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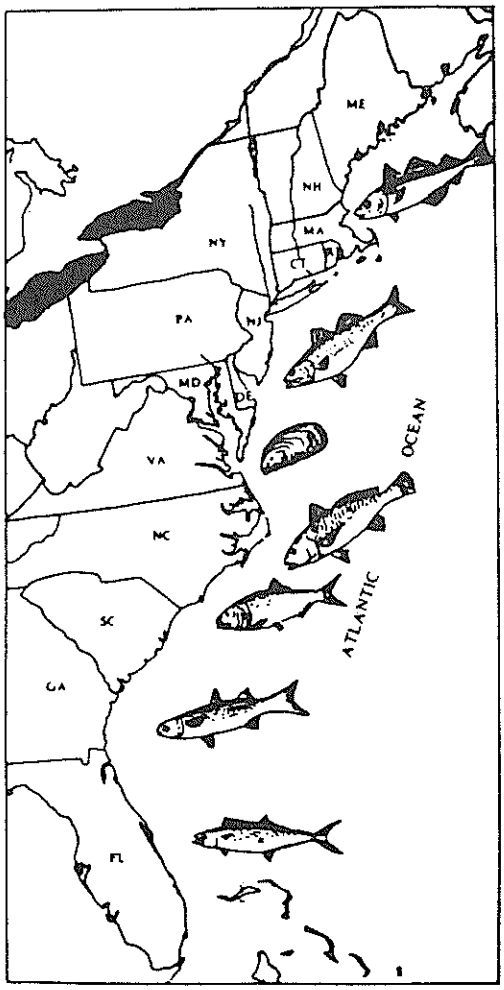

RECOMMENDATIONS CONCERNING THE STRIPED BASS RESTORATION PROGRAM

April 1987

THIS PROJECT WAS CONDUCTED IN
COOPERATION WITH THE U.S. FISH AND
WILDLIFE SERVICE, AND PARTIALLY
FUNDED BY FEDERAL AID IN SPORT FISH
RESTORATION ADMINISTRATIVE FUNDS.

Recommendations

Concerning the Striped Bass Restoration Program

for the Atlantic Coast with Emphasis on Chesapeake Bay

Report from the Technical Advisory Committee

to the

Striped Bass Stocking Subcommittee

of the Atlantic States Marine Fisheries Commission

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1. That striped bass tested and proven to be carriers of the IPN virus not be stocked into natural waters and especially not into waters with salmonids.

2. That additional research be conducted to determine the pathogenicity of the IPN virus isolated from striped bass to other warmwater and marine species, i.e., flounder, menhaden, shad, largemouth bass, catfish.

3. That Maryland striped bass reared in hatcheries be screened for IPN virus before being returned to Chesapeake Bay.

3 4. That researchers and managers fully review the known facts about the pathogenicity and life history of suspected disease organisms in known hosts before attributing loss of fish to the presence of that organism in new hosts.

Guidelines

Recommendations for a Tagging Program:

1. That if fish are to be stocked in coastal waters a sufficient number should be marked to allow determination of survival and percentage of contribution to natural stocks.

2. That binary coded wire tags be used to mark fish stocked in Chesapeake Bay. are the preferred means of marking hatchery reared fish int. coastal waters

3. That all fish should be marked if 1 million or less are stocked.

4. That if more than 1 million fish are to be stocked then the percentage to be marked should be calculated based on the number of fish released and the estimated number in the natural stock.

5. That tag codes should contain information sufficient to identify each lot of fish stocked.

Guidelines

Recommendations for an Evaluation Program for Permanently Marked Fish and on When to Cease Stocking:

1. Continue the stocking and evaluation program for 9 years to allow maturation and return of adult females, from three year classes.

2. Continue to conduct research to determine limiting factors affecting recruitment. This research should not be contingent upon the success or failure of the hatchery program.

3. Terminate stocking if restoration is successful as judged by return of Y-O-Y indexes for a period of 3 years to levels determined acceptable by each region, and ratio of marked hatchery fish to non-marked recruited fish declines.

4. Terminate stocking if marked and stocked fish fail to return as brood fish.

5. Terminate restoration program if fish return as brood fish but progeny fail to survive due to environmental conditions in nursery grounds.

Guidelines for
~~Recommendations to~~ Maintain Genetic Integrity:

1. Genetic integrity of Atlantic coast striped bass should be maintained within river basins.

2. Only progeny from native brood stock, when available, should be stocked in river basins and coastal waters.

3. Progeny from brood stock from adjacent rivers or hydrologically similar systems should be used if native brood stock do not exist.

4. Hybrids should be restricted to inland freshwater reservoirs or to other systems in which escapement and reproduction can, and will, be controlled.

