

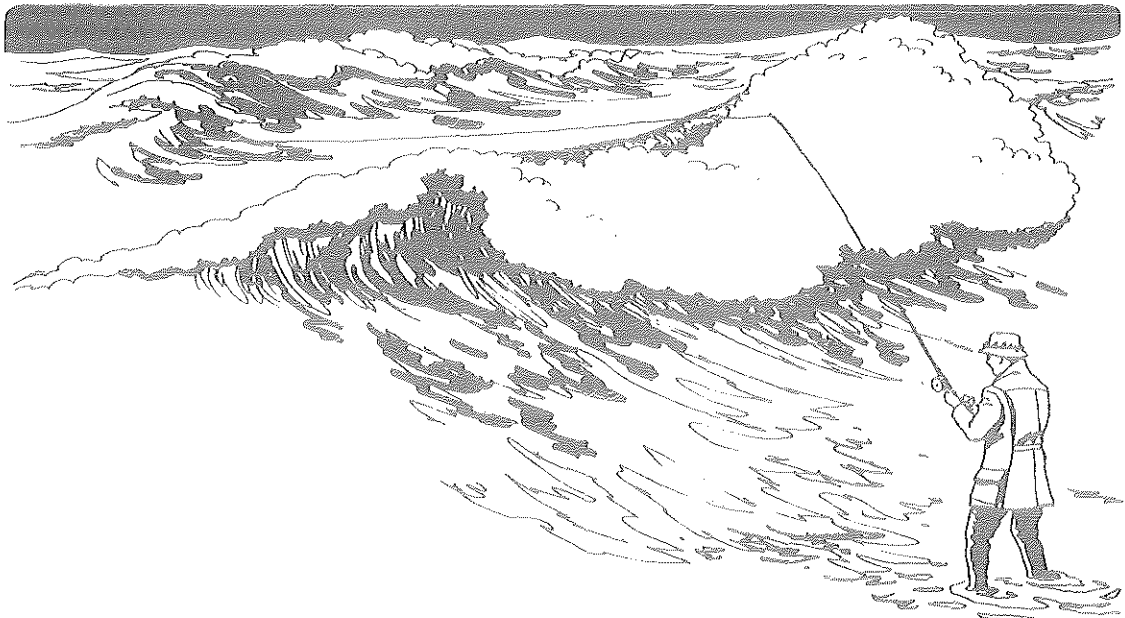
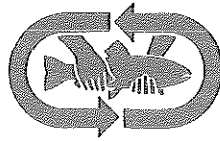
**INCREASING ANGLER PARTICIPATION
IN MARINE CATCH/TAG-AND-RELEASE
FISHING PROGRAMS:
Workshop Summary, Program Outlines,
and Angler Survey Results**

Jon Lucy, John Tiedemann, Maureen Donnelly, Michael Voiland,
Mark Malchoff, Brian Doyle, and Jerry Vaske

Edited by Elizabeth Krome

Final Contract Report Prepared For
National Marine Fisheries Service Northeast Region
Gloucester, Massachusetts
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Cooperative Project
Virginia, New Jersey, New York and New Hampshire Sea Grant Programs



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WORKSHOP SUMMARY, PROGRAM OUTLINES,
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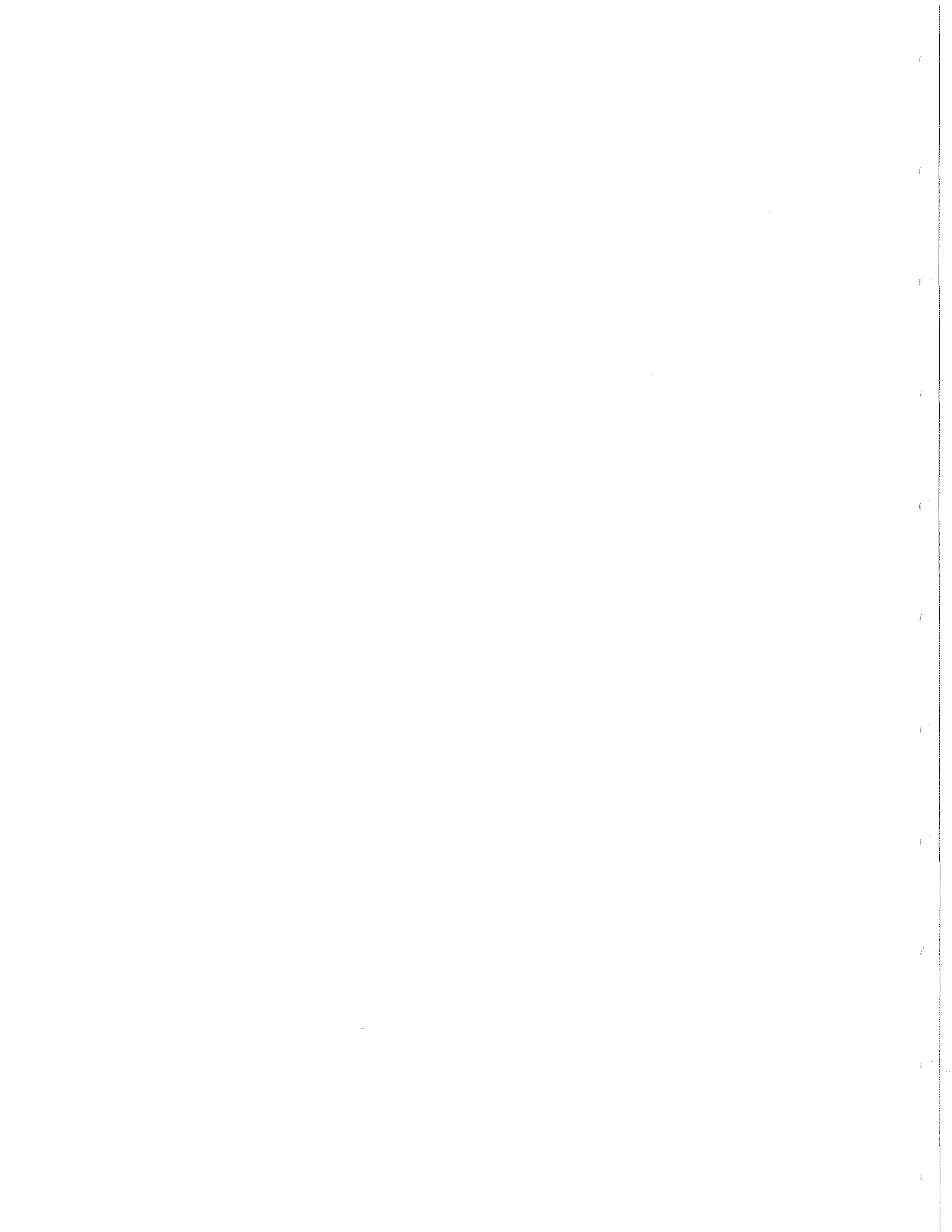
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PREFACE

Project Objective

The three-part objective of this Sea Grant/National Marine Fisheries Service project was: (1) to examine anglers' experiences with tag-and-release fishing programs; (2) to determine significant impediments, if any, to expanded participation in such programs as well as catch-and-release fishing in general; and (3) to address anglers' concerns and questions about catch/tag-and-release fishing by developing educational material to promote greater participation in these activities and minimize fish mortalities due to improper tagging or release techniques.

To achieve this objective, the researchers: (1) compiled information on existing tagging programs, including problems experienced by program coordinators and anglers; (2) compiled information from anglers concerning experiences with tagging and reasons for participating/not participating in existing programs; and (3) convened a workshop for tagging program coordinators, other researchers, fishery managers, and anglers to explore catch/tag-and-release fishing issues and directions for improving angler participation in these activities.

This final contract report contains two principal elements: (1) a summary of the workshop on Catch/Tag-and-Release Fishing in the Northeast: Issues, Problems, Potential, held in April 1990 at the Woods Hole Oceanographic Institution and (2) all materials contained in the Year One Contract Report, including summaries of tagging programs in the Northeast and angler survey results regarding experiences with tagging programs. This report is one of two products from the project.

The second product from the project is an educational brochure entitled *"Giving Something Back--Catch & Release and Tag & Release Fishing: Anglers' Guide to Programs and Resources on the Atlantic Coast."* The brochure addresses issues that the study found to be of concern to anglers regarding releasing or tagging and releasing fish. It also lists contacts for tagging programs in which anglers can participate and educational materials as well as equipment aimed at promoting more effective release of healthy fish. Single or multiple copies of the brochure are available free from the offices listed at the end of this section.

Acknowledgements

The authors wish to thank all of the tagging program coordinators, workshop speakers, and anglers who contributed time and information to the study. A debt of gratitude is especially owed to Dr. Alan White of the Woods Hole Oceanographic Institution (WHOI) and Ms. Lee Campbell, Communicator for the WHOI Sea Grant Program, for serving as willing and excellent hosts for the Catch/Tag-and-Release Fishing Workshop held in April 1990. Mr. Frank C. Mather III, retired from WHOI since 1980, made a special contribution to the exchange of information at the workshop

both through both his luncheon remarks and his involvement in workshop discussions. A certificate of appreciation was presented to Mr. Mather at the workshop for his past and continued contributions to tagging and improved understanding of pelagic fishes.

During preparation of the workshop summary and final contract report, Ms. Barbara Wingender of the New Jersey Sea Grant Marine Advisory Program took on the difficult task of transcribing the workshop session tapes. Ms. Elizabeth Krome prepared the workshop summary from transcripts, tapes, and co-principal investigators' notes; designed and edited the educational brochure; and edited the final contract report. Mr. Kenneth Beal and Ms. Joyce Lacerda of NMFS Northeast Region's Industry Services Division (Saltonstall-Kennedy Grants Program coordinators) in Gloucester, Massachusetts, and the project's technical monitor, Mr. Stewart Wilks, of NMFS Sandy Hook Lab, provided considerable assistance in administering the project. Ms. Jane Lopez of VIMS Sponsored Research Office also handled many administrative needs of the project. Dr. William Rickards, Director, and Dr. Dave Smith, former Assistant Director, of the Virginia Sea Grant College Program provided overall administrative and coordinating support for this cooperative multi-state Sea Grant Program effort.

Brochures are available from:

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NMFS Northeast Fisheries Center
Water Street
Woods Hole MA 02543-1097
508-548-5123

Recreational Fisheries Coordinator
NMFS Southeast Regional Office
9450 Koger Blvd.
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PROJECT HIGHLIGHTS

This project examined accomplishments, successes, and problems associated with major tag-and-release programs in the Northeast region (Maine to Virginia). Anglers were surveyed to determine their experiences and concerns regarding tag-and-release fishing. A workshop of tagging program coordinators, other researchers, fishing managers, and anglers was held to discuss issues and problems associated with catch/tag-and-release fishing efforts and to explore changes necessary to expand angler participation in such practices.

The following are highlights from compiled information and workshop discussions associated with the project.

Information Compiled from Tagging Program Coordinators

- Two basic types of tagging programs exist: those which depend upon anglers to do the majority of tagging, and those in which project scientists and trained personnel do the tagging. Both types of programs depend largely upon recreational and commercial fishermen and fish processing houses to return tags from captured fish.
- Important to the success of tagging programs are: (1) clearly stating the objectives; (2) using tested tags and tagging devices; (3) designing and implementing fish handling and tagging procedures appropriate to the targeted species of fish; (4) developing training information for angler participants; (5) providing a reward or incentive system to promote tag returns; (6) establishing a public relations and education campaign, including a prompt response to persons returning tags; and (7) coordinating tagging efforts with appropriate agencies and organization.
- Tagging programs have significant problems related to: (1) improper handling of fish and poor tagging practices; (2) the quality of data obtained from taggers and from anglers returning tags; (3) quality angler involvement and a meaningful rate of tag returns.

Anglers' Experiences and Views on Tag-and-Release

- Over one-third of the 378 survey respondents participated in tagging programs, with the majority beginning tagging within the past five years (since 1984).
- Primary reasons for not participating in tagging programs included: (1) not knowing who to contact for tags; (2) not knowing about existing programs; (3) not wanting to be bothered with tagging; (4) being concerned about causing injury to fish; and (5) fearing how tagging data would be used.

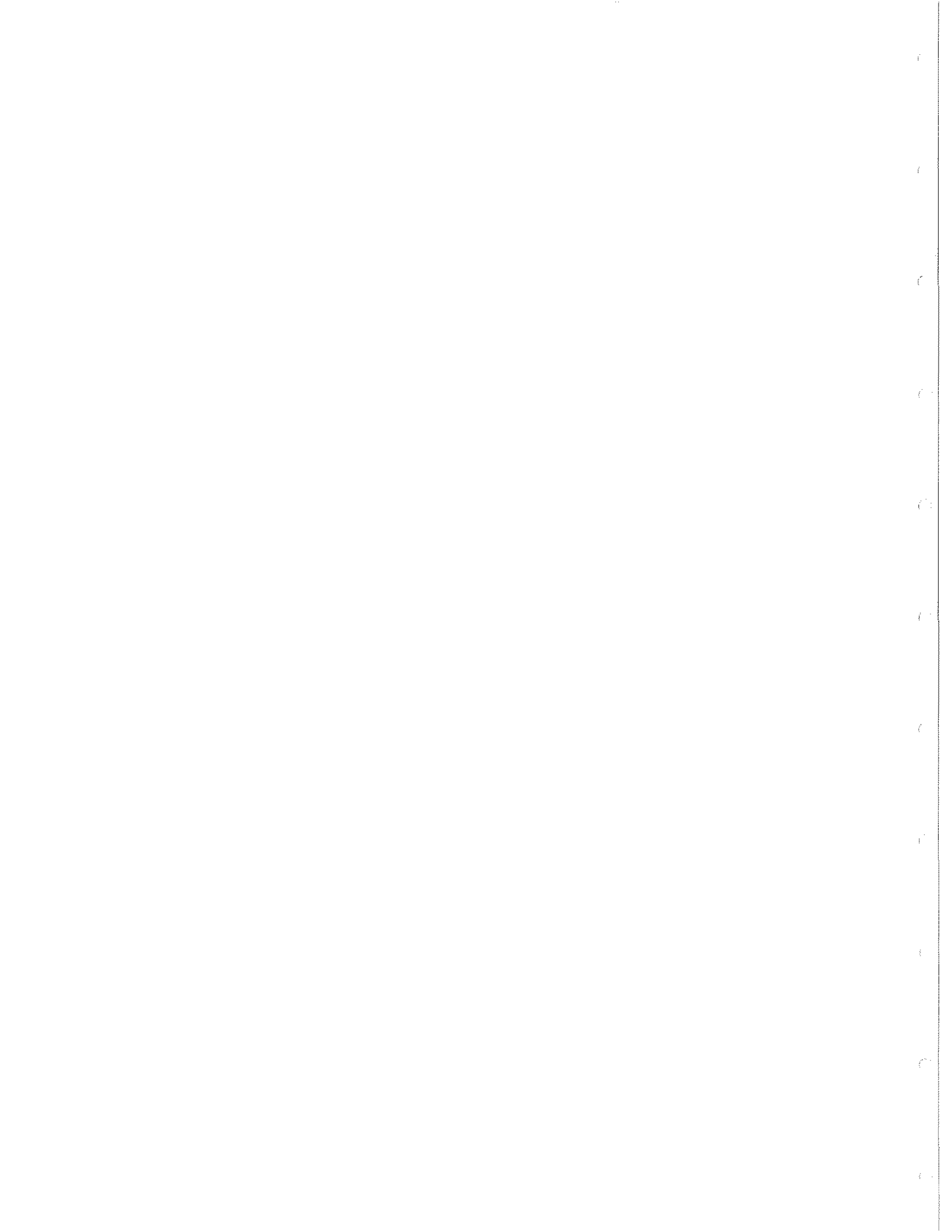
- Tagging programs with the highest rates of participation included the NMFS Cooperative Game Fish and Shark Tagging Programs and the American Littoral Society Program.
- The majority of those participating in tagging programs experience no problems with the programs.
- Of those anglers experiencing problems, those most frequently mentioned were (1) inadequate instruction on tagging procedures; (2) ineffective tags; (3) problems with the tagging apparatus, and (4) problems getting new tags.
- Although most persons catching tagged fish returned tags promptly, some did not; these latter individuals listed the following reasons for their slow responses: (1) lack of understanding of the importance of tagging; (2) concern over how the tag return data would be used.
- Anglers' suggestions for ways to expand tagging participation included: (1) more education efforts on tagging, tagging procedures, and the benefits of tagging data; (2) incentives for participation; (3) more information about the benefits of participating in tagging programs; and (4) more publicity on the results of tagging programs.

Woods Hole Workshop Issues and Recommendations

- Increased educational efforts are needed to improve tagging program participation, the quantity of data collected, and the quality of data obtained; educational efforts need to be directed at not only the angling community, but also the media and the public at large.
- Educational and public relations efforts of most tagging programs are hampered by low budgets and correspondingly small staffs.
- More research is needed on tag shedding problems with specific species and specific tags; double-tagging efforts would help determine where problems occur, as would tests whereby tagged fish are held in captivity to observe tag retention rates.
- Issuing tags in bulk to clubs and tournament officials can result in poor record-keeping as to which anglers have which tags; most programs prefer to issue tags to individual anglers.
- Programs need to facilitate the return of tag data by such means as toll-free numbers and reward incentives.
- Better educational efforts are needed from tagging programs regarding how tag return data will be used. If tag return data may be used in future management decisions or to impose stricter regulations on

catches, programs need to be forthright with such information and work to explain to fishermen how the data can benefit the fishery resource.

- Tagging results have proved that many coastal pelagic species travel great distances and are shared more widely internationally than once thought. Effective tagging and fishery management programs must establish an international scope to be successful.
- In most cases, tagging programs in which scientists and trained technical personnel are the taggers provide the best quality and most useful tagging results, but such programs are expensive to operate.
- Tagging results on striped bass, flounder, bluefin tuna, lobsters, and other species have produced strong evidence as to the serious impact of heavy fishing pressure on fishery stocks. Other valuable data such as stock identification, growth rates, and location of spawning and nursery areas have also been obtained through tagging.
- More study is needed to determine the impacts of tagging-related fish mortality and hook-and-release mortality and to find ways to reduce such mortalities. Training angler taggers would help reduce fish injuries and mortalities.
- Tagging of fish should not be encouraged just for the sake of tagging or as "the right thing to do" to help fishery resources; potential negative effects of tagging need to be considered also.
- Factors that encourage involvement in tag-and-release fishing are education/training, publicity about the rationale behind programs, and ease of participation.
- Factors that discourage participation in tag-and-release fishing (or in some cases catch-and-release), are confusion, laziness, and fear about how the data will be used; other impediments include the desire to eat the fish or display the catch at dockside, the belief that tag- or catch-and-release programs are irrelevant to fishery management, or the feeling that the reward for participation is insufficient.
- New tagging efforts directed at previously untagged species need to test tags on fish specimens in control situations. There is a need for more information in the scientific and popular periodical literature as to how various tags perform in certain species of fish.
- Tagging data repositories need to be better coordinated. It is extremely important that all tagging efforts collect data conscientiously and make it available to fishery management agencies as well as the larger fishing community for maximum benefit to all.



