced fisheries personnel normally involved with anchor tagging both hatchery and wild-caught striped bass. After the initiation of the experiment, any mortalities were removed daily, identified by tag number, recorded, and frozen for later dissection. The carcass was examined for external symptoms of bacterial and fungal infections such as lesions, fin rot, and fungus, and then the internal organs examined. Extent and location of the tissue damage was recorded. Tanks and drains were checked daily for tags, and any shed tags were removed and recorded.

The data are being analyzed. One tagger had a significantly lower survival rate (26.7% vs. 83.5 and 79.4 %), complicating the analysis. This tagger inserted the tag slightly higher and more posterior than the recommended location. In this location, the tag anchor penetrated the swim bladder or kidney. Survival of control fish was 96.3%. Unlike the first trial, mortality did not begin until the third week of the study. The injuries had a more chronic than acute impact. This has implications in the temporal pattern of tag loss/mortality. Previous studies assumed an immediate post-tagging mortality, followed by a stable period, then a period of increasing tag loss as tags break, abrade, or fish die from predation. Tag shedding was a minor occurrence; only 63 tags (2.6 %) were shed (new Floy tag, 46%; original Floy tag, 28%, and the hybrid Hallprint, 25%), and shedding rate only increased slightly over time.

None of the tags tested was considered appropriate for tagging juvenile striped bass, but changes in tag design, material, and insertion could improve tag retention and survival.

8. Cooperative striped bass tagging program

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A coast wide tagging study was initiated in 1986 with the purpose of providing vital information on mortality and migration rates to those involved in management of Atlantic striped bass (Emergency Striped Bass Research Study for 1987). It was understood from the beginning that hard work by multiple partners over a long time would be required to sustain such a tagging program and fulfill its initial purpose. Twelve years later the Cooperative Striped Bass Tagging Program is the result. The Cooperative Striped Bass Tagging Program is comprised of 4 critical operations: tag release, tag recovery, data management, and data analysis. Success of the Tagging Program depends on sustained commitment to all 4 operations. During the past 12 years, through the cooperation of 15 state and federal agencies, over 175,000 wild striped bass have been tagged with an external anchor tag and released in waters of 10 states. Currently, tagging efforts are organized to target fish within producer areas (Chesapeake Bay, Hudson River, and Delaware Bay) and coastal migrants (eastern Long Island, offshore North Carolina, offshore Massachusetts, and New Jersey). Thanks to the active participation of recreational and commercial fishermen, over 50,000 tags have been recovered. The U.S. Fish and Wildlife Service maintains a database of tag releases and recoveries and issues reports to those involved in data analysis. Methods for analysis of tag-recovery data have evolved rapidly since the genesis of the Tagging Program. The Striped Bass Tagging Workgroup, which operates under the Striped Bass Stock Assessment Subcommittee of the Atlantic States Marine Fisheries Commission, has worked to apply rigorous and objective methods to estimate mortality of striped bass. Ongoing analyses focus on variation of mortality among stocks, ages, sexes, and harvest regulations. Tag-based mortality estimates are among the vital indices used to monitor the status of Atlantic striped bass. The value of any tagging program is in direct relation to clarity of purpose, level of commitment, longevity, and quality control. The Cooperative Striped Bass Tagging Program has proven to be a valuable tool in the management of striped bass for now and, with continued commitment, will be so in the future.

9. Development of a national tag registry

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Due to a growing interest in angler-based tagging, in January, 1998 a workgroup (sponsored by the National Marine Fisheries Service and the Atlantic States Marine Fisheries Commission) composed of representatives from federal and state agencies, interstate commissions and major angler-tagging groups began to address issues regarding angler-based fish tagging programs. Such issues include confusion between angler-based programs and government tagging efforts, potential tag-induced mortality in fish, identifying objectives of tagging programs and uses of angler-generated data. As part of a solution to help track and identify programs, workgroup participants collaborated on the development of a prototype Internet-based tag registry which would allow managers and volunteer taggers to share information regarding tagging programs, including tag colors used, tag number sequences, species tagged, geographic coverage and other facets of programs. In addition to improving current programs, such a system can aid in guiding future programs by helping groups to contact the appropriate management agencies, learn about state/federal laws and guidelines regarding citizen-based tagging, consider all of the important facets about tagging programs, and register their tags if they proceed. Future issues which need to be addressed include refining and implementing the tag registry, training of volunteer taggers, and providing proper guidance to groups considering initiating new programs to ensure that they contribute to management efforts.