5. Neither striped bass nor hybrids should be stocked in coastal or inland waters without notification and approval of the proper and official state fishery agencies.

Guidelines
~~Recommendations for Size, Source, and Time of~~ Stocking:

1. That stocking of hatchery-reared fish should be recognized as only one tool available to resource managers and that the appropriateness of this tool will vary with circumstances.

2. In areas without natural reproduction, stock ~~either~~ phase I ~~or phase II fish and tag a percentage of phase II fish~~ and tag.

3. ~~In areas with~~ natural reproduction, ~~stock phase II fish after establishment of juvenile~~ index and all stocked fish should be marked.

4. Stock phase II fish ~~in~~ the fall when water temperature is approximately 10 - 15°C.

5. ~~Do not~~ stock fish that would compromise the genetic integrity of native stocks.

Either phase I or II fish are acceptable for stocking but they must be marked (see previous statement)

Guidelines to Insure State Programs are Non-conflicting:

1. Programs among and within states should be coordinated by adhering to recommendations made by this Committee.

2. Each state should take appropriate regulatory or statutory action to insure that striped bass stocked by private entities into coastal waters be in accordance with these guidelines.

Guidelines for an Evaluation Program:

1. That in order to avoid duplication, tagging programs involving potentially migratory stocks of striped bass be coordinated on a coast-wide basis.

2. That a central data base be established for all tags used in coastal stocking programs.

3. That coded wire tags be placed only in the left operculum.

4. That an evaluation program be established as part of any stocking program and that the evaluation program be budgeted at a value equal to that of the stocking program.

History and Charges

The Technical Advisory Committee (TAC) was established by the Striped Bass Stocking Subcommittee of the Atlantic State Marine Fisheries Commission. Members were selected to represent Atlantic Coast states from Maine to North Carolina, the migratory range of striped bass along the East Coast. Two employees of the U.S. Fish and Wildlife Service were also included on the Technical Advisory Committee. Advisors were consulted from state and Federal agencies, public and private organizations.

The Committee met three times to discuss the six charges initially assigned during the meeting on 19-20 March 1985 at Annapolis, Maryland and the seventh charge (number 3-B below) assigned during the meeting at Annapolis, Maryland, 29-30 October 1985. The third meeting was held at the Virginia Institute of Marine Science in Gloucester, Virginia on 4-5 March 1986. The seven charges are as follows:

1. That the Committee should develop a system for inspecting the present and planned stocking programs to ensure the health of eggs and larvae and to protect against the transport of harmful diseases.

2. That the Committee should review the tagging programs on stocked fish and make recommendations on a coordinated tagging program for all stocked fish.

3-A. That the Committee develop an evaluation program for the present restoration programs throughout the range of Atlantic migratory stocks and make recommendations as to when the stocking should be stopped, whether the stocking programs are successful or not.

3-B. That the Committee should review the stocking practices of both public and private entities to determine if they threaten the integrity of native striped bass along the Atlantic Coast.

4. That the Committee should review the strategies for stocking in various systems and make recommendations as to strains of fish to be used, phase of young to be stocked and timing of stockings.

5. That the Committee should review the present stocking programs in each state to ensure that state programs are non-conflicting on a coast-wide basis.

6. That the Committee develop a system that would evaluate the contribution the stocked fish will make to the brood stock that will eventually spawn in the wild. This system would also include marking and tagging methods.

Charge 1.

That the Committee should develop a system for inspecting the present and planned stocking programs to ensure the health of eggs and larvae and to protect against the transport of harmful diseases.

Problem 1.

During the March meeting of TAC, concern was expressed that we develop a system for inspecting and certifying the disease classification of all striped bass eggs and larvae to be moved through the hatchery program. Disease control and certification procedures are much better developed for coldwater hatcheries than for warmwater hatcheries. Striped bass are typically cultured in warmwater facilities and exposed to the same pathogens common to warmwater fish.

With the discovery of the IPN virus (that produces infectious pancreatic necrosis in susceptible hosts) in striped bass from Chesapeake Bay, this seemed to be the most threatening pathogen. TAC sought information from the experts in fish health research and management and attempted to answer the following questions to provide an analysis of risk:

1. What is the IPN virus?

2. Is IPN virus the same in all species of fish?

3. Is IPN virus lethal to all fish?

4. At what age are fish killed by the virus?

5. Would fish exposed to the pathogen, but apparently not affected, be carriers?

6. Can the IPN virus from striped bass be transmitted to other warmwater species? To salmonids?

7. Does IPN kill striped bass?

Status 1.

There are several different serological types or strains of IPN virus. IPN isolated from Chesapeake Bay striped bass was lethal to brook trout. IPN is typically a problem only in salmonids under 80 days old. However, stress has reportedly induced a secondary infection in adult salmonids.