WORKSHOP SUMMARY

ENHANCING CATCH/TAG-AND-RELEASE FISHING IN THE NORTHEAST REGION: ISSUES, CONCERNS, POTENTIAL

The following summaries represent the major concepts and issues of discussion from the presentations made at the Catch/Tag-and-Release Fishing in the Northeast Workshop, held April 27-28, 1990, at the Woods Hole Oceanographic Institution, Woods Hole, MA (see workshop agenda at end of section).

Sea Grant Tag-and-Release Assessment
John Tiedemann and Maureen Donnelly

Major tag-and-release programs operating in the northeast region from Virginia to Maine were identified. Program coordinators were asked to describe the primary objectives of their programs, the duration, staffing, level and type of angler participation, tagging devices and procedures, and contributions of data to management decisions.

The common denominators of successful programs are fairly obvious: objectives are clearly stated; the type of tag used has been researched and proven successful over time; information contained on the tag remains readable and produces good return rates; tagging procedures are appropriate to the skill level of those involved; publicity is adequate; and the effort is coordinated with appropriate groups or agencies.

Concerns expressed by program coordinators generally fell into three categories: first, the potential for improper handling and tagging techniques to injure the fish; second, the importance of obtaining quality data; and third, the necessity for maintaining and expanding angler involvement.

Increased education was a common thread throughout all these concerns-- education not only of the angling community but of the media, the outdoor writers, and the public at large.

Attitudes within the angling community were surveyed. Two kinds of general questions were asked. The first set related to the participation in various tag and release programs, and the second related to attitudes toward tag and release. Most of the concerns that were found in the survey will be mentioned in other sessions at this workshop; specific tabulation of the responses can be found in Appendix A.

Tag-and-Release Highlights Around the Nation, A National Perspective on Tag-and-Release

"Rip" Cunningham, Frank Carey, Dennis Sabo, John Spence, and Tomi Vadset

A change in fishermen's attitudes has taken place within recent memory. In the last ten years tag-and-release has increasingly become an important part of tournament fishing, and also a part of the day-to-day fishing experience. The percentage of fishing tournaments advertising in *Saltwater Sportsman* that offer some form of recognition for releasing fish (i.e., release categories) has risen from 5-10% ten years ago to 60-75% at present. This shift in attitudes can be attributed to several factors. Anglers' publications have begun spreading the conservation message, not only in editorials but also in their overall coverage. Fishing clubs and conservation organizations have done much to establish tag-and-release. Simple peer pressure has also become important. In addition to all these factors, the realization is growing among fishermen that fish stocks are in poor shape and that more information on stock dynamics is needed to reverse the trends.

Some examples of significant tag return results:

- Tagging of steelhead trout from Alaskan rivers has revealed a trans-Pacific migration of steelhead from the Gulf of Alaska to the coast of Japan and Russia. This migration route crosses an area where high seas drift nets are heavily concentrated.
- A tag returned from a medium-sized sailfish 11 years after tagging proved that the life span of sailfish was much longer than the previously-assumed 7 years.
- A tagged striped bass had grown from 11 inches to over 30 pounds in 10 years.
- A shark dart tag placed in a sandbar shark in 1971 off New Jersey was recovered from the shark north of Daytona Beach in 1990.

A useful adjunct to traditional tagging programs is acoustic telemetry tagging of fish. Whereas traditional tag returns yield information about the long-term migrations, growth, and life history of a species, radio transmitters can supply data on feeding habits, swimming speed and depth, and other short-term behavior. The two kinds of data taken together can give a more complete picture of a fish's daily habits, information that is critical to understanding an organisms's response to its environment.

The perception that tag-and-release data significantly help commercial fishermen better locate fish is widespread and often cited by recreational fishermen as a reason they neither tag fish nor return tags. It is also possible that some anglers use this excuse to cover their un-

willingness to take the trouble of returning tags. To the extent that this misconception on use of data is an honestly held opinion, education is necessary.

One limitation on the education of anglers about tag-and-release is that most tagging programs have small staffs and budgets; thus expansion of their programs is difficult or impossible. Popular sportsfishing publications appear to be the key to getting information out on tag-and-release.

Tag-and-release fishing allows a charter boat captain the opportunity to provide anglers with the exciting experience of releasing a fish; it is also a good opportunity to educate them as to the biology and natural history of the fish. This increased knowledge is likely to help shift anglers' attitudes away from the "meat" fishery approach toward a conservation ethic.

Selection of tags is critical. For example, the wrong tag for striped bass may attract feeding bluefish. In addition, a tag that stays secure in the fish's muscle and is not easily shed or lost is critical to successful tagging programs. A very low rate of return from a large number of fish tagged may indicate problems with tag shedding or the integrity of the tag itself. Some older tag designs have been found to have a limited life span because the glue holding the plastic streamer to the tag head deteriorates with time and streamer pulls away from the tag head.

The tag recently developed by The Billfish Foundation (TBF) was designed to minimize tag shedding and to reduce the problem of marine growth eroding the data on the tag. The dart-type tag has a teflon-like head; evidence is that scar tissue forms around the tag head after insertion, aiding in tag retention. An interesting feature of the TBF tag is that it incorporates a bilingual tag message along with the TBF phone number. The tag was developed by TBF in cooperation with Dr. Eric Prince of NMFS, and tag return data are shared with NMFS.

Angler-Based Tag-and-Release Programs: Recommendations for Success

Ed Scott, Jack Casey, Pam Carlsen, and Julie Porter

NMFS Cooperative Game Fish Tagging Program. Quality control/quality assurance is critical to the success of any program. The tagging techniques, choice of tag, and ability to adapt methodology and improve tag design all need QA/QC effort.

As tag types are improved it is important to have as little change as possible in the legends on the tags. This minimizes confusion on the part of anglers and also makes the data more compatible with the existing data bases.

Tag retention can present significant problems. An old type of all-nylon key tag was compared with steel barbed-dart tags, and the key tags came out very frequently. One major tag manufacturer had problems with tag separation that resulted in a 95% failure rate. Loss of tags is also increased by marine growth, which adds stress to the tag. In addition, with any kind of tag the placement is crucial. For instance, on small school tuna, it is essential to hook the tag into the bones supporting the dorsal fin, or it will pull out easily.

The cooperative tagging program, begun in 1954 by Frank Mather at Woods Hole Oceanographic Institution, was taken over by NMFS in 1980. Since 1954 over 78,000 billfish have been tagged and released. As of last year 1,113 have been recaptured. Over 35,000 tuna have been tagged and released, and 4,000 have been recaptured. The rate of return for bluefin tuna is 15%, significantly higher than for most other species. This is because of the commercial aspect of the fishery; the return rate is generally better for commercial fisheries than for recreational. This difference may also be related to the often-cited reluctance of recreational anglers to return tags that they think will help commercial fleets find more fish.

One problem with issuing tags in bulk is that few of the tags (7% in one instance) are actually used. Recording of release data can also be sketchy in this kind of situation. A more closely monitored situation allows a program manager to know exactly who has which tags. It needs to be as easy as possible for anglers who recapture a tagged fish to return the tag data; a toll-free telephone number may be effective, especially when the reward offered for the recapture may be less than the cost of the long-distance call to report the data. Some tags have been lost in the postal process, as the tags may damage mail-sorting machinery and various parts of the envelope contents may be discarded. Another problem with tag return data is its quality, due to the necessity for anglers to estimate the fish's length and weight. Weight estimates are fairly unreliable, as shown by a return on a fish that was estimated at 50 lbs weight when released and 35 lbs when recaptured.

Many fishermen hesitate to return tags because they fear the information from them will be used as the basis of legislation or regulation that will be detrimental to them. This is a difficult fear to address, since additional knowledge may indeed result in the conclusion that a particular stock is so depleted that stricter regulation is necessary. The most successful approach to this situation may be a long-term education effort, involving the opinion-makers, the outdoor writers, and the anglers with a lively sense of curiosity. These are the people who can help make tagging and tag return a routine part of the angling world. Getting the right people involved is a key ingredient in success; then the task is to keep them involved, informed, and motivated.

The popular sportfishing media are essential allies in getting information out on tag-and-release. The publications can be very effective in informing fishermen about various tag programs in operation, what to do when they catch a tagged fish, and how to become active in tagging through angler-based programs.

NMFS Cooperative Shark Tagging Program. This program, with nearly 5,000 taggers, has tagged 87,000 fish since 1963, and 3,000-4,000 tagged fish have been recaptured. The recaptures include 32 species of sharks, with the longest time at liberty 24 years, for a sandbar shark. The longest distance traveled was 3,700 miles, for a blue shark. The fastest rate of travel, 44 miles per day, was recorded for a blue shark that had help from the Gulf Stream. A typical year would be 1989, with 5,600 sharks (33 species) tagged and 328 recaptures of 19 species in 15 countries. This program uses two types of tags. One is a modification of a Mather dart tag containing a message capsule with a request for return in five languages. The other type is a sheep-ear tag clipped through the fin; it is used more by biologists than by amateurs, as it involves more handling of the fish. These tags seem to be retained well; tags have been seen after 20 years that appear ready to last another 10-15 years.

One of the insights that tagging has provided biologists is that even some coastal pelagic species travel great distances. These resources are probably much more widely shared internationally than has been thought. Thus any effective management plan must have an international base.

Double tagging to determine the retention rate of various tags appears to be highly desirable. This is the only way to develop an estimate of the relative retention rates of different tags under field conditions, and it can be done with little additional effort or cost. When the FT-1 tag was compared with the steel dart tag, the steel dart tag showed a shedding rate of 20%; the FT-1 had a lower rate. One study indicates that the Mather tag has a shedding rate of about 25% in sharks.

Good tag retention is not the only consideration, of course; in some programs it may be desirable to sacrifice some retention characteristics for ease of tag use and practicality.

Numerous problems can occur with the technique of placing tags. For example, too heavy a rubber band will hold the tag streamer tightly to the stick, preventing it from pulling away when the fish is struck with the tag. The tag-holding needle on the tagging stick can be too long, forcing the tag too deeply into the fish tissue. The tag dart must be placed correctly in the muscle tissue with the prongs of the tag oriented towards the fish's tail, or the tag will work itself out of the tissue.

American Littoral Society. The tagging program of the American Littoral Society (ALS) stresses commitment of the anglers who join, pay dues, purchase tags, and practice safe tag-and-release techniques. The ALS provides staff to handle data, questions, and correspondence, provide tagging kits, and encourage the taggers. Members include individuals or families, fishing clubs, and charter boat captains. Communication between ALS and its member taggers is frequent. ALS maintains an 8" minimum for fish to be tagged; about 110,000 fish have been tagged and 4,500 recaptured in this program.

Canadian Bluefin Tuna Tagging Program. Tagging has been used in the Browns Bank area off the Canadian coast. The commercial fishermen there initiated a project tagging giant bluefin tuna (in the 300-400 lb range) during the commercial fishery (August-September 1990). This effort allows scientists to estimate the size of the population and the rate of turnover. The commercial fishermen feel that the fishery has historically been regulated without sufficient data, so they view the additional information as being in their interest.

Research and Management Based Tag-and-Release: Benefits and Problems

John Waldman, Bruce Halgren, Ed Irby, and Jack Musick

Migratory Striped Bass Tagging Program. A distinctive feature of the striped bass study in the Hudson River is that it has been funded and organized by the utility companies, with the New York Power Authority taking the lead. This situation has several advantages. The strict quality control has yielded excellent data. Because trained biologists are doing the tagging, a wide variety of tags can be considered for use, and the tagging can be targeted for specific areas of interest. It is also possible to get good estimates of tagging mortality under these circumstances. The chief drawback is that this kind of situation is very expensive.

About 90,000 striped bass in the East River off Manhattan were tagged with internal anchor tags. The normal routine was to use two boats for tagging, one to catch the fish and the other for tagging. An improvement in the procedure was the substitution of a live car for on-board tanks. The mortality rate of fish upon return to the river dropped from 17% to 1% after this change.

This study showed the stocks in the Hudson had grown at an annual rate of about 8% since 1974. A general repetitive pattern of movement within the Hudson was also found. Fish tagged in the lower river were found by mid-April in the central river, and by May at the head of the tidewater area. There were few returns after June, presumably because both the fish and the fishermen left the area. Coastal migrations were also detected, usually to the north (sometimes as far as Maine and Nova

Scotia), with a spring migration to the east and north, a fall migration to the open coast, and some late fall and winter migration to the south.

The program offered a \$5-10 reward per tag returned, with an additional incentive of a chance at one of nine prizes (\$100-1,000) selected by drawing once a year. Anglers returning tags receive a certificate of participation and updates on information gained through the program. Posters and flyers are the chief means of publicity.

Bluefish, Flounder, Striped Bass Tagging Programs. One of the oldest ways of marking fish is simple fin-clipping. This is suitable for use on fairly small fish, but the clips are not always obvious to fishermen. Fin clip studies on fish released from hatcheries showed that their survivability was excellent (as good as in the hatcheries) and that their growth rates after release were at least as good as in the hatcheries.

An interesting tagging effort has involved blue crabs and lobsters. Both present the problem of how the tag will survive through molting. To succeed, the tags must be precisely placed in the muscle at the integument in the rear. Tagging of lobsters in the early 1970's was valuable in convincing commercial fishermen that fishing pressure was responsible for the declining size of the animals they caught.

A primary problem in any tagging program is making sure that tags are returned. The key is to generate as much publicity as possible-- posters, flyers, and press releases. It is also helpful to have a phone number on the tag with the notation "call collect." A telephone conversation may enable a program staffer to get more information than would have been written down with a returned tag.

Other issues in tag return can be classified as (1) cooperation, (2) concerns about tag-induced mortality, and (3) the role of the constituency in tagging. Reluctance to cooperate is often attributed to the fear of consequences in allocation. The need is for education. Anglers need to know that most allocation schemes are based on historic landing data, not on tag data. Both commercial and recreational fishermen need to realize that management agencies are generally fairly objective.

Some fishermen are concerned that the tag itself may change the behavior of the fish, or may make it more attractive to predators. It can be pointed out to these fishermen that better tag return rates yield better data, which enables scientists and managers to better address these concerns in the future.

What is the role of fishermen in tagging programs? In recapture it is invaluable. But the question of whether recreational and commercial fishermen should be putting tags on fish is not as clear-cut. In some

cases it is the only way fish can be tagged cost-effectively (sharks, billfish, and tuna are examples). However, tagging in general should probably not be encouraged simply as the "right thing to do;" the potential gains should outweigh the negatives. The mortality attributable to tagging (as opposed to mere hooking) must be weighed against the potential benefits of the data. Other questions must be asked: Is the tag appropriate? Are the taggers trained? What will happen to the data? Will it be properly recorded, and will it be made available to managers?

Florida Snook Tagging Program. The Florida program has always stressed care of the fish. For instance, snook are highly stressed by catching by the jaw. Now nets are used to catch snook for tagging. The placement of the internal anchor tag is also very important. The program emphasizes training so that the taggers will be careful of the fish. The same element of personal contact that is apparent in training has resulted in increased tag return. Someone from the department who spends time on the dock or in bait and tackle shops is likely to encounter anglers who have tags in their tackle boxes or at home in a drawer. The personal contact is often incentive enough for them to return the tags.

The achievement in Florida has been in turning around the prevailing ethic, from the belief that the only place for a snook was in the cooler, to the willingness to release fish and persuade others to do likewise. This has been helped by good fisheries management; when the fish stocks improved, cooperation improved.

One problem with posters as publicity is that if they are very nice, they won't stay on display long. They may be taken as collectors' items, often within a week.

A problem has arisen with people who want to tag fish but do not want to work with the state program. Trained taggers report that these anglers may not be careful with the fish, may induce high levels of mortality, and may exert little care in the placement of the tag. This situation also yields problems with competing data. Some regulation of fish tagging is under consideration in Florida, to ensure that taggers are better trained and that there is better control over how the tags are going out. If tagging is going to be used as a management tool it is important to get quality tags out and quality returns. The current unregulated situation also poses a public relations problem: a fisherman may catch a tagged fish from another program, see damage to the fish, receive no reward, and perhaps never receive even an acknowledgement of his tag return. This unrewarding experience may make him unwilling to go to the trouble to return tags to any program.

Summer Flounder Tagging Program. Summer flounder is the most important finfish in the mid-Atlantic commercial and recreational fisheries, both in pounds landed and in value. A tagging study in the winter showed

that flounder move offshore and south in the winter, and onshore and north in the summer.

It had been hypothesized on the basis of tagging data and egg and larval analysis that there were two flounder stocks in the mid-Atlantic. This hypothesis needed to be tested in order to evaluate proposed changes in size limits. To determine where the Virginia summer flounder went in the winter, summer flounder larger than 250 mm were tagged in inshore areas of Virginia. The idea was the northern offshore stock returns inshore in summer off Massachusetts, New York, and New Jersey, and that the southern trans-Hatteras stock returns to the Chesapeake Bay area inshore in spring (April-May). Tagging was done in two areas: behind the barrier islands of the Eastern Shore (in small boats), and in the lower Chesapeake Bay (by a commercial trawler). Floy cinch-up tags were used and were quite effective. Tag loss was virtually zero. Tag returns in 1987 and 1988 were about 7%, which is consistent with other studies.

Professional tagging allows the collection of much more demographic data than tagging by recreational fishermen. For instance, data on length frequencies showed recruitment failure in two successive years. As others have mentioned, some thought should be put into what ancillary data can be collected while the tagging is being done. At little additional cost, a lot of valuable information can be obtained.

Cooperation rates for tag return are hard to assess. The split between recreational and commercial/research returns in 1986-87 (42% vs. 58%) corresponded well with the NMFS estimates of catches (40% vs. 60%) based on angler surveys and landings surveys. The next year, however, when the flounder population had dropped 70%, the recreational returns were substantially down. The following year, with an even lower population, the proportion changed completely from that in 1986-87. This reflected the closing of inshore areas to trawlers in the fall of 1989. A suggested bag limit for recreational fishermen angered many of them and may be depressing the rate of tag returns from anglers

The Virginia and North Carolina estuaries are thought to be prime nursery areas for summer flounder. These small fish probably appear later in New Jersey and New York. This idea is supported by the fact that the juvenile index predicting a collapse in the population also predicted the collapse, with a year lag, in the New Jersey/New York fisheries. To investigate this hypothesis a tagging study of juvenile summer flounder is being undertaken. The tagging procedure (with Floy tags) that will be used was used previously on hogchoakers with virtually no mortality and a very high return rate.