OPEN DISCUSSION:

Means to a "quality" striped bass fishery

February 18, 1999
Baltimore, Maryland

Mr. John Field, Anadromous Species Coordinator with the Atlantic States Marine Fisheries Commission (ASMFC), opened the discussion by describing the issue of "quality" striped bass fisheries. He indicated that the ASMFC Striped Bass Management Board had recently asked the Striped Bass Citizens Advisory Panel to define criteria for high quality recreational and commercial fisheries, and thus help shape future interstate management for the species. This charge had led to various viewpoints and definitions within the Advisory Panel, and Mr. Field felt that this open discussion could help clarify viewpoints, initiate discussions between industry leaders, and aid in consensus building.

Mr. Fred Schwab from the ASMFC Advisory Panel indicated that there is a lack of large to medium sized fish in Long Island sound throughout the fishing season, and this demonstrates problems with the current coastal fishery.

Dr. Victor Crecco from Connecticut Department of Environmental Protection indicated that Connecticut volunteer angler logbooks show increasing and high numbers of striped bass over 40. Mr. Schwab suggested that bait fishers are getting a disproportionate number of large fish, and this is skewing some reports.

Mike Burke from the ASMFC Advisory Panel said there is a wide variety of anglers in New Jersey, and that a quality fishery would accommodate all of them. Specifically, certain subsistence fishers wanted good chances of catching a single small fish for consumption. Other fishers, primarily those belonging to angling clubs, wanted to see larger numbers of big fish.

Gil Pope from the Advisory Panel indicated that Massachusetts and Rhode Island hook & line commercial quotas were filled in record time in 1997: approximately 9 weeks. This suggested good numbers of 36 fish, which were just above the legal minimum size in those fisheries. He indicated that ASMFC should figure out what a big fish means to various fishers as a first step to achieving a quality fishery.

One participant said that Massachusetts's anglers are confused about ASMFC goals and where the current management program is headed.

Brad Burns from Coastal Conservation Association - Maine said the average New England angler is alienated by the dual size limit standard in Amendment 5. These users won't come to most public hearings, but represent a large number of anglers who would like to see a greater opportunity to harvest fish for the table.

Mr. Pope suggested that ASMFC should explore opinions on the smallest acceptable size limit for striped bass fisheries. This would indicate the threshold at which people would regularly throw back legal fish. He also said that fishery managers should consider how accommodating one user group may harm or hinder another.

Rip Cunningham from *Saltwater Sportsman* magazine suggested that a quality fishery is exposure to the natural age structure in the population, with anglers having a good possibility to harvest one or more fish.

Ed O'Brien from the ASMFC Advisory Panel indicated that drastic increases in coastal striped bass catch, as per the Marine Recreational Fisheries Statistics Survey (MRFSS), don't jibe with anglers complaints about scarcity of larger fish.   He added that managers could pursue ways to allow subsistence fisherman to regularly harvest smaller fish along the coast.

Mr. Pope suggested that a quality commercial fishery is characterized by high and stable wholesale prices, and possibly higher quotas in some areas.

One participant said that management agencies are lacking a lot of data on how angler behavior changes with changing regulations and stock size. Lower size limits or other liberalized regulations might encourage newcomers in the fishery, who have different conservation ethics than more veteran anglers.

Other audience members said that quality fishery definitions or acceptably safe size limits might change by geographic areas.

ROUNDTABLE DISCUSSION:

Misconceptions and communication problems between scientists, resource managers, and user groups

Moderated and summarized by
Anne Lange, National Marine Fisheries Service

The roundtable discussion centered on five questions regarding communication and information gaps in interstate striped bass management. These questions were:

1. Have biologists made a convincing case that Atlantic striped bass biomass is restored to the ASMFC benchmark levels of the 1960s? If not, what is lacking in terms of scientific proof or fish abundance?

2. In your opinion, what are the remaining research priorities for striped bass biologists and managers?

3. How are the fishermen or other user groups you interact with obtaining their information on striped bass biology and management? How influential are these media?

4. How could trust be enhanced between user groups and the research or management communities?

5. What is the most important factor compromising successful management of striped bass today?

Panel members represented the recreational, commercial and conservation sectors as well as the scientific and management communities. One representative of each constituent sector provided a summary of that group's perspective on the questions above. Following initial presentations, the panel members and the audience provided additional perspectives on the issues. Panel members were:

Recreational	Rip Cunningham, (presenter) *Saltwater Sportsman* magazine
Recreational	Fred Schwab, chair, ASMFC Citizens Advisory Panel
Commercial	Gil Pope (presenter), ASMFC Citizens Advisory Panel
Commercial	Niels Moore, National Fisheries Institute
Conservation	Bill Goldsborough (presenter), Chesapeake Bay Foundation
Technical Committee	Gary Shepherd, National Marine Fisheries Service
Science/management	Paul Diodati, Massachusetts Division of Marine Fisheries
Science/management	Ginny Fay, National Marine Fisheries Service