IPN virus was found in 1984 in striped bass collected from Chesapeake Bay and in moribund juvenile fish from the Crane Aquaculture facility of Baltimore Gas and Electric Company. Based on a similar loss pattern in 1984, IPN has not been ruled out as cause of mortality in a hatchery in New York, but the IPN virus was not confirmed.

All U.S.F.W.S. hatcheries in the southeast with striped bass were tested in 1985 for the presence of the IPN virus. Techniques employed were the same as those listed in "Salmonid Fish Health Protection Program for the Fish and Wildlife Service". Spleen and kidney homogenates were inoculated on CHSE culture tubes and dishes. Cultures were incubated and examined for the presence of the virus. Approximately 300 fish from five hatcheries (60 fish/hatchery) were examined for IPN with negative results.

Gametes (eggs and sperm) were collected from all striped bass spawned in Maryland in 1985 and screened for the presence of IPN by Dr. Frank Hetrick, University of Maryland. Approximately 65 samples from fish spawned in hatcheries were screened; plus 50 samples of sperm and 30 samples of eggs taken from wild fish were screened. No evidence of IPN was found in these approximately 145 samples checked in 1985. The virus has never been isolated from eggs, but has been detected in some sperm samples.

In controlled laboratory tests at the National Fish Health Laboratory, Leetown, West Virginia and at the University of Maryland, researchers have been unable to kill striped bass by exposure to IPN or by injection with IPN. Researchers have been unable to produce IPN carriers by exposing striped bass to IPN in the water. Striped bass of 30, 60, and 90 days of age became carriers, but did not die when inoculated with IPN virus. Similarly, the IPN virus isolated from flounder will not kill salmonids even when injected; however, salmonids will form antibodies to the virus. IPN appears to be a cosmopolitan organism found in watersheds throughout the range of striped bass, but apparently causes little, if any, harm to striped bass.

Recommendations 1.

1. That striped bass tested and proven to be carriers of the IPN virus not be stocked into natural waters and especially not into waters with salmonids.

2. That additional research be conducted to determine the pathogenicity of the IPN virus isolated from striped bass to other warmwater and marine species, i.e., flounder, menhaden, shad, largemouth bass, catfish.

3. That Maryland striped bass reared in hatcheries be screened for IPN virus before being returned to Chesapeake Bay.

4. That researchers and managers fully review the known facts about the pathogenicity and life history of suspected disease organisms in known hosts before attributing loss of fish to the presence of that organism in new hosts.

5. Additional recommendations may be made by this committee based upon the results of this year's screening program.

Charge 2.

That the Committee should review the tagging programs for stocked fish and make recommendations on a coordinated tagging program for all stocked striped bass.

Problem 2.

In any system where hatchery-reared fish are to be released to enhance natural stocks, there needs to be some way to distinguish between hatchery-reared and wild fish. Problems are compounded in large open systems such as the Chesapeake Bay. Fish moving through the Bay may cross several state jurisdictions and as migratory stocks range up and down the Atlantic Coast. A coordinated tagging and tag recovery system could provide definitive statements on the survival, movement, and capture of hatchery-reared striped bass. Such a program would provide concrete evidence as to the effectiveness of stocking efforts in Chesapeake Bay and along the Atlantic Coast.

Status 2.

Various tagging methods are currently used successfully to mark limited numbers of hatchery-reared striped bass. The method of choice depends upon the number of fish to be tagged, the method of tag retrieval, the longevity of the mark on fish, the overall cost of operation, and on the objectives of the tagging program. A summary of the methods used in the Atlantic Coast states is found in Appendix I.

The Committee determined the objectives of the tagging program for Chesapeake Bay were two-fold--short term and long term. The short term objective was to determine the percent of stocked fish in the young-of-the-year index. Long term (5 years, plus) objectives were (1) to determine the contribution of hatchery fish to the spawning population and (2) to study the migratory patterns of stocked fish.

There appears to be only one mark, binary coded wire tags, that would likely be retained in striped bass to support studies up to or exceeding 5 years. The major objections to use of this tag is that it cannot be recognized by the public and the initial cost of the tag injection and detection equipment.

With the moratorium on the catch of striped bass in Maryland, the return of tags by commercial and sport fishermen is not legally possible. The tag assessment program must be conducted by Maryland DNR personnel, by contractors working for DNR, or through a joint effort with other agencies and states.