The Pros and Cons of Being Involved with Tag-and-Release:
Angler Views
Michael Voiland

To develop a better understanding of the interests, motivations, and behaviors of Lake Ontario's salmonid anglers, a survey of 1,101 boat owners was conducted, with a 68% return rate. Of the respondents, 61% had fished Lake Ontario by boat for salmon or trout. The data in this survey, which addressed salmonid fishing, may also be applicable to participation in tag-and-release programs.

Data in the survey showed that tournament participants are more catch-oriented than nonparticipants, but they have an even stronger affiliative orientation. The more important salmonid fishing is to anglers compared with other recreation activities, the more catch-oriented the anglers are. Over time the anglers develop less interest in catching fish to eat or "limiting out" and more interest in maintaining the fisheries resource, releasing fish, learning habits of salmonids, and other non-consumption fishing activities.

The factors that encourage involvement in tag-and-release programs are education/training, publicity about contacts and about the rationale behind the programs, and ease of participation. Factors cited as discouraging involvement include confusion, laziness, and fear of how the data will be used. Other impediments to participation may be the desire to consume the catch, the desire to display a catch at dockside, the belief that tag-and-release programs are irrelevant to fishery management, and the feeling that the reward for participation is not sufficient.

Honored Luncheon Speaker

*Frank C. Mather III, Scientist Emeritus,
Woods Hole Oceanographic Institution*

Mr. Mather, considered to be the pioneer of tagging programs for pelagic species, particularly tuna and billfish, shared with workshop participants his experiences during the early days of tagging giant bluefin tuna. His struggles to develop a tag that would stay put in fish musculature were sometimes matched by difficulties in convincing the scientific community that important information could be gained from tagging.

Highlighting his remarks were such major tagging accomplishments as documenting the migratory patterns of northern bluefin tuna, particularly differences occurring among school, medium, and giant fish. Tagging also provided hard data for distinguishing western and eastern stocks of northern Atlantic bluefin, information critical to the International Commission for Conservation of Atlantic Tunas (ICCAT) in its ongoing efforts to manage bluefin stocks. Mr. Mather's perseverance and dedication to tagging efforts resulted in the Cooperative Game Fish Tagging Program now coordinated by the National Marine Fisheries Service at its Southeast Fisheries Center in Miami.

In recognition of Mr. Mather's past accomplishments and continued advisory involvement in tagging work, he was presented a framed certificate of appreciation which read as follows:

"The organizers and participants of the Catch/Tag-and-Release Fishing Workshop, held April 27-28, 1990 at Woods Hole, Massachusetts, wish to bestow this certificate of recognition and gratitude upon Frank C. Mather, III, Scientist Emeritus, Woods Hole Oceanographic Institution, for his significant pioneering efforts and many scientific contributions to the furthering of knowledge and understanding of the life history and management of Atlantic tunas and billfishes, in particular the bluefin tuna, *Thunnus thynnus*, presented this 28th day of April 1990."

Catch/Tag-and-Release Realities: Injury and Mortality, Improper Handling and Release, Acquisition and Use of Data
Paul Diodati, Chet Zawacki, Beth Valdez, and Dave Blazer

The possibility of mortality due to releases is a concern often raised by anglers who are hesitant to tag fish. A study of 1015 striped bass tagged and placed in a Massachusetts salt pond showed there was a 4% mortality due to handling and transport. A 4.3% rate of tag loss was observed in a group of control fish. Overall hook-and-release mortality rates ranged from 4% to 29%. Higher mortality rates were associated with "playing" of the fish for more than 80 seconds and water temperatures above 24° C (75° F). Single hooks produced 13% mortality, as compared with 4% for treble hooks. The overall rate of hooking mortality was estimated to be 8%, the same level as the estimated natural mortality of fish never hooked in the study. Further analysis is being done on conditions or combinations of catch situations which contribute to higher levels of hooking mortality.

As the experience of the fishermen doing the tagging decreases, the mortality rate of the fish increases; this is compatible with the observation that longer handling time for fish results in increased mortality rates. This finding emphasizes the importance of training taggers. The American Fisheries Society has published guidelines for accepted scientific procedures in tagging. It should be noted that animal rights concerns could affect tagging programs.

Low return rates noted in some studies may be related to release mortality, but other factors may be more important. For instance, one study of 700 tagged winter flounder yielded a return rate of only 2.5%. The illegal commercial fishing that was known to take place in the study area may have reduced the return rate, because such fishermen were probably unwilling to reveal the location of their catch. Illegal fishing activity may be a factor in other programs as well.

A study of striped bass hooking mortality in Chesapeake Bay showed that rates climbed dramatically as salinity decreased; in addition, larger fish (>18") had higher mortality rates. Water temperature and trauma due to the catching process (using artificial lures) were not very significant risk factors. Fish "gut hooked" on baited hooks all died.

Preliminary studies in Chesapeake Bay with bronze-coated, stainless steel, and tin-cadmium-coated hooks (#1 and #2) indicated that corrosion of hooks left in fish was not the major reason for loss of such hooks. Rapid dislodgement of hooks was the major way in which hooks were lost from mouths of test fish. Most dislodgement occurred within 30 days. Fish on tin-cadmium-coated hooks stopped feeding after two weeks. Follow-up studies to determine feeding or mortality problems attributed to such hooks being left in fish indicate some problems may exist. More detailed work is planned by Dr. Eric May, Maryland DNR, Tidewater Administration, Fisheries Division (301-266-5370).

A database on hooking mortality studies for both fresh and saltwater recreational fishes was being compiled by Texas fishery managers beginning in September 1990. Further information on the database can be obtained from Gary Matlock, Director of Fisheries, Texas Parks and Wildlife Department, 4200 Smith Road, Austin, TX 78744 (512-389-4800).

Recommendations from Working Sessions

Tagging programs that are targeting previously untagged species need to test tags on fish specimens in a control situation to determine the "behavior" of tags and tag shedding rates. There may be some species of fish that are not suitable for tagging programs. Also, some fishermen may be more difficult than others to train in proper tagging procedures.

A fundamental tagging issue is whether program coordinators should work to reduce tagging mortalities as far as possible, or whether they should encourage tagging for its own sake.

A persistent problem in tagging is the difficulty of publicizing information on how various tags perform so that fishermen and tagging program coordinators can be alerted to problems with certain tags. Persons initiating new tagging programs need to check with experienced tag program coordinators to determine which tags and tagging techniques work best. Tagging data repositories need to be better coordinated so that researchers and fishermen can derive maximum benefit from existing data and tag return data will not be lost. It is extremely important to coordinate data collection and make the results available to the fishery management agencies as well as to the larger fishing community. A central coordinating agency is needed for collecting and distributing results of tagging studies. (This concept is being put into action by NMFS through the Southeast Fisheries Center in Miami, FL.)

Fishermen catching tagged fish need to be dedicated to obtaining reasonable estimates of fish length. They should be prepared to use calibrated streamer devices, marks on their boats, or other measures to estimate the length of recaptured fish.

Training of fish taggers is essential and should be done, where possible, by biologists working one-on-one with fishermen seriously wishing to tag fish. A tagging training program could be established using certified tagging instructors who then train others.

Fishermen frequently distrust government-sponsored tagging programs. When tag return data is utilized for determining catch quota allocations among various fishing interests (commercial vs. recreational, etc.), it may erode the cooperation of fishermen in returning tags.

Fishermen want tagging to be relatively easy and they want evidence that tagging does not harm fish. They want the tagging procedure to be practical for use in situations such as fishing from jetties or fishing at night.

The Right Mix of Ingredients Can Work

Comments by Pete Barrett, Associate Publisher, Fisherman Magazine. (Mr. Barrett was unable to attend the workshop because of family illness but provided these thoughts afterwards at the request of the organizers.)

The concept of tagging and then releasing the ocean's fish, especially game fish caught for sport, to swim away free and alive, returning the fish to its native element in the wild, is gaining in popularity and importance to the recreational fisherman and to the scientist.

With tag-and-release, saltwater fishermen can "have their cake and eat it too" while at the same time, scientists obtain the vital data needed to develop comprehensive management plans that assure stable fish populations. The recent explosion of striped bass fishing opportunities along the East Coast from Chesapeake Bay to New England offers some insights into how tag-and-release can provide a viable recreational fishery with minimal reduction to the spawning base of these fish and maximum potential for economic opportunities for sport fishing businesses such as tackle shops, marinas, and charter boats.

Striped bass fishermen in private boats and in the surf, and on charter and party boats, have been catching thousands of bass each summer and fall for the last few years, yet the majority of these fish have been returned to the water because they did not meet federally mandated minimum length requirements. Despite the restrictive catch limits, a vibrant recreational fishery existed in most coastal states as catch-and-release became the only option available if fishermen wanted to catch striped bass. Many, many anglers cheerfully caught, then released their fish and took joy in the simple pleasure of being able to catch one of

their favorite fish. The experience of fishing was worth more than the killing of the fish.

Tag-and-release is expanding rapidly in the big game world as tuna begins sharing the limelight previously available only to the more famous billfish, the blue and white marlin. If ever a group of fish needed a tagging study, they are the wonderful and exciting tuna species. Frank Mather pioneered the methods back in the 1950s. Today in the 1990s, many offshore sport fishermen, upset at the prospect of losing their favorite pastime, are opening their eyes to the potential of fish tagging.

There are problems to overcome, and not everyone sees eye to eye on the methods of tagging, the design of the tag, the tabulation of the results, or how to promote tag-and-release to assure minimal harm to the fish themselves. Despite some disagreements, most tag and release proponents are united about the basic approaches to the concept. The interchange of ideas at workshops where new and old methods are compared, future plans are made, and solutions to problems are found, can only enhance the impact of tag-and-release fishing for the future.

The renewed and expanded interest in tag-and-release generated from this workshop will result in more enthusiastic support from recreational fishermen and scientists. As fishermen, fisheries managers, and biologists see the increased amount of information that can be compiled from tagging studies, the value of tag-and-release will grow and become more useful in the future.

Tag-and-release will be one of the important solutions to assure quality fishing for tomorrow. This workshop is on the leading edge of developing and expanding this philosophy.

AGENDA

**Enhancing Catch/Tag-and-Release Fishing in the Northeast
Region: Issues, Concerns, Potential**

April 27-28, 1990, Woods Hole, Massachusetts

Friday: Welcome, Orientation, and Workshop Objectives

Ken Beal, Northeast Fisheries Center, National Marine Fisheries
Service

Alan White, Sea Grant Program, Woods Hole Oceanographic Institution

Jon Lucy, Virginia Sea Grant, Virginia Institute of Marine Science,
College of William and Mary

Sea Grant Tag-and-Release Assessment

John Tiedemann, New Jersey Sea Grant

Maureen Donnelly, University of New Hampshire

**Tag-and-Release Highlights Around the Nation, a National
Perspective on Tag-and-Release**

Moderator: Jon Lucy, Virginia Institute of Marine Science, College
of William and Mary

"Rip" Cunningham, Jr., Salt Water Sportsman Magazine

Frank Carey, Woods Hole Oceanographic Institution

Dennis Sabo, Massachusetts Maritime Academy; Captain, Charter
Vessel Peptide

John Spence and Tomi Vadset, The Billfish Foundation

Saturday: Welcome

Ken Beal, Northeast Fisheries Center, National Marine Fisheries
Service

Alan White, Sea Grant Program, Woods Hole Oceanographic Institution

Jon Lucy, Virginia Sea Grant, Virginia Institute of Marine Science

**Angler-Based Tag-and-Release Programs: Recommendations for
Success**

Moderator: Andy Loftus, Sport Fishing Institute

Ed Scott, Coordinator, NMFS Cooperative Game Fish Tagging Program

Jack Casey, Coordinator, NMFS Cooperative Shark Tagging Program

Pam Carlsen, Tagging Coordinator, American Littoral Society

Julie Porter, Fisheries and Oceans, Canada

**Research and Management Based Tag-and-Release: Benefits and
Problems**

Moderator: Robert Dorazio, U.S. Fish and Wildlife Service:
 Coastwide Migratory Striped Bass Tagging Program
 John Waldman, Hudson River Foundation: Striped Bass Tag Recovery
 Program
 Bruce Halgren, New Jersey Bureau of Marine Fisheries: Bluefish,
 Flounder, Striped Bass Tagging Programs
 Ed Irby, Florida Department of Natural Resources: Snook Tagging
 Program--Working with Fishermen
 Jack Musick, Virginia Institute of Marine Science, College of
 William and Mary: Summer Flounder Tagging Program

***The Pros and Cons of Being Involved with Tag-and-Release:
 Angler Views***

Michael Voiland, New York Sea Grant

Luncheon Speaker:

Frank Mather, Scientist Emeritus, Woods Hole Oceanographic
 Institution: "Why We Tag Fish--What Good Does It Do?"

***Catch/Tag-and-Release Realities: Injury and Mortality,
 Improper Handling and Release, Acquisition and Use of Data***

Moderator: Ron Schmied, Southeast Regional Office, National Marine
 Fisheries Service
 Paul Diodati, Massachusetts Division of Marine Fisheries: Striped
 Bass Hook-Release Mortality Study
 Chet Zawacki, New York Department of Environmental Conservation:
 Data Use and Public Image Concerns
 Beth Valdez, National Marine Fisheries Service Sandy Hook
 Laboratory: Winter Flounder Tag Return Problems
 Dave Blazer, Maryland Department of Natural Resources: 1989 Striped
 Bass Hook-Release and Preliminary Hook-Retention Studies

The Right Mix of Ingredients Can Work

Pete Barrett, Associate Publisher, Fisherman Magazine (Sponsor:
 AFTCO Tag a Tuna for Tomorrow Program)

***Maximizing Benefits of Catch-Tag-and-Release in Marine
 Recreational Fisheries: Can Improvements Be Made?***

Leader: Mark Malchoff, New York Sea Grant

Concurrent Working Sessions

Reports from the Working Session Moderators

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PROJECT OVERVIEW AND RESULTS

INTRODUCTION

In 1988, the National Marine Fisheries Service (NMFS) Northeast Region identified the demonstration of fishing gear which increases survival of fish taken in catch-and-release marine fisheries as a priority for research and development projects. In response to this objective, the Sea Grant Marine Advisory/Extension Programs from Virginia, New Jersey, New York, and New Hampshire initiated a cooperative project designed to:

- assess accomplishments, successes, and problems associated with major tag-and-release programs under way in the Northeast region; and
- develop educational materials and forums which promote a greater understanding and utilization of conservation practices, including catch or tag-and-release techniques, among marine recreational fishermen in the region.

The rationale for this approach was based on the assumption that most marine recreational fishermen's experiences with catch-and-release concepts are associated with the numerous tag-and-release efforts ongoing in the region. If not participating themselves in such programs, fishermen are learning about the programs through newsletters, popular periodical articles, and annual fishing workshops and forums held throughout the region.

Tag-and-release programs raise some issues in the minds of anglers that are related to catch-and-release fishing in general, i.e., the survival rates of fish released under various fighting and handling scenarios. Anglers are also concerned about the added impact of the tagging procedure on the fish, as well as whether tags are lost from fish through either improper tag placement or tag abrasion. A special concern about tag-and-release programs for both recreational and commercial fishermen is the ultimate use of tag return data, particularly if the data are likely to be used to strengthen fishing regulations, assign catch quotas to recreational and commercial fisheries user groups, or in any way benefit one fishing group over another. Such concerns affect fishermen's willingness to assist in the tagging of fish as well as to return tags when they recapture marked fish.

BACKGROUND

Tagging and marking are important techniques used to study fish populations. The resultant mark-recapture data have been used extensively in fishery science for estimating population size, survival and mortality rates, growth rates, movement parameters, behavior, and stocking program

success (Grimes et al., 1983; Wydoski and Emery, 1985). Laird and Stott (1978) and Wydoski and Emery (1985) provide extensive reviews of the devices and methods that have been used to tag fish. Physical tags that are used for external application include Petersen discs, metal strap tags, dangler tags, spaghetti tags, dart tags, and anchor tags. These external tags are the types most familiar to marine recreational anglers.

Although it is uncertain when fish were first marked, Jakobsson (1970) notes that several centuries ago wealthy European landowners tagged the salmon and trout living in their streams. In the United States, fish tagging dates back to the late nineteenth century when Atkins successfully tagged Atlantic salmon in Maine (Rounsefell and Kask, 1945). Since that time, tag-and-release experiments have become commonplace in the study of marine fish populations, and the variety and types of tags have increased dramatically (Scott and Beardsley, 1984).

In the early years of fish tagging, almost all of the tagging was done by scientists or trained field technicians. More recently, some organizations and agencies have developed tagging programs utilizing significant numbers of recreational fishermen as volunteer field tagging personnel. The involvement of anglers in the Cooperative Game Fish Tagging Program and Shark Tagging Program of the National Marine Fisheries Service has enabled these programs to tag significantly greater numbers of large pelagic species than would otherwise be possible. Much broader geographical tagging coverage is obtained as well by utilizing fishermen in these programs (Scott and Beardsley, 1984). However, the potential for expansion of angler participation in tag-and-release fishing is dependent to a large degree on publicizing tagging experiments through the press, fishing organizations, and other public educational efforts; providing for an angler reward system; and overcoming angler resistance and negative attitudes toward tagging programs (Wydoski and Emery, 1985).

OBJECTIVES AND METHODS

This project is designed to identify and address concerns that exist in the marine recreational fishing community related to tag-and-release programs and catch-and-release practices. The principal objective during year one was to assess accomplishments and problems associated with major tag-and-release programs operating in the Northeast region. To accomplish this objective, the following information was sought from coordinators of major tag-and-release programs: program objectives, fish tagging techniques, tag returns and accomplishments, positive and negative angler feedback, and problems associated with tagging and tag return data.

In addition, the project team conducted surveys of anglers at various fishermen's forums and workshops in the region. Information was compiled on anglers' attitudes and experiences with tag-and-release pro-

grams as well as their reasons for not participating in such programs. The survey also requested suggestions from anglers regarding how angler participation in tag-and-release programs might be enhanced.

RESULTS AND DISCUSSION

Feedback from Tagging Program Coordinators

Two basic types of tag-and-release programs exist in the Northeast -- those which depend upon anglers to do the majority of tagging and those in which project scientists and trained personnel do the tagging. Both types of programs rely on the cooperation of fishermen for tag returns. Coordinators of the major tag-and-release programs operating in the Northeast region were interviewed to get information on the primary objectives of their programs; the duration, staffing, and level of angler participation in the programs; descriptions of the tagging devices and procedures used; examples of program accomplishments and data use; comments regarding program management; and any problems experienced with tags or tagging procedures (see Table 1 for a listing and Appendix A for the profiles of each program).