<u>Conservation:</u>
Bill Goldsborough lead the discussion by acknowledging that there are legitimate differences in opinions on the status of striped bass. Conservation is important to all sectors and is also a concern relative to allocations among states and user groups. He noted a concern that too often

groups will try to use problems with conservation to support their cause/perspective, stating that their approach is more conservation minded. He felt that it is important for managers to be specific in defining allocation versus conservation issues, and that users, especially the press, must make a concerted effort to distinguish between these issues.

In addressing the five focal questions, Mr. Goldsborough responded as follows:

1. YES, in his opinion, as phrased, the biologists have made a convincing case. Total biomass is restored. But, in layman's terms, biomass isn't the issue. Science needs to address concerns about the age/size structure, and should note that some fisheries may take longer, because of historic size structures, to be fully restored in terms of sizes. More attention should also be paid to striped bass life history and how it affects management. Producer areas are different than the coastal areas with regard to availability of large fish and management can only go so far in making consistent measures in all areas. Use of a single size ignores the fact that over half of the Chesapeake Bay fish leave the Bay by 18".

2. Mr. Goldsborough felt that research priorities should include improvement of current estimates of age specific growth/migration/mortality. Scientists should also emphasize that while catches in the producer areas may now be approaching levels of the 1970s, we are now taking 18" versus 12" fish, and are still fishing below target fishing mortality rates (F's).

4. Trust can be enhanced in a number of ways. The ASMFC Striped Bass Technical Committee should provide one page summaries of all its results, in layman's terms. The Board should summarize and distribute all Board decisions with explanations of why the decisions were made. The press needs to get the complete story and to report it truthfully and carefully. As an aside, he also suggested that ASMFC spend 10% of what is currently going toward striped bass assessments on habitat issues, which he feels are important in the continuing health of the stock.

5. Mr. Goldsborough stated that he felt there is significant misinformation being spread about the stock's status, though this may be innocent, the misinterpretation is passed on to readers of the fishing press. There needs to be more effort by biologists to explain the results and by the media to report it accurately.

Recreational:
Rip Cunningham noted that his comments were not necessarily representative of all recreational groups, but of a subset of individuals. Mr. Cunningham's response to the focus questions is summarized below:

1. Mr. Cunningham did not feel that there was a convincing case of restoration because recreational users don't use or understand spawning stock biomass (SSB). In fact, scientists have made a convincing case that it has NOT been restored since people who fished in 1960s notice the difference in the numbers and sizes of the fish they catch now versus then. The age composition is not the same and great numbers don't necessarily mean the stock is restored.

2. Mr. Cunningham stated that we need a better understanding of bycatch, and discard mortality by all the different user groups. This analysis should include gear/season/area evaluations, such as differences in hook mortality caused by circle versus barbless hooks. He indicated that fishery scientists should also investigate how to maintain a better forage base, since scientists are seeing smaller fish. Mr. Cunningham believed we have many striped bass in the population, but they need more to eat. He asked which will be the best management strategy: a high minimum size limit, a very low size limit, or a slot limit? How will these choices impact the population structure over the long-term? Recreational fishermen ask the same questions and have a great variety of answers. He said scientists and managers must try to determine how to evaluate and meet the best economic value over all sectors.

3. Most fishermen are getting their information from the media, and the media are probably more influential than they should be. People believe what they read and put more into it than they should. Much more care needs to be taken by the outdoor press in getting each story straight. Anglers also get information through their fishing clubs and organizations, the Internet and by word-of-mouth. There is a great deal of interest in getting information on what is happening with the fishery. There should also be a comprehensive public relations effort by ASMFC, possibly with a liaison working with regional outdoor writers to get the story out.

4-5. From the recreational point-of-view there is distrust. There is an impression of a commercial bias in the ASMFC decision-making process, with the commercial industry winning, and therefore recreational fishermen losing, the allocation battle. Public input is not taken into account. There seems to be elitism among managers who feel they know the answers of how to deal with the stock and they don't need public input. When recreational fishermen don't agree with decisions they think they just need to call ASMFC and ask for change. In reality, recreational fishermen can make their greatest impact at the state level. They don't realize that it is a coastwide effort and all states work to establish a compromise, so not all decisions are based strictly on science. Allocation is not just science. Some assume that all decisions against their perspective are due to the science input, and that notion needs to be corrected. When large volumes of input are ignored they feel that their needs are not being met. ASMFC needs to establish methods to better isolate science from management, and it may also be better to have others, besides the State directors, represent States interests on the Management Boards.