The binary coded wire tag would allow identification of groups of fish reared in various hatcheries and released at different points in the Chesapeake Bay. Sufficient codes are available on the binary tags to insure that no redundant tags are used in subsequent years or by other agencies or states marking

and releasing striped bass along the Atlantic Coast. The number of fish to be tagged is a function of the number of fish in the system and the number of fish to be stocked. The cost of tagging fish is far lower than the cost of recapturing fish. Sufficient quantities of fish must be tagged to insure a statistically valid number of recaptures. Dr. Phil Goodyear, U.S. Fish and Wildlife Service, Leetown, West Virginia, suggested that if the population of natural stocks is 5-10 million young-of-the-year fish and if 1 million hatchery-reared fish were to be stocked, then all fish released should be marked. However, if 2 million fish were released then it would not be necessary to mark all fish, but only a percentage of them. The actual number of fish to be marked is dependent upon the frequency of the marked fish in the population and the sampling effort available.

Recommendations 2.

1. That if fish are to be stocked in coastal waters a sufficient number should be marked to allow determination of survival and percentage of contribution to natural stocks.

2. That binary coded wire tags be used to mark fish stocked in Chesapeake Bay.

3. That all fish should be marked if 1 million or less are stocked.

4. That if more than 1 million fish are to be stocked then the percentage to be marked should be calculated based on the number of fish released and the estimated number in the natural stock.

5. That tag codes should contain information sufficient to identify each lot of fish stocked.

Charge 3-A.

That the Committee develop an evaluation program for the present restoration programs throughout the range of Atlantic migratory stocks and make recommendations as to when the stocking should be stopped, whether the stocking programs are successful or not.

Problem 3-A.

Much of the early opposition to a hatchery stocking program for the Chesapeake Bay was based on the failure of hatchery programs established in the late 1800s along the Atlantic Coast. There was no assurance that success in 1985 would be any easier to achieve than it was in 1885. In those earlier programs, striped bass fry and other species were stocked into coastal waters for several years, yet produced no apparent changes in the commercial or sport harvest.

Status 3-A.

In recent years, very successful striped bass fisheries have been established and maintained in inland reservoirs through use of hatchery-reared striped bass. In most cases, striped bass have been stocked as 35- to 45-day-old fingerlings (phase I fish). However, in selected cases larger 6- to 8-month-old (phase II fish) striped bass have been stocked into reservoirs and coastal estuarine areas. Differential survival of phase I and phase II fish has not been well documented in the literature, but some states, i.e., Alabama, California and North Carolina, have routinely stocked phase II fish. During the period 1967-1979, Alabama stocked nearly 4 million phase I fish into coastal waters and from 1981 through 1985, they stocked approximately 40,000 phase II striped bass. Reported catches by striped bass fishermen and tag returns increased 2 to 3 fold when an average of 8,000 phase II fish were stocked per year as compared to returns when an average of 333,000 phase I fish were stocked each year. Similar positive results have been reported from California after stocking yearling fish. North Carolina now contributes to a successful fishery in Albemarle Sound by stocking phase II fish. Some fish tagged and stocked in 1979 have returned to the spawning grounds.

The success of the coastal stocking programs in Alabama, California and North Carolina, as well as those in inland reservoirs of other states, have been proven by the popularity of the program with sport fishermen. With the moratorium on striped bass fishing in Chesapeake Bay, methods other than appearance in the creel or commercial catch must be used to evaluate the success of the stocking program. TAC considered four evaluation criteria, as follows, that might indicate restoration, or failure of restoration, of striped bass in Chesapeake Bay and contributions of the stocked fish:

1. Return of marked and stocked striped bass to the spawning grounds as brood fish.

2. Change or failure of change in Y-O-Y index.

3. Changes in the viability of eggs and larvae.

4. Changes in the ratio of juvenile marked hatchery fish to unmarked fish in collections made by beach seine, gill nets, pound nets and electrofishing.

The restoration program would be considered successful if three successive year classes of hatchery-reared and stocked fish were to return to the spawning grounds and produce viable fry. Conversely, it would be considered a failure if stocked fish failed to return as brood fish or if progeny of those fish failed to survive. Since females commonly mature when they are 5 or 6 years old, it would require a minimum of 5 or 6 years for return of the first year class stocked. An additional 2 years would be required for the next two year-classes. A minimum of 8 to 9 years

would be required to evaluate the success or failure of the stocked fish as brood fish.

The restoration will only be fully successful if progeny of the brood fish survive to produce the next generation. If environmental conditions are unsuitable for survival of fry, but suitable for fingerlings, then the stocking program will be judged a success, but the full restoration program will be judged a failure. If stocked fish survive and return as brood fish, but do not produce the next generation, then this would indicate that a mitigation program could successfully support a put-grow-and-take fishery.

Recommendations 3-A:

1. Continue the stocking and evaluation program for 9 years to allow maturation and return of adult females from three year-classes.

2. Continue to conduct research to determine limiting factors affecting recruitment. This research should not be contingent upon the success or failure of the hatchery program.