A number of basic components appear to be important when conducting tag-and-release programs. These include:

- having clearly stated objectives;
- determining the appropriate marking or tagging device;
- insuring that tags contain adequate information;
- designing appropriate procedures giving consideration to stress of capture, marking, and handling;
- determining the skill level necessary for project participants;
- developing a reward or incentive system;
- setting up a public relations campaign; and
- coordinating tagging efforts with all appropriate agencies and organizations.

Concerns and insights expressed by the tagging program coordinators included:

- Improper handling and tagging techniques. Some program coordinators expressed reservations over the capability of anglers to properly handle, tag, and release fish without inducing stress and/or mortality, and others were concerned over damage to fish caused by the tag or the tagging apparatus at the tag entry site. Studies to date are limited, but those that have been conducted indicate that fish tag retention is good and that tag-induced mortality is not significant. Hooking and improper handling and release of fish appear to be more significant in terms of increasing stress on the fish. These types of studies are continuing.

Table 1. Major Fish Tagging Programs Profiled.

<p>National Marine Fisheries Service Narragansett Laboratory South Ferry Road Narragansett RI 02882-1191</p> <ul style="list-style-type: none"> • <i>Cooperative Shark Tagging Program - all species of sharks except smooth and spiny dogfish</i> 	<p>National Marine Fisheries Service Northeast Fisheries Center Sandy Hook Laboratory Highlands NJ 07732</p> <ul style="list-style-type: none"> • <i>Winter Flounder Migration Study</i>
<p>National Marine Fisheries Service Southeast Fisheries Center 75 Virginia Drive Miami FL 33149-9986</p> <ul style="list-style-type: none"> • <i>Cooperative Game Fish Tagging Program - tuna, billfish, other pelagic species</i> 	<p>U.S. Fish and Wildlife Service National Fisheries Research Center P.O. Box 700 Kearneysville WV 25430</p> <ul style="list-style-type: none"> • <i>Coastwide Migratory Striped Bass Tagging Program</i>
<p>AFTCO Mfg. Co. Inc. 17351 Murphy Ave. Irvine CA 92714</p> <ul style="list-style-type: none"> • <i>Tag a Tuna For Tomorrow Program - yellowfin, bigeye, bluefin, longfin albacore tuna</i> • <i>Tag/Flag Tournament - albacore, bluefin, yellowfin, bigeye tuna; blue marlin, white marlin, sailfish, amberjack, cobia</i> 	<p>New York Department of Environmental Conservation Division of Marine Resources Bureau of Finfish and Crustaceans Bldg. 40 SUNY Stony Brook NY 11790-2356</p> <ul style="list-style-type: none"> • <i>Striped Bass Tagging Program</i>
<p>American Littoral Society Sandy Hook Laboratory Highlands NJ 07732</p> <ul style="list-style-type: none"> • <i>Marine Game Fish Tagging Program - a variety of inshore species including striped bass, summer flounder, winter flounder, bluefish, sea trout, drum</i> 	<p>Massachusetts Division of Marine Fisheries Cat Cove Marine Laboratory 92 Fort Avenue Salem MA 01970</p> <ul style="list-style-type: none"> • <i>Striped Bass Hook-&-Release Study</i>
<p>Virginia Marine Resources Commission P.O. Box 756 Newport News VA 23607</p> <ul style="list-style-type: none"> • <i>Black Drum Tagging Program</i> 	<p>New Jersey Department of Environmental Protection Division of Fish, Game, and Wildlife Bureau of Marine Fisheries P.O. Box 418 Port Republic NJ 08241</p> <ul style="list-style-type: none"> • <i>Bluefish, Winter Flounder, Striped Bass, Summer Flounder, Blue Crab Tagging Programs</i>
<p>North Carolina Department of Natural Resources and Community Development Division of Marine Fisheries Manteo NC 27954</p> <ul style="list-style-type: none"> • <i>Red Drum Cooperative Recreational Fishermen Tagging Program</i> 	<p>Hudson River Foundation P.O. Box 1731 New York NY 10163</p> <ul style="list-style-type: none"> • <i>Hudson River Striped Bass Tag Recovery Program</i>
	<p>Virginia Institute of Marine Science School of Marine Science College of William and Mary Gloucester Point VA 23062</p> <ul style="list-style-type: none"> • <i>Summer Flounder Tagging Project</i>

- Obtaining quality data from taggers and tag returns. Programs need to:
 - 1) use standardized forms for the collection of information for easy compilation and analysis to meet the objectives of the tagging operation;
 - 2) be able to verify and track tags and data; and
 - 3) provide adequate training of participating taggers.

- Maintaining and expanding angler involvement. Although a large volume of fish have been tagged in the various tag-and-release programs, return rates are fairly low, ranging from about 2% to about 10.5% with an average of approximately 5.3%. While a number of factors may affect relative return rates, techniques which may increase return rates include:
 - 1) promotion of the objectives of the programs to overcome misconceptions of fishermen related to use of tag return data;
 - 2) offering appropriate incentives to encourage angler participation and improve the likelihood of returned tags; and
 - 3) increased education of the fishing community, through the media, workshops, and public forums, as to the importance of collecting adequate data for management decisions.

Angler Views on Tag-and-Release

In order to better understand angler opinions on tag-and-release and catch-and-release activities in the Northeast, surveys were conducted at a number of regional sportfishing forums held during 1989. These included the New Hampshire Coastal Sportfishing Forum, the Suffolk County (NY) Tuna Workshop, the New York Sportfishing Federation Forum, and the Virginia Sport Fishermen's Forum. Surveys were also administered to participants in *The Fisherman* magazine annual New Jersey shark tag-and-release tournament, as well as to a sample of marlin and tuna fishermen in Virginia. A survey questionnaire was given to each of the participants and a total of 378 surveys were completed.

Over one third of the responding fishermen participated in a tag-and-release program, with the majority initiating the activity within the last 5 years. The most popular programs were the NMFS Cooperative Game Fish Tagging Program, the NMFS Cooperative Shark Tagging Program and the American Littoral Society Program. Most of the participants reported no problems with the tagging programs in which they participated. For those who had experienced problems, inadequate instruction on tagging

procedures, ineffective tags, problems with the tagging apparatus, and problems with getting new tags were most often cited.

For individuals who had caught tagged fish in the past, species tagged most often included shark, striped bass, tuna, and billfish. The majority of individuals promptly returned the tags. For those who didn't, lack of knowledge or training in tagging procedures, lack of understanding of the importance of tagging, and concern over what happens with the data were the most important reasons noted. For managers, these findings suggest the importance of providing information and education regarding the tagging process.

The main reason for not participating in a tagging program was not knowing who to contact for information. Other reasons included a lack of knowledge about existing programs, not wanting to be bothered with tagging, concern about injury to fish, and an interest in how tagging data is used.

Suggestions regarding ways to encourage tag-and-release included education about tagging programs, tagging procedures, and the benefits of participating; incentives for participation; and explanations regarding the results of the program. Whereas a manager may have difficulty in changing the attitude of an individual who just does not want to be bothered with tagging, these findings suggest again that education regarding the importance of tagging, the proper way to tag without harming the fish, the ways in which data are used, and who to contact for information could increase participation significantly in tag-and-release programs.

Further discussion of the survey findings is found in Appendix B.

Attitudes on Release-Based Saltwater Sportfishing Tournaments

In March 1989 a Saltwater Sportfishing Tournament Directors Workshop was held for tournament organizers in the mid-Atlantic area to exchange ideas and information on who tournament fishermen are, why they participate, and how to plan, organize, and operate tournaments in relation to fishery management, legal, and fiscal concerns. Topics discussed at the workshop also included kill-versus-release tournaments, the place of tag-and-release in meeting tournament goals, and other conservation measures appropriate for tournaments.

The recent trend away from kill tournaments is only partly due to state or federal regulations setting size restrictions or bag limits for species like blue marlin, white marlin, sailfish, striped bass, and summer flounder. Pete Barrett, associate publisher of *The Fisherman* magazine, pointed out that tournaments of today have different goals than tournaments of 20 or even 10 years ago and that these new goals reflect the changing attitudes of today's fishermen. For example, in

the past, tournaments usually awarded prizes and cash for the most fish killed. However, most tournaments now recognize only the largest fish entered and many tournaments have limits on sizes or quantities of qualifying fish. Whereas the addition of a release category to a tournament 10 years ago was unthinkable, in 1988 there were 16 tournaments in New Jersey and 14 in New York that stressed or added a release category.

Barrett emphasized that the conservation ethic works best when it helps to balance sportsmanship and excessive bag limits. The ideal tournament is able to blend the taking of a reasonable amount of fish for entering at weigh-in, while providing some incentive to gain recognition for releasing the catch. To stress conservation and eliminate the "kill 'em all" attitudes of the past, he recommends that tournaments reduce qualifying catches by limiting the number of fish that can be entered or by establishing minimum sizes (weight or length) for qualifying fish.

In terms of release tournaments, proven formats include: (1) use of a point system for each species released based on the relative abundance of the qualifying fish; (2) blending release with limited kill by awarding points for fish that are estimated to be under established minimum sizes for qualifying fish; and (3) using observers conscripted from outdoor writers and local fishing clubs, or drawn by lottery from a pool to which each boat assigns one crew member (Barrett, 1989).

Jim Murray, Director of North Carolina Sea Grant's Marine Advisory Service, highlighted alternatives that can be used to minimize or reduce kill in fishing tournaments and addressed the concept of non-traditional species as tournament targets. According to Murray, as competition for popular marine sportfish grows and limitations are placed on popular tournament fish, tournament managers will have to consider alternatives to the traditional fishing tournaments including catch-and-release with measure-in rather than weigh-in techniques, implementing point systems for fish caught and released, and establishing minimum weights. Another alternative is to add underutilized species to existing tournaments or to develop new tournaments around these species. The advantages of this include diversification, added excitement, increased demand for saltwater fishing, improved public relations, and wiser utilization of the entire resource (Murray and Bahen, 1986; Murray et al., 1986).

At the workshop, directors of existing tournaments were asked about their experiences with tag-and-release and their thoughts on the role of tag-and-release in the tournament setting. Of the 11 tournaments represented by the responses received, only two (18%) were presently conducted as tag-and-release. One was a shark tournament cooperating with the NMFS Cooperative Shark Tagging Program, and the other was a tarpon tournament that did not specify the type of tags used.

Representatives of these tournaments indicated that they had not encountered any problems that discouraged them from continuing their efforts.

The excitement of catching a fish someone else will also have the opportunity to catch was cited as a benefit related to tag-and-release tournaments. However, it was also noted that angler education in proper tagging methods is essential to the success of these efforts, but is not easy.

Regarding the responses from tournament directors who are not conducting tag-and-release events, 12% indicated that they did not know tagging programs existed for anglers before hearing the workshop discussions and receiving the materials in their registration packets. The remaining 88% indicated that they did not feel that tagging is appropriate for a tournament. Their opinions were varied, but included:

- Twenty-five percent never considered tagging because of the species they were targeting (interestingly, these respondents were conducting inshore tournaments for bluefish, flounder, and weakfish);
- Twenty-five percent expressed concern about how tag return data are being used and cited data use by commercial fishing interests as their primary concern;
- Twelve percent indicated that they are concerned that tagging may cause injury to the fish; and
- Twelve percent felt that it is too much trouble to keep up with tags and tag records in a tournament setting.
- The remaining 25% gave no specific reason as to why they felt tag-and-release was inappropriate for tournaments.

Popular Angler Periodical Literature Addressing Catch-and-Release and Tag-and-Release

Salt Water Sportsman magazine is published monthly and *The Fisherman* magazine is published weekly with four editions covering the Northeast region -- the New England edition, the Long Island and Metro New York edition, the New Jersey and Delaware Bay edition, and the Delaware, Maryland, and Virginia edition. These magazines report on every aspect of saltwater fishing, from the "how to", to current saltwater happenings, information, and observations of interest. They constitute the major fishing-related periodic literature familiar to most coastal anglers. While the species-oriented articles stress fishing techniques and fishing hot spots, most also attempt to promote a conservation ethic by encouraging anglers to handle fish properly, keeping only those they will utilize, and release the rest.

Salt Water Sportsman and *The Fisherman* routinely report on all phases of catch-and-release or tag-and-release in a variety of columns, such as "New Angles" and "Coastwise" in *Salt Water Sportsman* and "Pass It On"

and "Casting Around" in *The Fisherman*, as well as in feature articles (see Ristori, 1988, for example). Coverage includes summaries of new or existing angler participation tag-and-release programs, requests for angler participation in tag-and-release programs, explanations of how and where to return tags if fish are recaptured, highlights on tag return data of interest including information on exceptional migrations or fish survival, practical tagging and release techniques, and gear designed to enhance proper handling and release of fish caught with hook and line.

Since the inception of the U.S. Fish and Wildlife Service striped bass restoration program, *Salt Water Sportsman* and *The Fisherman* have reported on these efforts. They have urged anglers to watch for striped bass bearing spaghetti tags and to cooperate by returning tags promptly. In addition, they have reported on return data of interest. For instance, they reported the biologists' discovery that striped bass as young as 9-12 months old leave Chesapeake Bay and forage along the coast as far north as New Jersey and Massachusetts (it had always been assumed that one- and two-year-old striped bass remained in the Bay). They also reported that biologists tagging adult striped bass wintering off the North Carolina coast in 1988 captured three fish that had been tagged before--one in the Hudson River by the Hudson River Foundation, one in New Jersey waters by an American Littoral Society tagger, and in Chesapeake Bay by the Maryland Department of Natural Resources. *The Fisherman* has also periodically published updates on the Hudson River Foundation striped bass tagging program (see Waldman and Dunning, 1989, for example).

Tagging efforts of the NMFS Cooperative Shark Tagging Program have been highlighted over the years. Anglers have been instructed that if they catch a tagged shark, they should keep the fish, measure the fork length (nose to fork of tail), record the tag number and recapture data, and remove a six to ten inch chunk of backbone directly over the gills, freezing it overnight or pickling it in alcohol. Anglers have been instructed to send the recapture information and backbone to Jack Casey at the Northeast Fisheries Center in Narragansett, Rhode Island. Information regarding tag returns of interest have included reports of sharks traveling thousands of miles from the northeastern U.S. to the eastern Atlantic, the West Indies, and South America. For example, it was reported that a blue shark tagged in 1978 in New York waters was recaptured eight years later some 3,740 miles south off Brazil (which provides evidence that the equator is not a barrier to blue shark migrations). A mako shark tagged off Block Canyon was recaptured a year and a half later some 3,600 miles away off Senegal, West Africa. It was also noted that in 1988 volunteers tagged 5,873 sharks of 32 species and that during the same period, 304 tagged sharks of 19 species were recovered, representing more recaptures in a single year than at any time during the 25 years that the program has been conducted.

The billfish and tuna tagging efforts conducted by the NMFS Cooperative Game Fish Tagging Program have also been highlighted by these magazines. Anglers have been urged to assist NMFS scientists studying the age, growth, migrations, and stock sizes of billfish and tuna by boating tagged fish and contacting Dr. Eric Prince at the NMFS Southeast Fisheries Center in Miami, Florida. Anglers' participation in the program as taggers is also promoted. Tagging data of interest reported from this program have included documentation that bluefin tuna cross the Atlantic and move from North America to South America.

In an effort to call attention to the importance of game fish tagging, the National Coalition for Marine Conservation (NCMC), the Sport Fishing Institute (SFI), the International Game Fish Association (IGFA), and the American Fishing Tackle Manufacturers Association (AFTMA) initiated a tagging awards program in conjunction with the Cooperative Game Fish Tagging Program of the Southeast Fisheries Center of NMFS. The categories for the awards are blue marlin (NCMC), sailfish (SFI), bluefin tuna (IGFA), and white marlin (AFTMA). Both *Salt Water Sportsman* and *The Fisherman* have been instrumental in promoting this program, now called the AFTCO Tag/Flag Tournament.

In another industry-sponsored effort to promote conservation and tag-and-release, AFTCO Manufacturing Company began the Tag a Tuna For Tomorrow Program in 1988. Magazine coverage of the Tag a Tuna Program has ranged from promotion of participation in the program and reports of tagging activity to feature articles (Secrest, 1988; Barrett, 1988; Garfield, 1989) and both magazines are also contributing to the cost of the program and donating prizes.

Techniques and gear that may help improve handling and release of an anglers' catch and improve the efficiency of both catch-and-release and tag-and-release activities have been covered in depth (see Sosin, 1988, for example). Types of gear highlighted have included new devices designed to allow fish to be lip-gaffed or secured by the tail and released unharmed, and new hooks and hook-removing devices allowing quick release of unwanted fish. Fish measuring boards and measuring techniques have been discussed, as have methods of organizing tags and tagging equipment in the cockpit or on the beach for easy and efficient tag-and-release.

Salt Water Sportsman and *The Fisherman* invite reader correspondence and print selected letters and editorial responses each issue. A review of the "Casts and Blasts" column in *Salt Water Sportsman* and the "Short Casts" column in *The Fisherman* reveals that angler concerns about catch-and-release or tag-and-release generally fall into one of the following categories:

- Concerns over the collection and use of tag return data to benefit commercial fishing interests at the expense of marine recreational

anglers. For example, some anglers apparently feel that the information generated by tag-and-release efforts is extremely valuable and made readily accessible to commercial fishermen. This concern is most often expressed in relation to pelagic species, especially billfish and tuna.

- Concerns over injury or mortality of fish due to improper handling and release techniques or improper tag application. Some anglers question whether there may be significant mortality associated with catch-and-release of marine game fish and whether survival rates of tagged fish justify tag-and-release. Other anglers express concerns over improper handling of fish, including boating fish before release rather than de-hooking and releasing fish in the water. Some fishermen question whether it is best to cut leaders or reach into the mouth of a fish to unhook it before it is released.
- Disgust with the continued waste of fish in some sectors of the salt-water fishing community and the need for greater educational efforts designed to instill a conservation ethic among anglers.

Finally, extensive magazine coverage has been given to promoting tag-and-release and catch-and-release in saltwater tournaments for big game species like billfish, tuna, and sharks as well as inshore species. The conclusion reached is that although non-release tournaments will always have their place in the fishing world, properly planned release tournaments can be a great success and are an effective way to reduce pressure on species suffering from stock declines and to stress resource conservation.