<u>Commercial:</u>
Mr. Pope stated that there should not be a problem with having to choose sides of the issues. Recreational and commercial interests are not totally different and their interests should not be considered mutually exclusive. His comments on the focal questions included:

1. No one really knows if the stock is really restored to 1960 levels since we don't have any accurate estimates of recreational landings from the 1960s, or even more recently. We need this information to make allocation decisions. If we are to believe one sides' recollections of historic fisheries, we must believe both sides (commercial and recreational). Massachusetts and Rhode Island filled their commercial quotas of large fish in less than 9 weeks, so how can it be that there aren't any large fish available as is being stated by many

recreational anglers? If the proportion of large fish in the population is not as high as before, and commercial quotas of these large fish can be taken in such a short period of time, doesn't that mean that the total population must be much larger than in the past?

2. Priorities in research should include studies on forage food, age structures, and whether or not striped bass are getting thinner for a given length than was seen in the past.

3. Mr. Pope said he deals with both commercial and recreational fishermen and most have very diverse views about the information they have gotten. Recreational fishermen seem to repeat information word-for-word from recreational magazines, and are often very critical of ASMFC. He said it was obvious from his readings of recreational letters on Addendum II that whoever informed them provided them with much misinformation. He was concerned with postcard or letter-writing campaigns to fishery managers because they are not at all informative. If individuals have views on an issue, they should send a letter stating those views rather than participate in mass mailings of generic postcards. The media provided misleading information about Addendum II management options: e.g., it was never stated in the magazine articles that in Chesapeake Bay, the large quota would be shared with recreational and commercial users. It was always stated as commercial quotas, leaving the impression that the recreational users were left out of the fishery, or received a much lower share of the catch. The magazines also omitted the point that the 2 fish-per-day at 28" recreational limit was the likely reason for any over harvest of large fish which may have occurred in 1997. The Advisory Panel (AP) was aware of this information but still voted for the less conservative option rather than the current plan which was eventually approved by the Management Board.

4. Trust could be enhanced by urging all parties to tell all the truth and not part truths. All meeting reports should be provided to state commissions so everyone knows all the facts, and when the press expresses its opinions it must be stated as such, and not implied that the opinion is fact. Every state should ensure that the striped bass AP has both recreational and commercial representation.

5. Exploitation of the recreational versus commercial allocation issue and misrepresentation of information to meet ones' own agenda and/or to maintain readership/membership compromises successful management. While most commercial users are not trying to eliminate recreational fisheries, it appears to some that recreational AP members want to eliminate the commercial industry. If we look at some of the historical data where recreational catches were very large, we have to acknowledge that the recreational fishery was at least as responsible for declines as was the commercial industry.

The remaining panelists provided additional perspectives relative to the five questions and to issues raised by the three presenters.

Paul Diodati indicated that scientists have proven the case that the stock is restored. If people aren't satisfied with the management strategy that has lead to the current status of the stock, what would they have preferred? Would it have been better to have left the fishery closed until the size structure was what some people want, or to have allowed the fishery to open as it has?

As far as bias between the recreational and commercial sectors and how/if it affects management decisions, we must recognize that ASMFC is addressing issues for fisheries from North Carolina to Maine, representing 15 states, and that the Technical Committee members are from those different states. The states have different fisheries, not just recreational and commercial, but also different fisheries within each. So it is hard to find bias when ASMFC Board members are trying to meet the needs of all states.

Mr. Diodati argued that outreach is important. Massachusetts has many public hearings and that should be done in other states as much as possible. This may be difficult since so many people and clubs are out there, and you really need to make an effort to get the word out when public meetings are held. Research needs include things like forage and diet, and the impacts of striped bass on the environment.

Ginny Fay agreed that there is a need to have better outreach. The NMFS Office of Intergovernmental and Recreational Fisheries was established, in part, to address this need for the federal government and is working to develop outreach programs coastwide and nationally.

Gary Shepherd addressed the issue from the assessment scientist's perspective. They provide scientific results and don't decide on the best allocation or management measures. In the assessment, the scientists account for the number of dead fish. Allocation is a management issue. Under the current management approach, striped bass is managed on a state-by-state basis rather than on a population level. Every time a regulation changes, reference points will also change. When the Technical Committee made a matrix of regulations implemented since 1982, it had to do it on a six-month basis since there were so many changes. This array of regulations makes it difficult to evaluate the impact of small regulatory changes on the total population. So they don't always have the exact answer to what-if questions posed by the public.