3. Terminate stocking if restoration is successful as judged by return of Y-O-Y indexes for a period of 3 years to levels determined acceptable by each region, and ratio of marked hatchery fish to non-marked recruited fish declines.

4. Terminate stocking if marked and stocked fish fail to return as brood fish.

5. Terminate restoration program if fish return as brood fish but progeny fail to survive due to environmental conditions in nursery grounds.

Charge 3-B.

That the Committee should review the stocking practices of both public and private entities to determine if they threaten the integrity of native striped bass along the Atlantic Coast.

Problem 3-B.

Striped bass introduced into new habitats may compete with native fish for resources or may spawn with the native fish and alter genetic integrity.

Status 3-B.

Striped bass from Chesapeake Bay are phenotypically different from those from further north, for example the Hudson River, and from those further south as in North and South Carolina. Eggs from these fish have a small oil globule as compared to those from Chesapeake Bay. Some other much more subtle genetic differences have been documented and still others

likely exist. The variation in traits and characteristics of striped bass along the Atlantic Coast may well reflect their adaptation to unique environmental conditions.

Striped bass and hybrids have been and continue to be introduced into coastal waters and drainages along the Gulf Coast formerly inhabited by the Gulf Coast strain of striped bass. Introductions of these non-native fish have placed additional pressures on the native striped bass and complicated restoration efforts. Similar hatchery programs for salmon on the West Coast have increased competition that native fish face for resources, spawning sites, and nursery space in their historic range. Only limited numbers of non-native striped bass and hybrids have been released along the Atlantic Coast. The Committee has found no documented evidence that the small numbers of non-native fish released to date have changed the genetic integrity of native stocks, but additional releases of non-native fish are not recommended.

Aquaculture is an expanding giant in the U.S. and there is growing interest in commercial production of striped bass and hybrids. Similarly, many commercial and sport fishermen support introductions of hatchery-reared fish even on a put-grow-and-take basis. On occasion non-native fish may have been released into coastal waters by both private or public groups. The Committee considered the pros and cons of such releases and evaluated their impact on native striped bass.

Recommendations 3-B:

1. Genetic integrity of Atlantic coast striped bass should be maintained within river basins.

2. Only progeny from native brood stock, when available, should be stocked in river basins and coastal waters.

3. Progeny from brood stock from adjacent rivers or hydrologically similar systems should be used if native brood stock do not exist.

4. Hybrids should be restricted to inland freshwater reservoirs or to other systems in which escapement and reproduction can, and will, be controlled.

5. Neither striped bass nor hybrids should be stocked in coastal or inland waters without notification and approval of the proper and official state fishery agencies.

Charge 4.

The Committee should review the strategies for stocking in various systems and make recommendations as to strains of fish to be used, phase of young to be stocked, and timing of stockings.

Problem 4.

Several Atlantic Coast states currently have, or have plans for, stocking programs for striped bass in coastal waters. Since fish stocked into an open system are free to migrate along the coast, there is a potential for activities in one state to interfere with or be counter productive to actions in other states. There also exists the possibility that strains of fish stocked into an area with native fish might irreversibly alter the gene pool of resident stocks. Both the size of fish stocked and the time when fish are stocked may affect survival of striped bass and success of the hatchery program.

Status 4.

Stocking programs for striped bass either in existence or in the planning stage have one of three goals along the Atlantic Coast from Maine to North Carolina. These goals are (1) to restore depleted striped bass stocks, (2) to augment existing stocks, or (3) to establish stocks to support special programs. The Committee earlier recommended (Charge 3-B.) stocking practices to protect native brood stock and addressed the strain of fish to be stocked.

The size (fry, phase I or phase II) of fish to be stocked and the timing of their release can be adjusted to maximize survival and to minimize conflict with current population survey programs. For example, there is little evidence that stocking fry into coastal waters has ever produced a significant change in the fishery. Similarly, while some phase I fish have survived when stocked in coastal waters, experience from the Gulf Coast states indicates that phase II fish were more readily recruited into the fishery. Y-O-Y indexes used in several coastal states appear to be the best indicators of initial population size for a given year class. Releasing hatchery-reared fish into waters with similar age and size wild fish compromises the Y-O-Y index and all subsequent estimates of population size unless hatchery-reared fish are marked and distinguishable from wild fish. In California, phase II fish are maintained in hatcheries through the winter and released as yearlings in the spring. The number of fish that can be reared in a given hatchery declines as the size interval increases. Conversely, the quality, expected survival, and cost of fish increases as size increases from fry to phase I, to phase II, and to yearlings. The evidence examined to date suggests that the phase II fish is the most cost-efficient fish to rear, mark, release, and evaluate in systems with natural reproduction.

Recommendations 4:

1. That stocking of hatchery-reared fish should be recognized as only one tool available to resource managers and that the appropriateness of this tool will vary with cirumstances.