SUMMARY

In 1987 a national sport fishing symposium, "Catch-and-Release Fishing - A Decade of Experience" was held as a follow-up to a symposium held 10 years earlier called "Catch-and-Release Fishing as a Management Tool". At the workshop it was noted that catch-and-release has evolved as a management tool that can be used to establish and sustain optimum angling quality by reducing or manipulating angling mortality. For example, the use of special regulations including size limits and/or possession limits encourages fishermen to release most of the fish caught but allows them to keep some fish (Barnhart and Roelfs, 1988).

Behnke (1987) stressed the importance of addressing the sociological or the people-management aspects of special regulations in order to make these efforts work. Behnke's insights included:

- The observation that effective communication between the program managers and the angling community is necessary for catch-and-release programs to succeed. This can be facilitated through (1) fisheries symposia designed to contribute both to fish management by promoting

the exchange of information and to people management by involving sportsmen; and (2) publications to communicate information to the public, especially to overcome some anglers' misunderstanding of fisheries management objectives.

- The suggestion that agencies identify an authoritative spokesperson for the program who is thoroughly knowledgeable about the factors determining the successes and failures of special regulations, who is admired and respected by the anglers, and who makes frequent contact with angler groups. This personalized contact with participating anglers can assist greatly in the legitimizing, publicizing, and educating process.

Other topics addressed at the 1987 catch-and-release symposium included angler participation and reaction to a variety of freshwater catch-and-release programs; evaluations of fish mortality associated with various freshwater catch-and-release practices; and consideration of catch-and-release as a management strategy for a variety of freshwater species.

The concept of marine game fish release and the use of tag-and-release in saltwater sportfishing tournaments were also discussed. It was agreed that with increased pressures being exerted on marine fishery resources through habitat destruction and overfishing (including game fish tournaments involving species of little or no food value), catch-and-release angling is a management tool whose time has come (Behnke, 1987; Epstein, 1987; Pate, 1987).

These conclusions were echoed by outdoor writer Mark Sosin as he described his vision of saltwater sport fishing in the 21st century (Sosin, 1989). Sosin pointed out that as seasonal, size, and bag restrictions become more prevalent in the marine environment, benchmarks for success among recreational anglers will change significantly, with catch-and-release receiving greater attention than it already commands.

Thus, many fisheries managers and angling leaders agree that catch-and-release must become an angling philosophy if marine recreational fishing is to remain viable, and that catch-and-release and tag-and-release must be promoted through educational programs that teach a conservation ethic.

Educational materials addressing catch/tag-and-release that have been developed for the marine recreational angling community recently include videos such as *Pass It On* (National Marine Fisheries Service, Southeast Regional Office), *Release* (Murray Brothers), and *Marlin Conservation: Tag-and-Release* (Pacific Ocean Research Foundation); and print material like *Invest in Your Bluefish Future - Release a Fish Today* (Atlantic States Marine Fisheries Commission), *Fisheries Conservation Begins With You: Tips On Releasing A Hooked Fish* (Delaware Sea Grant), *Fish 'N Tag: Fish Tagging Programs For Coastal New Jersey* (New Jersey Sea Grant), *Tag*

and Release Programs Available to Fishermen (Virginia Sea Grant Advisory No. 40, Virginia Sea Grant); *The Field and Stream Guide To Fish Handling* (Times Mirror Magazines, New York, NY [copies not available]), and the Mustad Fish Hook Release Card (O. Mustad & Son).

Addresses of Organizations

Atlantic States Marine Fisheries
Commission
1400 Sixteenth St. NW
Washington DC 20036
202-387-5330

Delaware Sea Grant
Marine Advisory Program
University of Delaware
700 Pilottown Rd.
Lewes DE 19958
302-645-4346

Murray Brothers
207 East Blue Heron Blvd.
Riviera Beach FL 33404
305-845-1042

O. Mustad & Son
247-253 Grant Ave.
Auburn NY 13021
315-253-2793

National Marine Fisheries Service
9450 Koger Blvd.
St. Petersburg FL 33702
813-893-3141

New Jersey Sea Grant
Building 22
Fort Hancock NJ 07732
Attn: Communicator
908-872-1300

Pacific Ocean Research Foundation
74-425 Kealakehe Parkway #15
Kailua-Kona HI 96740
808-329-6105

Sea Grant Publications
Virginia Sea Grant Marine Advisory
Program
Virginia Institute of Marine
Science
College of William and Mary
P. O. Box 1346
Gloucester Point VA 23062
804-642-7170

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 APPENDIX A

INFORMATION FROM TAGGING PROGRAM COORDINATORS

Two types of tag-and-release programs exist in the Northeast--those that depend on anglers to do the tagging and those in which project scientists and trained personnel do the tagging, which rely on the cooperation of fishermen for returns. Coordinators of the major tag-and-release programs operating in the Northeast region were interviewed to get information on the primary objectives of their programs; the duration, staffing, and level of angler participation in the programs; descriptions of the tagging devices and procedures used; examples of program accomplishments and data use; comments regarding program management; and any problems experienced with tags or tagging procedures.

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AGENCY/ORGANIZATION

National Marine Fisheries Service
Cooperative Shark Tagging Program
Narragansett Laboratory
South Ferry Road
Narragansett, RI 02882-1191
(401) 782-3320

Tagging Programs. All identifiable species of sharks except smooth dogfish and spiny dogfish.

Duration of Program and Staffing. This program was initiated in 1962; the program is operated by the program coordinator (Dr. Jack Casey) and a staff of three.

Primary Objective of Tagging Program. To study the migrations, age and growth, seasonal distributions, relative abundance, and other biological relationships of several species of large Atlantic sharks.

Approximate Number of Anglers Involved. There are about 3,500 to 4,000 anglers involved in this program (from 1963 through 1983 anglers accounted for 52% of the tagging, biologists 34%, foreign fish observers 10%, and commercial fishermen 4%).

Types of Recapture Data Sought from Anglers. Species, tag type and number, date and location caught, method of capture, fish condition, sex, length, and weight (if possible).

Description of Tag and Tagging Procedure. Dart Tag with six inch nylon monofilament streamer and plexiglass capsule containing the tag number, National Marine Fisheries Service (NMFS) Northeast Fisheries Center address, and a request for data in English, Spanish, French, Norwegian, and Japanese attached to a stainless steel needle.

- Tagging needles should be firmly mounted in 1 to 1 1/4 inch diameter hardwood doweling 6 to 8 feet long, and should protrude from the pole 2 1/2 inches.

- The dart head fits loosely into the slotted point in the needle, and the entire tag is held in place by rubber bands 2 to 3 inches up on the pole.

- The dart head is curved so that the two rear points will face downward into the muscle when the tag is inserted.

- Tag only sharks that you can identify.

- Do not over-fight the fish, as sharks fought to complete exhaustion are less likely to survive; however, the shark should be sufficiently played out to permit tagging without having to restrain it for too long.

- Sharks should be left in the water during the tagging operation; however, treat the fish gently as sharks are susceptible to internal injury. Allow the fish some latitude to swim, avoid tail ropes, gaffs, and restraining devices and prevent the shark from thrashing on shore or against the boat.

- Insert the dart at an angle toward the head end of the shark by driving the tag into the back of the shark near the first dorsal fin (the ideal location on large sharks is in the muscle at the very base of the first dorsal fin). When the tag is properly inserted the dart head will come to rest approximately 1 to 1 1/2 inches beneath the skin.

- When finished cut the leader rather than try to retrieve the hook.

- Record and report all tagging information promptly and completely.

Notes on the tagging procedure:

- Care must be taken to properly tag the fish so that the capsule assumes a trailing position on the shark.

- The skin of large sharks is very tough, so it is recommended that the tagging pole be held 2 to 3 feet above the shark and the tag inserted with a strong, quick, oblique thrust.

- In tagging small sharks, care must be taken to avoid injury to the backbone by controlling the depth of penetration of the dart head: make an incision with a pointed knife and carefully force the tag into the muscle.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. Recent totals include 5,873 sharks and 171 billfish, tuna, and miscellaneous species in 1988; and approximately 2,500 sharks in 1989 (preliminary results, January-June).

Number of Tag Returns and Return Rates. In 1988, 304 shark tags were recovered (this was the largest number of recaptures in a single year since the program began 25 years ago). U.S. anglers accounted for 42% of returns, U.S. commercial fishermen 37%, foreign fishermen 13%, foreign fish observers 4%, and other sources 4%.

In 1989 (January-June), 85 shark tags were recovered.

Examples of Use of Tagging Program Data. The program has contributed significantly to knowledge of growth rates and migratory patterns of large sharks.

Tag returns represent recaptures from all along the Atlantic coast, the Gulf of Mexico and trans-Atlantic areas. While many returns were within 100 miles of the tagging site in 1988, there were a number of unusual returns. For example:

A sandbar shark tagged in Virginia in 1965 was recaptured 1217 miles south on a longline off Sarasota, Florida after 22.9 years at large.

Other time-at-liberty records include common thresher (8 years), silky (7 years), bull (7 years), reef (5 years), porbeagle (4 years), and bignose (4 years) sharks.

A sand tiger recaptured showed a long distance movement from Florida to Delaware (600 miles).

A bignose shark set the species distance record traveling over 1400 miles from Maryland to Mexico.

The fastest rate of travel was recorded for a swordfish that traveled 22 miles/day from Cape Sable, Canada to Haiti (a distance of over 1200 miles).

In 1989, unusual returns included a blue shark tagged off Maine recaptured off Venezuela (2000 miles in 7 months) and a mako tagged off Block Canyon recaptured by a Portuguese longliner off Senegal, Africa (3600 miles in 1.5 years).

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Newsletter, periodic updates and reports, and rewards.

Program Management. During the past 5 or 6 years, the numbers of requests to join the program have been tremendous. As a result, the program has become selective in choosing participants based on experience because tags cannot be provided to all who would like to participate.

There have been dozens of newspaper articles, several TV specials, and a report in *National Geographic* on the program--all of them very positive about the program.

The program has increased public awareness and provided managers with data necessary to begin to develop a plan for managing the stocks.

Procedural Problems. Tagging trials during the first few years of the program with the M-dart tags and rototags indicated dart tags provided best results (visible, easy to apply, etc.).

There have been no problems observed with the tagging procedure in terms of impacts to the sharks.

There have been problems with anglers incorrectly identifying similar species.

Continual efforts are necessary to ensure accurate location, size, and other release-capture information are received from volunteer taggers.

There are problems with handling the large amount of data that is collected at times.

There is a need for the development of shark tags adaptable for very small sharks.

AGENCY/ORGANIZATION

National Marine Fisheries Service
Cooperative Game Fish Tagging Program
Southeast Fisheries Center
75 Virginia Beach Drive
Miami, Florida 33149
(305) 361-4253

Tagging Programs. Tuna, billfish, king mackerel, red fish, amber-jack, and cobia.

Duration of Program and Staffing. This program began in 1954; the program is operated by a program director (Mr. Edwin L. Scott) and staff of three scientists.

Primary Objectives of Tagging Program. To provide data for estimating migration patterns, distributions, stock structures, and exploitation rates for certain oceanic game fishes through the cooperative efforts of scientists and recreational fishermen; to provide data storage and summary reports for the AFTCO Tag a Tuna for Tomorrow Program begun in 1988 and Tag/Flag Tournament Program begun in 1989.

Approximate Number of Anglers Involved. Approximately 500-1,000 in the Northeast Region and 3,500 worldwide (including anglers in the AFTCO Tag A Tuna and Tag/Flag Programs).

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, length (fork length), weight (if possible), and sex (if possible, or supply a piece of gonad).

Additionally, the following samples are requested to be taken and frozen for delivery to the Southeast Fisheries Center: from marlin--otoliths, anterior vertebrae, the first five dorsal spines, anal spines; from tuna--caudal peduncle containing vertebrae and the head containing otoliths.

Description of Tag and Tagging Procedure. Yellow vinyl streamer attached to a stainless steel dart containing a tag number and the National Marine Fisheries Service (NMFS) Southeast Fisheries Center address.

- Fish should be held in a suitable tagging position alongside the boat by holding the leader over the forward end of the cockpit (fish should not be handled or removed from the water).
- The stainless steel dart tag is inserted into an applicator affixed to a 6-foot hardwood pole for tagging.
- The tag is inserted about two inches into the muscle tissue of the fish just underneath the forward portion of the dorsal fin for billfish and below the second dorsal fin for tunas. Tags should be inserted so that the streamer and forked end of the dart slant toward the tail of the fish.
- After tagging, the fish should be released by cutting the leader as close to the hook as possible. Frequently, an exhausted fish can be revived by slowly towing the fish through the water before cutting the leader.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. Over 100,000 fish have been tagged and released since the inception of the program in 1954 (this includes fish tagged in the AFTCO programs).

Recent totals for each big game species include:

- 1,986 sailfish in 1987 and approximately 2,466 in 1988;
- 1,341 blue marlin in 1987 and approximately 1,626 in 1988;
- 1,021 white marlin in 1987 and 1,094 in 1988;
- 279 swordfish in 1987 and 284 in 1988;
- 190 yellowfin tuna in 1987 and 314 in 1988; and
- 65 bluefin tuna in 1987 and 91 in 1988.

Number of Tag Returns and Return Rates. About 5,700 tag returns have been recorded to date (including fish tagged in the AFTCO programs) for an overall return rate of approximately 6%.

Returns in the last two years have included:

76 sailfish--39 in 1987, 37 in 1988 (tentative);
32 white marlin--17 in 1987, 15 in 1988 (tentative);
6 blue marlin--2 in 1987, 4 in 1988 (tentative);
20 bluefin tuna--10 in 1987, 10 in 1988 (tentative); and
16 yellowfin tuna--8 in 1987, 8 in 1988 (tentative).

Examples of Use of Tagging Program Data. Examples of the kinds of scientific information obtained from data collected by the Cooperative Game Fish Tagging Program includes showing that a group of white marlin summer off the mid-Atlantic coast and another group summer in the northern Gulf of Mexico. Tag returns have also indicated that the white marlin that summer off the mid-Atlantic coast winter off the northern coast of South America. Tagged white marlin have been recaptured after being at liberty for almost 12 years indicating a much longer life span than previously thought. These data are useful in providing proper management strategies for pelagic game fish stocks.

The geographical distribution of recent tag returns are as follows:

1987: sailfish--off east coast of Florida; white marlin--middle Atlantic states, Gulf of Mexico, and Straits of Florida; blue marlin--Curacao, Netherlands Antilles, and San Juan, Puerto Rico; swordfish--northern Gulf of Mexico; bluefin tuna--northeastern U.S. coast; yellowfin tuna--two transatlantic recaptures recorded (Canary Islands and West Africa), other recaptures occurred in middle Atlantic states.

1988 (tentative data): sailfish--off east coast of Florida and Florida Keys; white marlin--Gulf of Mexico and scattered east coast areas; blue marlin--off La Guaira and San Juan, as well as off North Carolina and the Bahamas; swordfish--Newfoundland and Georges Bank, as well as Florida; bluefin tuna--middle Atlantic states, Bahamas; yellowfin tuna--middle Atlantic states and west coast of Africa.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Each person who recaptures a tagged fish will receive a \$5-\$10 reward and information on when and where the fish was tagged. Recapture information is also sent to the fisherman who tagged the fish.

All participants are informed of the program's progress by an annual newsletter.

Program Management. The program no longer provides tags in large blocks to fishing clubs or fishing tournament organizers but will provide tag data cards if the club or tournament organizers wish to purchase a corresponding block of 400-500 tags directly from the manufacturers.

Procedural Problems. Letters and telephone calls concerning tag recaptures generally express appreciation for the program's work and encourage continuation of the effort; however, occasionally persons contacting the program about tags taken from smaller species, i.e. king mackerel, express disappointment about the small reward offered for returned tags and indicate that returning a tag is not worthwhile.

Distribution of large blocks of tags was discontinued because, in general, only a very small percentage ($\leq 10\%$) of the tags are used. When large numbers of tags are unaccounted for it becomes hard to maintain records regarding which angler received which tags. This prohibits follow-up on tag returns by the program to clarify any data deficiencies that may occur on tag cards and creates the possibility of unrecorded data from the original release of a fish.

Commercial fishermen occasionally indicate they have not returned tags because of negative feelings about NMFS-imposed fishing regulations.

Recreational fishermen sometimes express concern about commercial fishermen utilizing tag return data to put more fishing pressure on stocks.

AGENCY/ORGANIZATION

AFTCO Manufacturing Co. Inc.
17351 Murphy Ave.
Irvine, California 92714
(714) 660-8757

Tagging Programs. Tag A Tuna For Tomorrow and Tag/Flag Tournament.

Duration of Program and Staffing. Initiated in 1988 and expanded in 1989; staff consists of one program coordinator (Ben Secrest); sponsored by leading tackle manufacturers and fishing journals.

Primary Objective of Tagging Program. Designed to encourage the tag and release of yellowfin, bigeye, bluefin, and longfin albacore tuna taken on rod and reel. The program provides data for the National Marine Fisheries Service (NMFS) Cooperative Game Fish Tagging Program.

Approximate Number of Anglers Involved. Operated through the cooperation of dozens of East Coast sportfishermen, charter boat captains, and sportfishing clubs.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, length (fork length), weight (if possible), and sex (if possible, or supply a piece of gonad).

Description of Tag and Tagging Procedure. Each tag is distributed attached to the NMFS tagging report card and a tagging verification card. The standard NMFS tagging procedure is used by each angler.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. In the program's initial year 44 anglers tagged 84 tuna in the Tag A Tuna Program. These totals are reflected in the 1988 figures for the NMFS Cooperative Game Fish Tagging Program.

Examples of Use of Tagging Program Data. Data are used by NMFS to learn more about the relative populations of Atlantic tuna including their life span, growth rates, and migration routes. These data are needed to assess the effects of overfishing and disclose changes in fish populations so that prudent measures can be taken in time to ward off threats to the future of these game fish.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Each year, the first 500 anglers who tag-and-release a yellowfin, bigeye, bluefin, or longfin albacore tuna receive a commemorative Psychohead Green Machine lure and a SO-LO stow-away lure holder. The first 100 fishermen also received a special Tuna tie-tack from *Salt Water Sportsman* and a commemorative tee-shirt from *The Fisherman*. Additionally, any time a captain and his angler tag-and-release a tuna their names are entered in an annual drawing for over 200 offshore tackle and accessory prizes contributed to the program by AFTCO, Berkely, Daiwa, Kunnan, Sevenstrand, Lowrance, and Shimano.

Furthermore, the anglers and original taggers of the first six tagged fish recaptured will be awarded a quality offshore fishing rod and reel combo.

Any captain whose boat tags and releases 15 yellowfin, bigeye, bluefin, or longfin albacore tuna will receive a commemorative tag-and-release flag, and those who tag 25 or more will earn a special deluxe flag.

Salt Water Sportsman and *The Fisherman* periodically list the names of each angler who tags a tuna in this program.