There is criticism by fishermen that scientists don't believe their observations, but they have to understand that it is difficult to translate anecdotal information into the assessment. Scientist do try to take into account all the information available when evaluating the results. One problem is that fishermen see only a portion of the total stock at any given time. What they see may not always be interpreted the same as the results of the assessment of the total stock would suggest. The long-term goal in managing the fishery is to get a stable population. Even then, there will be short-term fluctuations that managers will not be able to avoid. The objective of the scientists is to provide information to managers on changes in the population so the managers can take action to minimize the impact to user groups. It must be recognized that variations are not always caused by poor science and mismanagement. They are also hearing complaints about a lack of large, older fish. The problem is that there has not been 30 years of consistent recruitment events and low fishing mortality, which would result in old fish. The scientists need to communicate their findings to the public better so everyone will understand the justification for decisions the managers make.

Fred Schwab felt that, in general, recreational fishermen don't distrust the scientific community. He feels the perception problems are with the decision-makers, not the scientists. He noted that back in late 1970s the recreational community was in support of management of the fishery. The basis for declaring the stock recovered was that the abundance was restored to historic levels. He surf casts so it is difficult to get fish since he can only catch them when they come close to shore, and those size classes are not sufficiently represented in the population yet. He feels that we are about where we were in the early, but not late, 1960s, with lots of small but not many large fish. Fred also feels that the information available from ASMFC publications is very informative but doesn't know how this is distributed. It may help if ASMFC works to get these publications to some of the larger clubs. He also feels there is too much bickering between users, states and north versus south, over their respective shares of the resource. An important issue to stability of the striped bass fishery is habitat degradation which also impacts many other species. ASMFC should also develop management plans for the support (forage) species, and not just menhaden.

Niels Moore commented that Gil Pope had done a good job summarizing what he has heard from most of the commercial industry. Most of the problems with the fishery are associated with the constant arguing over who gets what. Hats off to the managers, scientists and all those involved in the process-- this is a success story! He asked that people look at a chart of landings distributions from recent years. As the stock has recovered, recreational catches have exploded. This is good for the recreational industry and recreational fishermen. If you look at commercial versus recreational, you see that recreational harvest accounts for significantly more than the commercial harvest. It is disturbing, based on the facts, that recreational anglers say that ASMFC has a commercial bias and that the recreational fishery is losing the battle of allocation. Why would they have that perception when it is obviously not true? Mr. Cunningham says he hears it from sportfishing constituents, but why? *Saltwater Sportsman* magazine recently stated that sport fishermen have been kicked in the teeth... by ASMFC and its management decisions. Anglers are unduly influenced by reports of what is happening in Maryland and Massachusetts Mr. Moore believed that outdoor writers are often the source of misinformation, and the commercial industry feels that it is important that the truth gets out. Opinions must be identified as such in the media.

Gary Shepherd read a summary about the controversy regarding striped bass, the great public interest, the misunderstanding about what conservation is, the need to maintain and restore the stock and then identified the source as a report from the first ASMFC meeting in 1942. The report also speculated as to whether an increase to a 16" minimum size was not enough or too much.

Bill Goldsborough felt that decisions must incorporate the views of scientists but also the fishermen. If either side dominates management it is not good.

Other issues or viewpoints voiced by the attendees included:

People should realize that the ASMFC process is not based solely on counting volumes of correspondence or public hearing attendees, as expected when large numbers of post cards are submitted to advance a particular viewpoint. There are many nonharvesting consumers (i.e., seafood purchasers) who may not express any interest in regulations per se, but still have rights to access the resource through the market. The management process must consider their "silent" voice as well.

Fishery managers should try to ensure that the facts about the status of the striped bass stocks and management decisions are distributed to the fishing public, and ASMFC does have a responsibility for outreach. However, the question was raised about whether the ASMFC should be responsible for all distribution of the information. Some responsibility could also fall to the individual states to keep their citizens informed.

ASMFC is an organization of states. Its role is to deal with coastwide issues and to agree to enforce what is needed on that basis, but one participant felt it is up to the states to determine how to allocate the resource within their own jurisdiction.

The stock is sufficiently restored, but everyone must realize that it will take time for the fish to grow to the full size/age range.

Proper management of striped bass in the Exclusive Economic Zone (EEZ) is a contentious issue. There appears to be no biological reason to maintain the current possession ban in the EEZ, but there are different issues,which need to be addressed.

The stock is recovered but the fishery is not, in that not every component or traditional fishery is operating at what they may consider their optimal or quality level.

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