2. In areas without natural reproduction, stock either phase I or phase II fish and tag a percentage of phase II fish.

3. In areas with natural reproduction, stock phase II fish after establishment of juvenile index and all stocked fish should be marked.

4. Stock phase II fish in the fall when water temperature is approximately 10 - 15°C.

5. Do not stock fish that would compromise the genetic integrity of native stocks.

Charge 5.

That the Committee should review the present stocking programs in each state to ensure that state programs are non-conflicting on a coast-wide basis.

Problem 5.

Anadromous striped bass do not observe state or political boundaries and may migrate from inland to coastal waters and along the Atlantic Coast. Fish stocked by one state could enter the waters of neighboring states, compromise field data, and adversely affect management decisions and actions.

Status 5.

Several states along the Atlantic Coast stock striped bass in coastal waters or into riverine systems draining into coastal waters (Appendix II). In 1985 approximately 46,000 phase II fish from the Hudson River strain were stocked into public waters of the state of Maine to support the sport fishery. No fish were tagged.

Brood fish taken from the Hudson River in New York have been used to produce progeny, reared to 3 inches in an intensive culture system, then were tagged and released back into the river. The stocking program began in 1983 as mitigation for a power plant and in support of the sport fishery. In 1985, 14 females produced 14,341,000 eggs which hatched to produce 6,564,000 fry. A total of 284,578 3-inch fish were tagged with the binary coded wire tag placed in the cheek muscle and released into the Hudson River in 1985.

Phase I and phase II fish from the Brookneal hatchery in Virginia were stocked in New Jersey in 1984, 1985, and 1986. Fish were marked by fin clipping. The stocking program was designed to create a recreational fishery based on non-migratory stocks.

No striped bass have been stocked in coastal waters of Delaware at this time. The state planned to use brood stock taken from the Delaware River to produce progeny for stocking back into

the river. A private hatchery operated in Delaware and gave the State hybrid striped bass to stock in inland lakes.

Pennsylvania stocked hybrids in the Susquehanna River, but ceased to do so at the request of Maryland. Pennsylvania would stock non-hybrid stripers in the Susquehanna River if Maryland supplied them.

Maryland has stocked both striped bass and hybrids as phase I fish and fry in the past. In 1985, native brood stock were used to produce 9 million fry shipped to cooperating Federal and private hatcheries to be reared as phase II fish and returned to the Bay. Additional fish were supplied to researchers working on Chesapeake Bay related problems. A total of 186,926 phase II fish were tagged with the binary coded wire tag placed in the cheek muscle. A total of 4,000 fish were double-marked with internal anchor tags and additional fish were marked by freeze branding and released from a private hatchery.

Approximately 256,000 phase I striped bass from the Brookneal Hatchery were stocked in the James River in 1985. No fish were marked. Fish were stocked above dams on the James River to serve as future brood stock. No fish were stocked below the dam into coastal waters.

North Carolina has had a large and active program of stocking striped bass in its waters since the 1970s. This was a cooperative program with the Fish and Wildlife Service using Federal hatcheries. Most of the fish were stocked in North Carolina's Albemarle Sound, although some were placed into North Carolina's coastal rivers. North Carolina received 60,000 fingerlings from the Fish and Wildlife Service for stocking in 1985. North Carolina expressed concern that the Maryland fish being shipped into North Carolina were not certified disease-free.

With the closure of the striped bass fishery in Maryland and reduction in catch along the Atlantic Coast, there has been increased interest in commercial culture of striped bass. Commercial culture to date has been primarily directed to research, mitigation or enhancement of natural stocks. However, there is at least one producer of food-sized striped bass in New York and others are evaluating the markets. Commercial production of striped bass now exists at some level in New York, Delaware, Maryland and North Carolina. Undoubtedly, other states will soon follow. The Committee recognizes the potential for farm raised fish to supply the market for striped bass and to reduce pressures on native populations. However, the Committee also recognizes the potential negative affects (altered gene pool, escapement of non-native fish, introduction of diseases, etc.) that might result from uncontrolled aquaculture. We therefore encourage controlled development of the aquaculture industry.

Evidence suggests that striped bass and hybrids have been stocked with little to no coordination among states and often within states. A diversity of tagging and marking methods have been used by some while no tags or marks are used by others.

Recommendations 5:

1. That programs among and within states be coordinated by adhering to recommendations made by this Committee.

2. That each state take appropriate regulatory or statutory action to insure that striped bass stocked by private entities into coastal waters be in accordance with recommendations of this Committee.

Charge 6.

That the Committee develop a system that would evaluate the contribution stocked fish will make to the brood stock that will eventaully spawn in the wild. This system would also include marking and tagging methods.