Program Management. In 1989, AFTCO initiated the Tag/Flag Tournament in cooperation with leading conservation groups, fishing magazines, and governmental fisheries management agencies. The tournament is a year-long program designed to assist existing tagging efforts by encouraging greater angler participation in these programs.

Species included in the program are albacore, bluefin, yellowfin, and bigeye tuna, blue marlin, white marlin, sailfish, amberjack, and cobia.

All fish must be taken on rod and reel and tagged and released in Atlantic, Gulf, or Caribbean waters.

Depending on the species, tagging is done in accordance with the provisions and procedures of the following tagging programs: Fish Trackers, Inc.; Gulf Coast Conservation Association Tagging Program; South Carolina Marine Game Fish Tagging Program; and the NMFS Cooperative Game Fish Tagging Program.

AFTCO tag/flags and points are awarded for each individual fish of each qualifying species tagged and released. At year's end, individual trophies will be awarded to both the angler and the captain who tag the highest number of fish in each species. Additionally, the angler with the highest number of tagging points for all of the designated species will be named the "Atlantic Ocean Angler of the Year".

Award categories and sponsors are as follows:

Albacore--American Fishing Tackle Manufacturers Association (AFTMA) and New York Sport Fishing Federation (NY SFF);

Bluefin Tuna--International Game Fish Association (IGFA);

Yellowfin and Bigeye Tuna--AFTMA;

Blue Marlin--National Coalition for Marine Conservation (NCMC);

White Marlin--International Billfish Foundation (IBF);

Sailfish--Sport Fishing Institute (SFI) and IGFA;

Amberjack--Atlantic Coastal Conservation Association of Virginia (ACCA) and Florida Conservation Association (FCA); and

Cobia--FCA and ACCA.

AGENCY/ORGANIZATION

American Littoral Society
Sandy Hook
Highlands, New Jersey 07732
(201) 291-0055

Tagging Program. American Littoral Society (ALS) Tagging Program, tagging a variety of important marine gamefish species.

Duration of Program and Staffing. Initiated in 1965; staff consists of one project coordinator (Pam Carlsen); volunteers are members of the Littoral Society and the program is financially supported by membership dues and sale of tagging kits (\$4 per kit/10 tags per kit).

Primary Objectives of Tagging Program. To encourage anglers to tag the fish that they release to promote a conservation ethic among anglers; to provide scientific data on migration and growth, as well as insights and observations on the condition of the fish.

Approximate Number of Anglers Involved. Approximately 780 anglers; approximately 75 fishing clubs; anglers from Maine through the Gulf of Mexico participate in the program. It would be difficult to estimate the number of anglers that account for the majority of tagging; however, many are occasional participants.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, and length.

Description of Tag and Tagging Procedure. Yellow spaghetti tag containing the tag number and Littoral Society address.

- ALS suggests tagging fish of at least eight inches.
- Bring the fish into the boat or onto the beach and cover the fish's head with a damp cloth to calm it down, then measure the fish (fork length).
- Insert the tag about an inch into the blunt end of the hollow stainless steel inserting needle and push the sharpened end of the needle through the fish's dorsal side near the tail. When the needle is all the way through, pull the needle off the tag.
- Draw the tag through the fish until the two ends are even and tie a tight overhand knot, leaving about an inch of space between the knot and the fish's back to allow for growth and trim the excess tag ends.
- Quickly and gently release the fish and complete the data card and return it to ALS.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. Since the program's inception in 1965 through December 31, 1988, 210,720 tags have been distributed and 101,043 fish have been tagged and released; thus 48% of the tags distributed have been used.

Number of Tag Returns and Return Rates. Of the 101,043 fish tagged, 4,012 recaptures have been recorded, for a return rate of approximately 4%.

It is interesting to note that 170 more tags were sold, 1,953 more fish tagged, and 85 more fish recaptured in 1988 than in the previous year, and the returns for 1988 (411) represent 10% of all returns since the program began.

While it is not easy to catalog the number of fish of various species tagged over the course of the program's history, an analysis of tag returns for popular recreational species sought by anglers along the east coast during recent years reveals that striped bass and summer flounder annually account for the majority of fish tagged and the majority of the tag returns.

For example, of the 156 returns in 1985, 30% were striped bass and 44% summer flounder; of the 206 returns in 1986, 41% were striped bass and 53% summer flounder; of the 326 returns in 1987, 50% were striped bass and 36% were summer flounder; and of the 411 in 1988, 48% were striped bass and 27% summer flounder. Tautog, bluefish, black sea bass, weakfish, winter flounder, and red drum comprise the bulk of the remaining returns each year.

Examples of Use of Tagging Program Data. All return data are published quarterly in the bulletin of the Littoral Society, the *Underwater Naturalist*. Reporting via the *Underwater Naturalist* aids in promoting a conservation ethic among anglers by giving them a broad-based perspective on fish migrations and an awareness of fish species as coastal, i.e., a resource utilizing similar habitats coastwide, and an understanding that conservation is nationally, not locally significant.

Since all tag returns are published in the *Underwater Naturalist*, these data are available to any interested scientists. Furthermore, ALS staff is always willing to work with scientists to compile necessary data provided by tag returns. For example, scientists from Rutgers University studying the importance of estuarine habitats to juvenile fishes have recently utilized ALS data on summer flounder.

Perhaps the most significant use of American Littoral Society tagging data was an analysis of striped bass data from 1965 through 1983 by the

NMFS Northeast Fisheries Center to describe striped bass movements and survival trends during preparation of the Emergency Striped Bass Management Plan in 1985. These data were analyzed as follows: striped bass tagging and recovery data on a calendar year and year-at-large basis; striped bass survival rates on a calendar year and year-at-large basis; and striped bass tagging, recovery, and survival on a calendar year and year-at-large basis by month, geographic area, and length (Boreman and Lewis, 1987).

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. ALS treats taggers as true partners in this program, answering all letters, notes, and calls to maintain close contact with all participants. For many anglers this feeling of partnership and acknowledgement of their efforts in print in the *Underwater Naturalist* column is an incentive.

All anglers returning tags receive a letter with the original information from the initial tagging of the fish plus an invitation to join the Littoral Society and participate in their tagging program. Likewise, all taggers receive a record of the recapture of any of their fish. Notifications of tag returns are also accompanied by a tagged fish patch.

Finally, special recognition for anglers whose tagging efforts result in multiple recaptures (25, 50, 75, 100, 150) include patches, Society publications, books, beach bags, and ALS tee shirts.

Program Management. A constant dialogue with participating anglers is maintained. All angler input is taken seriously, and any questions received are given consideration by seeking expert advice from scientists at the NMFS Northeast Fisheries Center at Sandy Hook and other fisheries scientists, managers, and angling community leaders. ALS staff takes the time to respond in writing to all angler questions, complaints, and inquiries.

Angling groups should be encouraged to participate in established, staffed programs rather than start their own because tagging programs require a long-term commitment and the program must remain active for data to be meaningful. For example, a striper tagged in 1978 was recaptured ten years later in 1988, and this data would have been lost if the program had ceased operation.

On the other hand, there may be some good reasons to discontinue tagging of some species within a program. In the spring of 1987 ALS ended the practice of encouraging members to tag freshwater species. This decision was based on input from fish and wildlife biologists who cited the following reasons for ceasing the freshwater program:

- Very little information is needed on the growth rates and movements of freshwater fishes and what data are needed are best collected by the fisheries agencies conducting specific projects;

- Freshwater fishes are more susceptible to injury and disease after handling, and tags may hang up on obstructions within freshwater habitats; and

- On most lakes and ponds, little information is gained from any tagging project.

Recommendations to taggers to resolve a problem must always be made based on the best available information. For example, ALS received input from concerned anglers that during periods of warm water striped bass may become stressed if improperly handled when being tagged and released. ALS consulted a marine biologist and is distributing to anglers participating in the tagging program the information on how to properly handle and release stripers that was recently published in *The Fisherman* magazine.

Procedural Problems. All tag records received must be reviewed for compliance with procedures, and the program must respond to anglers if procedures are not being adhered to. For example, ALS has an 8-inch minimum for all species and anglers are directed to halt tagging under this size to eliminate potential mortality due to stress on smaller fish.

Tagging programs must be able to track taggers over time via their current address. This can be accomplished by ALS, as it is a membership program and tag return letters and the *Underwater Naturalist* mailing lists allow for maintenance of proper addresses.

When operating tagging programs with fishing clubs, the club must provide a responsible contact person; ALS deals with the contact person only to maintain control and accuracy of the data.

There is also a need to maintain a controlled distribution of tags to maintain the validity of program. Efforts must be made to track all outstanding tags and data cards and to maintain a clean data base.

Length measurements are not always provided with tag returns. In addition, data reported on fish length when tagged vs. length when recaptured is questionable at times due to variations in individual anglers' measurement techniques and the fact that some anglers are reporting estimated lengths rather than total length measurements as requested in the ALS procedural guidelines.

Finally, in some rare occasions a data card has not been submitted when a fish was tagged, yet a recapture occurs. This makes the recapture data meaningless until the original tag data can be confirmed, if it can be confirmed at all.

REFERENCE

Boreman, J. and R. Lewis. 1987. Atlantic coastal migration of striped bass. American Fisheries Society Symposium 1:331-339. published MS.

AGENCY/ORGANIZATION

Virginia Marine Resources Commission
P.O. Box 756
Newport News, Virginia 23607
(804) 247-2200

Tagging Programs. Black Drum Tagging Program.

Duration of Program and Staffing. Three years (began in 1987); staff includes the program director (Lewis Gillingham) and one assistant.

Primary Objective of Tagging Program. To determine migration patterns of large black drum inside Chesapeake Bay and along the mid-Atlantic and south Atlantic coasts.

Approximate Number of Anglers Involved. Eighteen tagging kits have been distributed to fishermen. One commercial fisherman accounted for all of the fish tagged in 1987.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, and length.

Description of Tag and Tagging Procedure. Floy dart tag with sheath to protect tag streamer (Floy tag #FH-69A).

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of 21 black drum have been tagged to date (all in 1987).

Number of Tag Returns and Return Rates. Two black drum tagged in this program have been recaptured, representing a return rate of 10%.

Examples of Use of Tagging Program Data. There have been no studies conducted to determine the impact of tagging on the fish. Because of the small number of fish tagged and limited tag returns, no definitive data are yet available concerning migratory patterns of fish.

One tag return occurred 24 hours after the fish was tagged on the ocean side of Virginia's Eastern Shore, and the fish had moved only a few miles along the shoreline.

The second return came from a fish at large for slightly over one year. The fish had been tagged just outside the mouth of Chesapeake Bay and the fish was recaptured off New Jersey.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Program Management. Because the program is small, no significant effort has been made to increase angler involvement, particularly since fish availability (and market conditions for commercial fishermen) have inhibited the impetus to release fish.

The program will continue and it is hoped that a greater abundance of fish will provide more tag-and-release opportunities for participating fishermen.

Procedural Problems. The tagging procedure seems to work well, and the sheathed tags stay in place; however, the thick skin of large black drum can make placing of the dart tag difficult. This problem was overcome by the commercial fisherman tagger by making a small incision through the skin with a small knife and inserting the dart tag through the incision.

The major problem has concerned poor availability of fish to the recreational and commercial fishery since the program's inception. No fish were tagged in either 1988 or 1989 and efforts to hold a "tagging rodeo" for recreational fishermen in May 1987 met with little success because of poor fishing reports.

AGENCY/ORGANIZATION

North Carolina Department of Natural Resources and Community Development
Division of Marine Fisheries
Manteo, North Carolina 27954
(919) 473-5734

Tagging Programs. Red Drum Cooperative Recreational Fishermen Tagging Program.

Duration of Program and Staffing. Seven years (1983 to present); staff involved with the program consists of the program director (Jeffrey Ross) and three assistants.

Primary Objective of Tagging Program. To determine various aspects of the life history and population dynamics of red drum, particularly seasonal movements and annual migrations of various size classes of fish; to determine age and growth rates of red drum in North Carolina waters; to determine mortality rates; to describe gear and user groups involved in the fishery.

Approximate Number of Anglers Involved. Over 20 volunteer anglers participate in the program.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, and length.

Description of Tag and Tagging Procedure. Floy stainless steel dart tag (Floy #FH-69), except for FT-1 Tags used on small fish; Print-Hall plastic tag (Australian).

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. Over 2,000 red drum have been tagged to date (961 through 1986, 300 in 1987, 434 in 1988, and over 500 in 1989).

Number of Tag Returns and Return Rates. Thirty-eight tag returns had been recorded as of 1988 (12 in 1986, 13 in 1987, and 13 in 1988) for an overall return rate of approximately 2%.

Examples of Use of Tagging Program Data. Tag returns have occurred mostly from the rivers and sounds of North Carolina, with several returns recorded from Virginia--one from the eastern shore and one from Rudee Inlet, Virginia Beach.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Program Management. This program is partially funded from Wallop-Breaux and state of North Carolina funds.

The program is selective in whom it provides tags to and utilizes only anglers who are experienced red drum fishermen.

Procedural Problems. By selecting anglers who participate in the tagging effort, most problems are eliminated. The program staff trains taggers by talking to them about tagging techniques, sending tagging instructions to each angler along with the tags, and going into the field to observe how anglers are tagging fish.

Anglers in the program are enthusiastic. They recommend other experienced anglers to the program staff and none of the volunteer anglers involved have dropped out of the program since its inception.

Some tagged fish have been held in captivity to examine tag retention rates. Fish held over a six month period have indicated good tag retention and no appreciable fish mortality.

AGENCY/ORGANIZATION

National Marine Fisheries Service
Northeast Fisheries Center
Sandy Hook Laboratory
Highlands, New Jersey 07732
(201) 872-3000

Tagging Program. Response of the Habitat and Biota of the Inner New York Bight to Abatement of Sewage Sludge Dumping--Migration of Winter Flounder.

Duration of Program and Staffing. Three years (1986-1989); the project was conducted by one principal investigator (Beth Valdez).

Primary Objectives of Tagging Program. To document changes in living marine resources and their habitats during and following the period in which sewage sludge dumping is phased out at a site 12 nautical miles from Sandy Hook, New Jersey in the inner New York Bight; to determine the magnitude and extent of winter flounder inshore-offshore migration patterns, their population composition, and their availability within areas of the New York Bight Apex since little is known about the movements of winter flounder utilizing the dumpsite area.

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. Recapture of tagged fish is accomplished by further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, and length (total length).

Description of Tag and Tagging Procedure. Yellow plastic laminated Petersen disc located at the back of the head containing the tag number, National Marine Fisheries Service (NMFS) Sandy Hook Laboratory address, and catch data request.

- At each sampling station, a 15-minute trawl using a 30-foot otter trawl is conducted to collect winter flounder.

- After capture, fish greater than 18 cm are held in a flow-through seawater system until processed.

- Each fish is sexed, scales removed for aging, and total length measurement recorded.

- A 1/2-inch diameter Petersen disc tag is attached with a nickel pin inserted through the nape musculature and held by a crimp in the pin on the opposite side against a blank disc.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of 7,346 fish were tagged and released at 22 Bight Apex stations and 14 inshore (Hudson-Raritan estuary) areas.

Number of Tag Returns and Return Rates. As of August 1989, there were 188 tag returns, amounting to a return rate of 2.6% (86.2% of the tag returns have come from recreational fishermen, 9.0% from research vessels, and 4.8% from commercial fishing vessels).

Examples of Use of Tagging Program Data. Winter flounder are one of the most valuable sport and commercial fisheries of the New York Bight. During colder months winter flounder inhabit coastal and estuarine waters and when water temperatures warm they move offshore into deeper water. Previous studies have shown that winter flounder populations consist of independent stocks associated with individual estuaries or coastal areas with significant differences in growth occasionally found in adjacent bays.

Data collected in this study have revealed the following regarding winter flounder migration and movement patterns within the New York Bight Apex and adjacent estuarine areas:

- Winter flounder within the study area exhibit generally accepted seasonal patterns of migration, offshore into deeper, cooler waters in late spring followed by an inshore movement for spawning in early winter; however, offshore movements may not be limited to deep ocean areas as adult winter flounder are frequently found in the deep channels of estuaries during warm months.

- The Navesink-Shrewsbury river system supports a population of winter flounder which return yearly during spawning season.

- There is intermixing between populations in New Jersey, the 12-mile sewage sludge dumpsite in the Bight Apex, and points north and east,

indicating that populations may not be as discrete as previously believed.

This tagging effort was not designed to support any management decisions, although the data may prove useful in future analysis of risk exposure associated with seafood captured in the New York Bight, and as supplemental data to management-based fisheries research being conducted by NMFS or state agencies.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Anyone who returns a tag receives a letter acknowledging the recapture and providing release data of interest and a copy of a chart showing where the fish was originally tagged.

Program Management. Giving the tagging program a research-based identity rather than associating it with a governmental agency (i.e., Sandy Hook Lab rather than NMFS) makes it more personal and disassociates the tagging program from what anglers may perceive as an effort to collect data for use in a restrictive regulatory action in the future. This in turn may encourage more returns from the recreational sector.

Procedural Problems. The lack of incentives (money or other rewards) may be partially responsible for the low return rates experienced by this program. Fishermen may also be suspicious of the use of this type of data in regulating their activities.

Commercial fishermen may not return tags because they fear that negative publicity will result if data show that fish landed locally spend time in the vicinity of the sludge dumpsite. Additionally, an active illegal commercial fishery is known to exist within Raritan Bay, and tag returns from fish captured in this fishery are highly unlikely.

Programs need to get information on their tag-and-release efforts in outdoor writers' columns/publications on a regular basis. This program would have benefited from a large publicity campaign in both New Jersey and New York making the program more visible to the angling community, including making anglers aware of what scientists need from anglers when a tagged fish is recaptured and that it is fine to keep a tagged fish as part of their catch if it is of legal size and simply return the requested recapture data (i.e., the tag data, not the entire fish, should be returned).

Adequate research vessel time and field assistance to conduct tagging were restrictions on this effort. Additionally, adverse weather had an impact on field sampling efforts.

Length data from tag returns is usually of little value since anglers provide estimates rather than specific lengths. The location of recapture is also not specific enough at times.

AGENCY/ORGANIZATION

U.S. Fish and Wildlife Service
National Fisheries Research Center
P.O. Box 700
Kearneysville, West Virginia 25430
(304) 725-8461

Tagging Program. Coastwide Migratory Striped Bass Tagging Program.

Duration of Program and Staffing. Five years (began in 1985 with hatchery-reared fish; tagging of wild fish began in 1986); staff consists of two Fish and Wildlife Service scientists, including the program director (Paul Rego).

Primary Objective of Tagging Program. To develop a data base to serve as one of the primary sources of information for scientists, managers, and administrators charged with anadromous striped bass management along the Atlantic coast; to obtain estimates on population dynamics and descriptive information necessary for future management of striped bass.

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. Recapture of tagged fish is accomplished through further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, length, and whether the tag was cut off the fish or left on if the fish was subsequently released.

Description of Tag and Tagging Procedure. Floy internal anchor tags with red or "hot pink" external streamers. The streamer portion of the tag contains the tag number, a note to cut off the streamer part of the tag if the fish is undersize, and the U.S. Fish and Wildlife Service (FWS) phone number. The anchor portion of the tag contains the tag number, and the U.S. Fish and Wildlife Service address and phone number.

- Fish are placed in a holding tank or pool of water from the collection site.

- A small surgical incision using a scalpel is made just posterior to the apex of the pectoral fin.

- The tag is inserted into the body cavity, and tested to ensure it is anchored by twisting and lightly pulling the streamer portion of the tag.

- The fish is then placed back into the water and, if necessary, revived by pushing it through the water so that water will flow over its gills.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of 90,000 striped bass have been tagged, of which 45,000 were tagged with binary-coded wire tags.

Number of Tag Returns and Return Rates. Approximately 9,000-10,000 tag recoveries have been made to date (90% of the tags have been returned by recreational fishermen) for an overall return rate of approximately 10.5%.

Examples of Use of Tagging Program Data. Some fish have been at large for up to three years and some multiple recaptures have occurred in pound nets or fyke nets.

The majority of fish tagged in Chesapeake Bay (Virginia and Maryland) have been recaptured in Chesapeake Bay, except for larger (older) fish which have been recovered outside the Bay. Fish tagged off Rhode Island and Long Island Sound have been recaptured mostly north of Maryland (Delaware Bay). Large fish tagged offshore North Carolina have been recaptured along the Atlantic seaboard from as far north as New England and Canada.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Anglers who cooperate by returning tags are offered \$5 or a National Fish and Wildlife Foundation cap with a Striped Bass Conservation logo on the front, along with a letter with the details of when and where the fish was reared and released.

Program Management. The program is operated in cooperation with state fishery management agencies from Maine to North Carolina, NMFS, and university scientists. Agencies and organizations cooperating in the project get sets of these tags from the FWS.

The Fish and Wildlife Service has conducted a strong public relations effort, including public service announcements, video releases, and periodic press releases to the print media.

The program has been well received by the public. Fishermen appear to be pleased to see biologists working hard on trying to conserve the striped bass resource.

Procedural Problems. Floy tags used in the Maryland Conowingo Dam and Fish Lift study showed unusual fouling problems.

Handling of fish in fresh water coupled with relatively high water temperatures has resulted in significant fish mortalities.

Occasionally, some fishermen report not wanting to return tags for fear of stricter regulations being placed on the fishery (primarily in North Carolina).

The Conowingo Dam study in Maryland (DNR) and Catch-and-Release Mortality Study in Massachusetts (DMF) are being conducted in conjunction with this program to address stress or mortality considerations related to the handling and tagging process.

AGENCY/ORGANIZATION

New York Department of Environmental Conservation
Division of Marine Resources
Bureau of Finfish and Crustaceans
Building 40 SUNY
Stony Brook, NY 11790-2356
(516) 751-7900

Tagging Programs. New York Striped Bass Tagging Program.

Duration of Program and Staffing. Three years (1986 to present); the program is operated by a program director (Victor Vecchio), two staff members, and five commercial fishermen.

Primary Objective of Tagging Program. To look at the movements and migration patterns of adult striped bass and to see if there are any homing tendencies by examining the growth of the fish and the total annual mortality; to look at the contribution of the Hudson River and Chesapeake Bay to the total makeup of coastal striped bass stocks.

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. They contract with commercial fishermen to catch the fish with an ocean haul seine. Personnel from the department do the tagging and release of the fish. Recapture of tagged fish is accomplished through further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, length, and whether the tag was cut off the fish or left on if the fish was subsequently released.

Description of Tag and Tagging Procedure. The Department of Environmental Conservation (DEC) uses the federal Fish and Wildlife Service striped bass tag--internal anchor tags with a streamer hanging on the outside of the fish in the belly area. The streamer portion of the tag contains the tag number, a note to cut off the streamer part of the tag if the fish is undersize, and the U.S. Fish and Wildlife Service phone number. The anchor portion of the tag contains the tag number, and the U.S. Fish and Wildlife Service address and phone number.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of 6,704 striped bass were caught with an ocean haul seine over a two-year period and 3,615 fish were released with tags.

Number of Tag Returns and Return Rates. For 1987, 160 (9%) of the striped bass released in the first year were recaptured. Data for 1988 are not currently available.

Examples of Use of Tagging Program Data. The data are being used to develop a data base to serve as one of the primary sources of information for scientists, managers, and administrators charged with anadromous striped bass management along the Atlantic coast.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Anglers who cooperate by returning tags are offered either \$5 or a cap with a Striped Bass Conservation logo on the front along with a letter with the details of when and where the fish was reared and released.

Program Management. DEC is conducting this program in cooperation with the U.S. Fish and Wildlife Service coastwide survey of adult striped bass stocks.

Procedural Problems. The DEC did not identify any problems associated with this program. They felt this was because qualified personnel do the tagging. They also did not identify any problems with tags being returned.

AGENCY/ORGANIZATION

Massachusetts Division of Marine Fisheries
Cat Cove Marine Laboratory
92 Fort Avenue
Salem, Massachusetts 01970
(508) 745-3107

Tagging Programs. Striped Bass Hook-and-Release Mortality Study.

Duration of Program and Staffing. This program was recently initiated (April 1989) and tagging of fish has just begun; staff consists of a project director (Paul Diodati), two assistants, and four volunteers.

Primary Objective of Tagging Program. To determine the impact of hooking on striped bass and estimate the resulting mortality on striped bass that are hooked and subsequently released.

Approximate Number of Anglers Involved. Sportfishing clubs catch the fish. They have six to eight anglers out twice a week hooking fish.

Description of Tag and Tagging Procedure. The Division of Marine Fisheries (DMF) uses commercial fishermen to trap the fish. All of the fish were tagged at sea by experienced taggers. This procedure allows the tagging to occur under less stressful conditions than may occur if amateur anglers were doing the tagging. The fish were brought back to the DMF lab and placed in a pond where they were acclimatized for a month (again to reduce stress). The hooking is taking place in this controlled setting by anglers from the local sportfishing clubs.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. There were 1,050 fish tagged by the commercial fishermen and brought back to the Division of Marine Fisheries lab; however, the study is not designed as a tagging program.

Examples of Use of Tagging Program Data. This research program is designed to look at mortality rates of fish that are hooked and released. It is not an angler tagging program. The Division of Marine Fisheries plans to look at the impact of angler tag-and-release efforts in the future.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Program Management. In informal discussions with fishermen, the DMF staff have found that fishermen love to tag fish and that tagging gives them more justification to get out and fish. However, they are discour-

aging tagging of striped bass in Massachusetts until they learn more about the effects of tagging. If clubs request them to come and talk about tagging, they refuse and explain to the club why not.

Procedural Problems. No problems were identified with this program. The tagging is being done by experienced personnel. Fishermen are hooking and releasing the fish and department personnel are looking at the mortality rates.

Some fishermen feel that the tags are not good for the fish. Commercial fishermen have reported catching tagged fish where the tag has been covered with algae and there have been infections around the tag.

The DMF feels that although tagging adds to the angler experience, it may not be good for the fish, i.e., that improper handling and possible poor hooking is too stressful for the fish. They also question whether information from volunteer tagging programs is of use to regional research and management efforts.

The DMF is trying to develop angler programs to decrease stress. For example, they encourage anglers to keep diaries to record their catch, length and weight of fish, climate conditions, etc.

AGENCY/ORGANIZATION

New Jersey Department of Environmental Protection
Division of Fish, Game, and Wildlife
Bureau of Marine Fisheries
Nacote Creek Marine Research Station
Absecon, New Jersey 08201
(609) 441-3292

Tagging Programs. Bluefish, winter flounder, striped bass, summer flounder, and blue crab.

Duration of Program and Staffing. Bluefish--three years (April 1984-March 1987); staff consisted of one biologist assisted by various lab personnel.

Winter flounder--six years (1982-1988); staff consisted of one biologist and two technicians.

Striped bass--initiated in January 1989; this program will continue as long as federal funding is secured; staff of three biologists.

Summer Flounder--initiated in September 1989; staff consists of one biologist assisted by various lab personnel.

Blue crab--four years (1982-1985); staff consists of one biologist and one technician.

Primary Objectives of Tagging Program. Bluefish--to provide information on local movement and seasonal migration of bluefish found in New Jersey's marine waters.

Winter flounder--to provide information on movement and seasonal migration of winter flounder found in New Jersey's marine waters; to examine the relationship between winter flounder from adjacent estuaries in order to determine if different stocks exist; and to determine the distribution of catches between recreational and commercial fishermen.

Striped bass--to complement the coastwide tagging efforts coordinated by the U.S. Fish and Wildlife Service which began in 1987; to provide information needed for estimating fishing rates; and to provide stock-specific information on biological and fishery characteristics.

Summer Flounder--to determine seasonal migration of immature summer flounder from New Jersey's marine waters.

Blue crab--to provide information on migration of blue crabs from selected New Jersey estuaries and examine the relationship between blue crabs from adjacent estuaries in order to determine if different stocks exist.

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. Recapture of tagged fish is accomplished by further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Tag number, date and location caught, and length (fork length preferred). Striped bass--whether the tag was cut off the fish or left on if the fish was subsequently released; blue crab--measurement of crab point to point.

Description of Tag and Tagging Procedure. Bluefish--laminated internal anchor tag with a yellow streamer in the belly area. A plastic oval containing the tag number, Nacote Creek Research Station address, and phone number is attached to the streamer under the fish's skin. Some bluefish were also tagged in the gill area. These tags are yellow streamers bearing a tag number and the Nacote Creek Research Station phone number.

- Bluefish are generally anesthetized prior to the tagging operation.

- A vertical (dorso-ventral) incision, approximately the same width as the tag disc, is made with a number 12 scalpel blade through the

abdominal wall into the peritoneal cavity just posterior to the apex of the pectoral fin as it lies on the fish's side (the incision is made to allow placement of the tag disc posterior to the pericardial cavity and anterior to the spleen).

- Tags are placed in a 1:1 betadine:water disinfectant solution to minimize bacterial contamination. It is also recommended that the scalpel blade be wiped across a betadine-saturated paper towel between fish.

- The tag is placed into the incision by folding the streamer back along the disc and inserting the disc into the incision. Once completely inside the fish's body cavity, the disc is anchored by pulling back on the streamer.

Winter flounder--13-mm orange plastic Petersen disc attached with a stainless steel pin inserted through the nape musculature at the back of the head containing the tag number, Nacote Creek Research Station address, and phone number.

Striped bass--internal anchor tags with a red or hot pink streamer in the belly area. The streamer portion of the tag contains the tag number, a note to cut off the streamer part of the tag if the fish is undersize, and the U.S. Fish and Wildlife Service phone number. The anchor portion of the tag contains the tag number, and the U.S. Fish and Wildlife Service address and phone number.

Summer flounder--laminated internal anchor tag with a yellow streamer in the belly area. A plastic oval containing the tag number, Nacote Creek Research Station address and phone number is attached to the streamer under the fish's skin.

- Summer flounder are tagged using the same basic procedure as the bluefish given above.

Blue crab--mature females tagged with a carapace tag attached from point to point; immature females and male crabs tagged with an anchor tag attached to the abdominal flap imprinted with a tag number.

- Carapace tags are attached point to point with monel wire.

- Anchor tags (Floy #FTL-69 lobster tag) are inserted with a hypodermic needle beneath the posterior dorsal carapace edge and angled toward the depressor muscle which articulates the modified fifth leg.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. Bluefish--A total of 1,615 bluefish were tagged and released--232 in 1984 (67% in Great Bay

and 33% in the ocean); 416 in 1985 (26% in Great Bay and 74% in the ocean); and 976 in 1986 (22% in Great Bay and 78% in the ocean).

Winter Flounder--A total of 14,820 winter flounder were tagged and released--990 in 1982; 4,017 in 1983; 3,590 in 1984; 2,998 in 1985; 1,415 in 1986; and 1,810 in 1987 were tagged in various estuaries along the Atlantic coast.

Striped Bass--A total of 592 striped bass have been tagged as of November 15, 1989 (83% in Delaware Bay, 10% in the ocean, 6% in the Navesink River, 3% in the Delaware River, and 1% in the Mullica River).

Summer flounder--A total of 126 summer flounder had been tagged as of November 15, 1989. All fish tagged were taken in ocean waters.

Blue Crab--A total of 11,558 blue crabs were tagged and released--2,944 in 1982 (Mullica River); 2,127 in 1983 (Great Egg Harbor Bay); 3,006 in 1984 (Great Egg Harbor Bay); and 3,481 in 1985 (Barnegat Bay).

Number of Tag Returns and Return Rates. Bluefish--Forty-one tag returns had been recorded by the end of 1986 (8 recaptures in 1984, 11 in 1985, and 22 in 1986) for an overall return rate of 2.5%.

Winter Flounder--Eight hundred eighty-five tag returns had been recorded by the end of 1988 (70 in 1982, 158 in 1983, 225 in 1984, 248 in 1985, 78 in 1986, 100 in 1987, and 6 in 1988) for an overall return rate of 6%.

Striped Bass--Thirty tag returns were recorded through July 1989 for an overall return rate of 5%.

Summer flounder--One return as of November 15, 1989.

Blue Crab--Two hundred ninety-seven tag returns were recorded between 1982 and 1985 (90 recaptures in 1982, 33 in 1983, 63 in 1984, and 111 in 1985) for an overall return rate of 2.6%.

Examples of Use of Tagging Program Data. Bluefish--Most recaptures (45%) occurred in New Jersey waters; 37% occurred to the north from New York to Massachusetts, while 18% were taken south of New Jersey from Delaware to Virginia. The earliest returns were from south of the tagging area indicating a northward migration. The fall migration was not so defined by return data; while at least one return was reported south of New Jersey in the fall of each year, returns also came in from New York and New Jersey in October and November.

Winter Flounder--Results of the tagging study indicate that during most years winter flounder summer in the Atlantic Ocean in an area north and east of the tagging area (north of the Manasquan River). Winter floun-

der move inshore, with most returning to the same estuary as the year before, sometime during September or October, and remain through May. Some movement from estuary to estuary does occur during the winter period but most fish remain in one estuary throughout the winter. Because of the high number of returns from the Point Pleasant Canal and Manasquan River from winter flounder tagged in the Metedeconk and Toms Rivers, it is probable that these fish utilize the Manasquan Inlet as access to the ocean.

Striped Bass--Location of recaptured fish range from the Chesapeake Bay in Maryland to Buzzard's Bay in Massachusetts, and in the Hudson River to Ossining, New York.

Summer flounder--None to date, program recently initiated.

Blue Crab--Most recaptures occurred within three weeks of tagging and indicated little or no movement within the estuaries.

All data are collected in support of the development of management strategies designed to reduce the probability of recruitment failure by protecting juvenile fish; to insure that there is a fair and equitable allocation of the resource to the existing recreational and commercial components of the fishery; to maximize the living conditions needed by the species to assure its continued abundance; and to improve understanding of the biological factors that interact to control abundance of the stocks.

For example, the results of the winter flounder tagging program along with other winter flounder research and published and unpublished information were utilized to prepare a draft plan for statewide winter flounder management. The fishery management plan contains management measures to control and regulate fishing for winter flounder including a recommendation to increase the minimum size limit on the commercial fishery and impose the same size limit on the recreational fishery.

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Anyone who returns a tag receives a letter acknowledging the recapture and data regarding where the fish was tagged, when it was tagged, and other data of interest.

Anglers returning Fish and Wildlife Service striped bass tags are offered either \$5 or a cap with a Striped Bass Conservation logo on the front along with a letter with the details of when and where the fish was reared and released.

Program publicity (posters, press releases, etc.) instructs anglers to call the Lab collect to report a tag recapture. Toll-free numbers are another alternative considered. Both of these are felt to encourage re-

turns that may not be made otherwise if an angler has to take the time to write a letter. Also, call-in returns allow more accurate data to be acquired, especially in terms of pin-pointing exact recapture locations.

Program Management. At present there is no way of determining natural mortality of fish tagged and the number of tagged fish that are recaptured without the tag being returned which hampers the determination of "fishing mortality".

Procedural Problems. Low return rates may be indicative of poor fisherman cooperation. Additionally, returns may be lost if anglers overlook the tag, especially in fish that are immediately released after landing.

The lack of angler incentives for returning a tag may be a problem; however, feedback from the angling community as to what type of incentives (cash, prizes, patches, etc.) are desirable is necessary.

Returns may be lost if phone number or address has worn off streamer tags.

Blue crab tagging efforts may suffer from tag rejection or possible high tagging mortality.

There is concern that anglers may mishandle fish during the tagging process, thus only trained biologists are utilized in tagging efforts.

It was also noted in relation to angler-based tag-and-release programs that these should be carefully designed in terms of tags and procedures used, as some tagging devices are not appropriate for some species due to the fishes' habits and behavior.

Length data from returns is not always valuable because anglers frequently provide estimates rather than specifics. The location of recapture is also not specific enough at times. These comments relate to the need for better publicity and understanding of what scientists need from anglers when a tagged fish is recaptured.

AGENCY/ORGANIZATION

Hudson River Foundation
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New York, NY 10163
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Tagging Programs. Hudson River Striped Bass Tag Recovery Program

Duration of Program and Staffing. Six years (1984 to present); staff consists of a project coordinator (Dr. John Waldman) and up to 10 additional personnel from the Hudson River Foundation (HRF), the New York Power Authority and Normandeau Associates.

Primary Objective of Tagging Program. To conduct biological monitoring in accordance with Hudson River Cooling Tower Settlement Agreement; to determine the contribution of stocked bass to the Hudson River population; to evaluate several tagging variables (size of anchor, type of streamer, reported recaptures as function of reward size, and other topics).

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. Recapture of tagged fish is accomplished through further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Anglers catching striped bass with Hudson River Foundation tags are requested to cut off the tags and record date and location caught, total length, and condition of tag insertion sites.

Description of Tag and Tagging Procedure. Internal anchor with a yellow external streamer in the belly area. About 1,000 fish tagged during the spring of 1989 were double-tagged with an additional Dennison dart tag with a yellow streamer under the dorsal fin. The streamer portion of the tag contains the tag number, Hudson River Foundation address, and indicates that anglers will receive a \$10-\$1,000 reward for returning the tag.