Problem 6.

Hatcheries and hatchery-reared fish are strong tools that can be used by managers to restore depleted stocks of native fish. However, without adequate evaluation there is no assurance, nor can there be any proof, that population recovery can be traced to stocked fish. Without an evaluation program, the degree of change and causes for changes in populations cannot be determined but are left to speculation.

Status 6.

The Committee earlier reviewed the needs for a tagging program and recommended that binary coded wire tags be placed in hatchery reared striped bass released as part of the Chesapeake Bay restoration program (see Charge 2). This is an internal tag not detectable by the public and requires special equipment and training for detection. Closure of the striped bass fishery in Maryland and restrictions in other states precludes the public from actively participating in an evaluation program even for externally visible tags.

An adequate tag evaluation program would provide data on the ratio of hatchery fish to wild fish and thus a basis to estimate population size in the Chesapeake Bay. Criteria considered useful in a tagging evaluation program would include any of the following:

1. Changes in the ratio of marked (hatchery-reared) to unmarked (natural reproduction) fish.

2. Changes in the proportion of tagged fish in samples of yearling stocks.

3. Retention of marked males in the Bay or tributaries draining into the Bay.

4. Return of marked females to area of release.

5. Presence on spawning grounds of adult fish marked as juveniles before release from hatcheries.

6. Evidence of spent (spawned) brood fish marked at stocking.

The Committee considered methods of capture and evaluation (seines, trawls, electrofishing, gill nets, dock side creel survey, fish market survey, etc.) and determined that we were unable to recommend a method or group of methods appropriate for all situations. Rather, the Committee recognized the need for flexibility in techniques to achieve common goals. A proper evaluation program is expected to require resources (funds and effort) equal to that of the hatchery production program. A central data repository, acquisition and processing center is needed to provide coordination among states and Federal agencies cooperatively working on Atlantic Coast migratory stocks. This central clearing house is needed to record and identify data from all tags, to insure that tags are not duplicative, and to accumulate data for proper analysis.

Recommendations 6:

1. That in order to avoid duplication, tagging programs involving potentially migratory stocks of striped bass be coordinated on a coast-wide basis.

2. The establishment of a central data base for all coded wire tags and in coastal stocking programs.

3. That coded wire tags be placed only in the left operculum.

4. That an evaluation program be established as part of any stocking program and that the evaluation program be budgeted at a value equal to that of the stocking program.

APPENDIX I

Summary of Marking and Tagging
Techniques Used for Hatchery-Reared
Striped Bass Stocked in Eastern Estuarine Rivers

Maryland marked fish with a freeze band in 1984. Approximately 30 fish per minute were marked and the freeze band was recognizable for about 6-12 months. Fish were surveyed by both Maryland Department of natural Resources personnel and by contractors working for the Department.

North Carolina stocked only phase II fish (fish reared in hatcheries for approximately 5 months and released in the fall as 15- to 25-cm fingerlings) and tagged 2-10% of those stocked. A crew of three tagged 1000 fish in 1.5 h with a cinch-up type tag placed below the dorsal fin. Fish as small as 7.5 cm were tagged in December and January with 24-h mortalities of about 1% when treated in a 3% salt solution. A reward system was used to encourage return of tags by the public. Data were gathered on movement of fish, exploitation rate of fish, and the type of bait used to capture fish. Tags used cost $650 per thousand.

Delaware used Peterson disc tags to conduct one tagging study in the 1970s. There were 194 recaptures over a 2-year period from 1534 fish tagged.

Pennsylvania has tagged no striped bass. All striped bass were released in inland waters.

New Jersey has used fin clips as marks on 2.5-inch and 5-inch fish. Salt and potassium permanganate were used prophylactically on fish marked with fin-clips in August. Handling losses were 16% for the small fish and 1% for 5-inch fish. The state conducted their own field assessment.

New York used the color coded wire tag placed in the nose of striped bass prior to 1984 and found tag retention was less than 60%. Striped bass were marked in 1984, 1985 and 1986 with the binary coded wire tag. This type of tag was used to mark 25,000,000 salmonids on the West coast. New York placed the tag in three locations in striped bass and found the nape location to have the highest retention rate. However, all fish tagged in 1985 and 1986 were tagged in the left operculum. Approximately 800 fish per hour were tagged with a machine costing $15,000. All fish were tagged and released at night into the Hudson River.

U.S. Fish and Wildlife Service investigated oxytetracycline (OTC) as a mark in striped bass at Panama City, Florida and the Southeastern Fish Cultural Laboratory, Marion, Alabama. OTC incorporated into the diet of striped bass was visible as a mark in the skeleton for only about 6 months. Microtaggants,

fluroscent pigments, and binary coded wire tags were also investigated for use on striped bass. Binary coded wire tags placed perpendicularly to the body axis in the cheek muscle of striped bass were retained at the 100% level for 6 months. This technique was also adopted by the state of California as their method of marking striped bass.

APPENDIX II

1985 Summary of Striped Bass Stocking Activities in Eastern Estuarine Rivers Maine to north Carolina

The States of Maine, New York, New Jersey, Maryland, Virginia and North Carolina had active stocking programs in 1985. The states of New Jersey, Pennsylvania and Delaware developed a striped bass restoration program for the Delaware River which could lead to stocking in that system in future years. Maine obtained about 47,000 Hudson River strain fish from the FWS for stocking into its Kennebec River. These fish were closely screened for diseases and certified disease-free before shipment into the State of Maine. The objective of the Maine program was to reestablish a self-sustaining population of striped bass to the Kennebec-Androcoggin estuarine complex.

The state of New Jersey had a program to establish a non-migratory strain of Brookneal striped bass in the Navesink River. In 1984, New Jersey stocked about 47,000 of these fish in the Navesink. In 1985, New Jersey stocked about 27,000 fingerlings and conducted investigations to check on survival and retention of these fish in the river. In 1986, about 25,000 fish were stocked. There was no screening process to detect pathogens in fish stocked in 1984, 1985 or 1986.

New York managed a hatchery on the Hudson River; the hatchery was established as a result of an agreement over a power plant settlement. The hatchery's goal was to produce and stock 600,000 fingerlings a year (approximately 1/20 of the Hudson River's natural production). All hatchery-reared fingerlings were marked with coded wire tags, fin-clipped and stocked in the Hudson in 1984.

Prior to 1984, the Pennsylvania Fish Commission stocked hybrid striped bass in the three lower impoundments (Conowingo Reservoir, Lake Aldred and Lake Clark) of the Susquehanna River. Some of these hybrids migrated downstream to the upper Chesapeake Bay. Pennsylvania ceased stocking hybrids into the Conowingo Reservoir when they became aware of the potential conflicts with the striped bass restoration program for the Chesapeake Bay. In 1986, a total of 65,650 phase I hybrids, if available, will be stocked into Aldred, Clark and Conewago Lakes. The latter lake is located on a tributary to the Susquehanna. In 1985, a total of 58,700 phase I hybrids and 2,500 yearling hybrids were stocked into Nockamixon, Wallenpaupak and Blue Marsh Lakes on the Delaware River. In 1986, a total of 50,800 phase I hybrids were stocked into these same impoundments. In 1985, 117,301 phase I purebred stripers were stocked into Lake Raystown, located on a tributary to the Susquehanna. In 1986, a total of about 134,000 phase I purebreds were stocked into Lake Raystown and Conowingo Reservoir.

Maryland and Virginia had a large cooperative program with the FWS planned for 1985. Virginia later decided to not actively pursue the program in 1985, but did sign an agreement for 1986. Historically, striped bass of the Brookneal strain have been stocked into the James River. However, Virginia plans to use wild brood fish to produce fingerlings to be stocked in marine waters.

Maryland operated its own state hatchery and planned to build a second state hatchery for striped bass. The goal of the state program was to supplement the striped bass spawning stocks. Other small hatcheries were operated by three utility companies, several towns, a private contractor and the University of Maryland. The goals of these hatchery programs within the state were unclear.

Fish and Wildlife Service supplemented the Maryland program by accepting Maryland striped bass fry for grow-out in its own hatcheries. Several hatcheries in the Northeast and Southeast regions received large numbers of fry from wild Maryland fish spawned in Maryland hatcheries. These fry were screened for IPN before being shipped, but were not certified disease-free. Phase II fish were shipped from the Federal hatcheries back to Maryland, tagged and stocked in the fall.

A stocking program for striped bass was begun in 1979 in North Carolina. Phase II fish were stocked in streams with natural reproduction where Y-O-Y surveys were underway. Phase I fish were stocked in systems where Y-O-Y surveys were not taken; approximately 5% of the fish stocked were phase I. Normally, about 150,000 fish were stocked each year, but 300,000 phase II fish were stocked in Albemarle Sound in 1985. Approximately 5-10% of those were tagged with cinch-up type tags. Only fish from the Albemarle Sound were considered to contribute to migratory stocks. One tag from a fish released in North Carolina was returned from the East River in New York; one other tag was returned from the Hudson River.

New Jersey, Pennsylvania, and Delaware investigated a restoration program for stripers in the Delaware system through their cooperative fish and wildlife program. New Jersey conducted a survey of the river in 1985 and the three states attempted to locate naturally occurring stocks. Water quality was expected to greatly improve. Their planned restoration program did not include a stocking program in 1985.

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