- Captured fish are transferred to a holding facility alongside the vessel to minimize mortality from handling, measured (total length), and examined for tags and tag wounds.

- A scale midway between the vent and the distal tip of the depressed pelvic fins, and five to six scale rows dorsolaterally from the ventral midline is removed.

- A horizontal incision approximately 5 mm long is then made through the abdominal wall.

- The anchor of the tag is inserted through the incision and the wound is treated with a merbromin-based topical antiseptic.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of 37,727 striped bass were tagged and released between 1984 and the end of 1987.

By the spring of 1989, about 66,000 striped bass had been tagged and released.

Number of Returns and Return Rates. A total of approximately 1,700 tag returns had been recorded as of February 1988. By December 1989 approximately 3,750 had been recorded for an overall return rate of about 5.7% (approximately 75% of the returns have been submitted by recreational fishermen).

Examples of Use of Tagging Program Data. New York waters (primarily the Hudson River and waters adjacent to Long Island) account for the highest percentage of tag returns, followed by New Jersey and New England; however, fish tagged in the Hudson River estuary have been recaptured as far north as the Annapolis River, a tributary to the Bay of Fundy in Nova Scotia and as far south as North Carolina offshore Currituck Island, Cape Hatteras.

Tag return data have confirmed the following regarding striped bass migrations (Waldman, 1988; Waldman, 1989):

- A greater proportion of large fish leave the Hudson River in spring and migrate farther from the river than small fish;
- The number of returns from the Hudson declines sharply beyond spring presumably from a reduction in angling interest and increased migration of fish out of the river; and
- Much greater movement occurs north and east from the Hudson River than south during spring and summer.

The program has produced a body of literature on improvement of tag designs and improved tagging procedures (see discussion of procedural problems below), and information on the physical effects of tagging, including incidental mortality (see Dunning et al., 1987; and Waldman, 1989).

COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. Rewards are offered for tag returns. Fish were marked with tags bearing reward values of either \$5-\$1,000 or \$10-\$1,000. When a tag is returned, the HRF sends a check for the minimum value of the reward along with a questionnaire to the respondent. When a fisherman returns a completed questionnaire his or her name is entered into a drawing for nine prizes of up to \$1000.

Additionally, respondents are sent a certificate, suitable for framing, thanking them for their participation in the program and informing them of when and where their fish was originally tagged.

Program Management. The background and origin of the program is rather unique. The Hudson River Cooling Tower Settlement Agreement among utilities, government agencies, and environmental protection groups stipulated that the utilities conduct biological studies of certain Hudson River fish stocks from 1981 through 1990, including striped bass. It also stipulated that the utilities evaluate the contribution of stocked striped bass to the Hudson River population. The Hudson River Striped Bass Tag Recovery Program is a spinoff of the primary requirements of the Hudson River Cooling Tower Agreement.

Since the stock assessment methods necessitate handling large numbers of adult and sub-adult fish, it was decided to simultaneously operate a second tagging program based on internal anchor streamer tags. As a result, striped bass have been captured, examined for hatchery marks (hatchery-reared striped bass are marked with coded wire tags implanted in the snout prior to release), and externally tagged and released since 1984. The fish released remain at large until recovered by fishermen or later sampling efforts.

The Hudson River Foundation was contracted to process tag returns, publicize the program, and analyze the tag return data. Normandeau Associates, Inc. performs the fish sampling and tagging, and performs the evaluation of the contribution of stocked fish.

It is not clear how long this program will continue, since the major stipulations of the Hudson River Cooling Tower Agreement are due to expire in 1990. It is unlikely that the tagging operation will continue in its present form, since it appears that the hatchery operations will cease, thereby precluding the necessity of discerning the origin of Hudson River striped bass. However, since thousands of tagged bass remain at large, it is expected that HRF will continue the tag recovery and data collection portions of the program.

Procedural Problems. In terms of recapture data, fish length data reported by anglers is very poor and of little use. Additionally, zip codes are sometimes reported instead of the tag number and the date of recapture is often interchanged with the date that the recapture is being reported. This is especially true in the case of some commercial fishermen who supply bulk returns encompassing several weeks or months.

Problems with tags and the tagging procedure have been encountered during this program. These have included abrasion of information from the tags by contact with the bottom and soreness and redness on fish in the vicinity of internal anchor tag placement. As a result the program has continued to experiment with improved tag design.

The original tags used experienced abrasion on occasion. To overcome this, the next version had a clear vinyl tube over the tag streamer. However, while the clear tube prevented abrasion, it allowed algae to

grow between it and the streamer, obliterating the legend and causing the tag to appear like a piece of wire.

To eliminate these drawbacks, another tag was designed. This tag had a short piece of monofilament between the tag's anchor and streamer. The monofilament was angled to permit the tag to lie closer to parallel with the fish's body. A soft anchor was incorporated and the tag was constructed out of a non-irritating polyethylene that was highly abrasion resistant. This tag withstood abrasion well, but the monofilament slowly cut through the fish's abdominal wall, causing the tag to shift to the rear of the abdominal cavity before contacting bone and dropping out.

In the present version, the monofilament has been eliminated and the streamer tube runs at an angle all the way to the anchor in the fish's body.

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AGENCY/ORGANIZATION

Virginia Institute of Marine Science
School of Marine Science
College of William and Mary
Gloucester Point, Virginia 23062
(804) 642-7173

Tagging Programs. Summer Flounder Tagging Project

Duration of Program and Staffing. Three years (1986 to present); staff consists of a program director (Dr. Jack Musick) and three scientists and technicians.

Primary Objectives of Tagging Program. To study movements and migration patterns of fish tagged in Chesapeake Bay; to identify stock composition; to collect basic life history information on the species including relative abundance and catch per unit of effort (CPUE).

Approximate Number of Anglers Involved. No angler involvement in tagging, all tagging completed by project personnel. Recapture of tagged fish is accomplished by further sampling efforts and through the cooperation of local fishermen.

Types of Recapture Data Sought from Anglers. Anglers keeping legal size fish (≥ 13 inches) send the tag to the Virginia Institute of Marine Science (VIMS) and supply the date and location caught, and length.

Anglers releasing fish either record the tag number or clip off the tag and supply VIMS with the date and location caught, and length.

Description of Tag and Tagging Procedure. Orange cinch-up tag (Floy #FT-4) in the caudal peduncle on the dorsal surface.

PROGRAM ACCOMPLISHMENTS

Distribution of Numbers of Tagged Fish. A total of approximately 12,400 summer flounder have been tagged and released to date.

Number of Tag Returns and Return Rates. Seven hundred fifty tags have been returned over three years for an overall return rate of approximately 6.1% (about 60% of the returns have come from commercial fishermen and 40% from recreational fishermen).

Examples of Use of Tagging Program Data. To date 80% of the tag returns have come from Virginia or to the south of Virginia and 20% have come from north of Virginia. The program has demonstrated that two separate populations of flounder use Chesapeake Bay. Juveniles use the bay as a nursery area coming from two populations of spawning adults; adults utilize the bay as a feeding area in the summer months.

Data were used by the Virginia Marine Resource Commission when a bag limit of 10 flounder (≥ 13 inches) per angler per day was put into effect on August 1, 1989 after regulations were imposed to restrict trawler fishing inside state waters (3 mile limit).

Program coordinators have explained the results of the tagging program to anglers and charter captains, trying to correct misconceptions

regarding recreational fishermen taking a larger percentage of flounder than commercial fishermen. An attempt was made to meet with captains in Wachapreague but efforts were not successful.

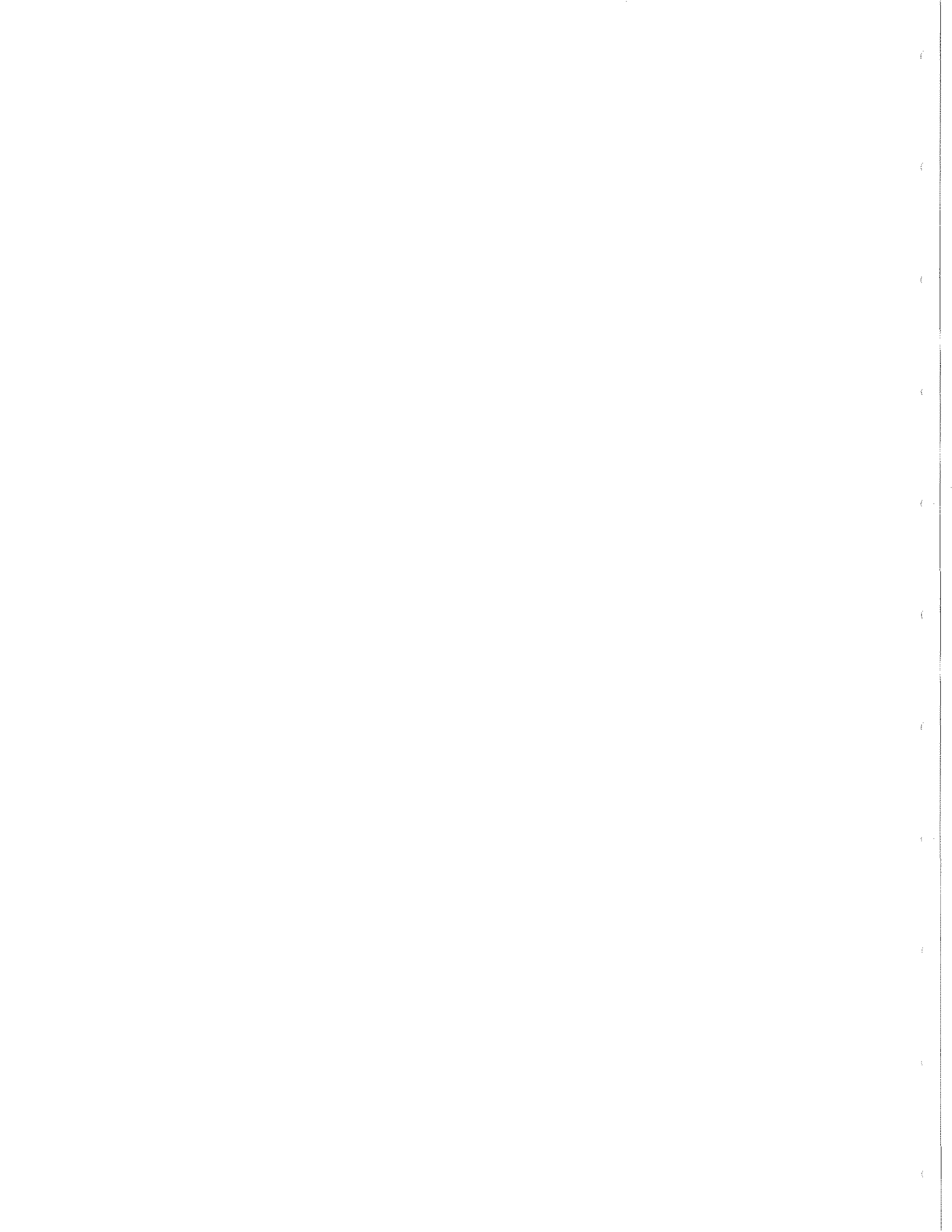
COMMENTS REGARDING PROGRAM OPERATION AND MANAGEMENT

Incentives. A \$2 reward is offered for each returned tag. A year-end drawing is made for various additional cash prizes (\$500, \$100, and four at \$50).

Program Management. Anglers and charter captains from Wachapreague, Virginia, where the flounder fishery is the major fishery of the area, have indicated resistance to returning tags in opposition to regulations (they claim that the research data are being used to regulate and negatively impact the fishery). This may impact the ratio of tag returns between commercial and recreational fisheries in the future.

Procedural Problems. Studies have been done on the impacts of the tagging program on the fish themselves. Researchers have recaptured fish tagged one year earlier and the tags and the entry area of the tag on the fish appear to be in good condition, although the tags do pick up some growth of fouling organisms.

Seventy-five fish were also held in the laboratory for approximately one year and only one fish appeared to be in danger of losing the tag. Fish held in the wet lab showed no tagging mortality but problems do exist when moving fish from vessel to lab for mortality studies.



APPENDIX B

**SURVEY OF RECREATIONAL FISHERMEN'S INVOLVEMENT IN,
AND ATTITUDES TOWARD, TAG-AND-RELEASE FISHING IN THE
NORTHEAST**

Sport fishermen's behavior and attitudes related to tag-and-release programs are summarized below. These data were collected from four sport fishing forums held in New Hampshire, New York, and Virginia; the *Fishermen Magazine* shark tournament held in New Jersey; and offshore marlin and tuna fishermen in Virginia. A survey questionnaire was given to each of the participants and 378 surveys were completed.

Involvement In Tag-and-Release Programs

Over a third (38%) of the fishermen participated in tag-and-release programs. A quarter of these individuals had been involved with a program for only 1-2 years, while nearly a third each fell in the 3-5 year (31%) and 6-10 year (28%) participation categories (Table 1). Sixteen percent had done tag-and-release for more than 10 years.

Nearly half (43%) of those who are involved in tag-and-release participate in the National Marine Fisheries Service (NMFS) Cooperative Game Fish Tagging Program, and another third in the NMFS Cooperative Shark Tagging Program (Table 2). Fifteen percent listed the American Littoral Society program, while 2% specified the AFTCO Tag A Tuna For Tomorrow program.

Fishermen were asked how many fish they had tagged since they had begun participating in a program (Table 3). Only 3% reported tagging no fish. A third had tagged 1-10 fish, about a quarter (22%) 11-30 fish, and about a fifth (16%) 31-50 fish. Just over a quarter (26%) had tagged more than 50 fish.

Sixty-one percent of the individuals who had tagged fish had had none of these tags returned (Table 4). Over a quarter (28%) had received back one to five of their tags, while only 11% reported acquiring more than five tag returns.

The majority of participants (88, or 61%) had not had problems with their tagging program. For those who had encountered difficulties, over a quarter (26%) stated that they had received inadequate instruction on tagging procedures (Table 5). Nearly a quarter (23%) said their tags had not worked well, while a similar number (21%) reported other problems with the tagging apparatus. About a fifth (19%) had received either slow feedback from the program or had problems getting new tags. Only one individual did not know who to contact for more tags.

All respondents were asked about the types of tagged fish they had caught (Table 6). Of those who responded, 37% had never caught a tagged fish. About a fifth (18%) reported catching tagged sharks, while another 14% had caught tagged striped bass. Just under a tenth (8%) each had caught tuna and billfish, with 5% specifying flounder. Other tagged species were reported by a tenth of the respondents.

Of the 59 individuals who had caught a tagged fish, 49 (83%) reported returning the tags promptly. Twenty-five individuals said they had trouble returning tags (Table 7). Of these, 24% felt they had a lack of knowledge or training in the tagging process. Equal numbers (16%) reported a lack of understanding of the importance of tagging and a concern over what happens with the data from tagged fish. Eight percent each specified a concern over lack of returns, a lack of knowledge of existing programs, and a lack of desire to participate as reasons that inhibit the return of tags.

General Beliefs About Tagging Programs

Almost everyone (99%) believed that there are benefits in becoming involved in tag-and-release. When non-participants were asked why they were not involved with tag-and-release programs, nearly half (49%) responded that they knew tagging programs existed, but they did not know who to contact (Table 8). Eight percent each either did not know tagging programs existed or they just went out to fish for fun and couldn't be bothered with tagging. Seven percent were concerned about injuring fish, while an equal number voiced concerns about how tagging data is used. A few non-taggers were uncomfortable tagging fish, caught too few fish or fish too small to tag, or kept all their catch for personal consumption.

The most frequent response (33%) to the question of how to encourage tag-and-release fishing was to educate people and to provide better exposure for the programs (Table 9). Others (22%) felt that incentive programs such as tournaments would increase participation. About a tenth of the respondents believed that education about the benefits of programs (12%), information on tagging procedures (12%), and explanations regarding the results of tagging programs (9%) would increase involvement. Six percent felt that tags should be made more available, and 3% wanted information on fish resources including their life history. A few of the fishermen felt that commercial fishermen should be strongly encouraged to return tags (1%), that individuals should be given information about depletion of the stocks (1%), and that programs should be designed to explain the handling of fish for release (1%).

Conclusions and Recommendations

Over one third of the responding fishermen participated in a tag-and-release program, with the majority initiating the activity within the

last five years. The most popular programs were the NMFS Cooperative Game Fish Tagging Program, the NMFS Cooperative Shark Tagging Program, and the American Littoral Society Program. Most of the participants reported no problems with the tagging program in which they participated. For those who had experienced problems, inadequate instruction on tagging procedures, ineffective tags, problems with the tagging apparatus, and problems with getting new tags were most often cited.

For individuals who had caught tagged fish in the past, species tagged most often included sharks, striped bass, tuna, and billfish. The majority of individuals promptly returned the tags. For those who did not, lack of knowledge or training in tagging procedures, lack of understanding of the importance of tagging, and concern over what happens with the data were the most important reasons noted. For managers, these findings suggest the importance of providing information and education regarding the tagging process.

The main reason for not participating in a tagging program was not knowing who to contact for information. Other reasons included a lack of knowledge about existing programs, not wanting to be bothered with tagging, concern about injury to fish, and an interest in how tagging data are used. Suggestions regarding ways to encourage tag-and-release included education about tagging programs, tagging procedures, and the benefits of participating; incentives for participation; and explanations regarding the results of the program. Although a manager may have difficulty in changing the attitude of an individual who just does not want to be bothered with tagging, these findings suggest again that education regarding the importance of tagging, the proper way to tag without harming the fish, the ways in which data are used, and who to contact for information could significantly increase participation in tag-and-release programs.

Table 1. Years of participation in tag-and-release programs.

No. of years of participation	No. (%) of respondents
1	13 (11)
2	17 (14)
3-5	37 (31)
6-10	33 (28)
11-20	16 (13)
>20	4 (3)
Total	120 (100)

Table 3. Number of fish tagged.

No. of fish tagged	No. (%) of respondents
0	5 (3)
1-5	25 (17)
6-10	23 (16)
11-20	15 (10)
21-30	17 (12)
31-50	23 (16)
51-75	11 (7)
76-100	9 (6)
101-200	9 (6)
>200	10 (7)
Total	147 (100)

Table 2. Number of participants in specific tagging programs.

Tagging program	No. (%) of respondents
NMFS Cooperative Game Fish Tagging Program	81 (43)
NMFS Cooperative Shark Tagging Program	62 (33)
American Littoral Society	28 (15)
Tag a Tuna Program	4 (2)
Others	14 (7)
Total	189 (100)

Table 4. Number of tags returned.

No. of tags returned	No. (%) of respondents
0	83 (61)
1-5	38 (28)
6-10	5 (4)
11-20	2 (1)
21-30	1 (1)
31-50	2 (1)
51-75	-
76-100	1 (1)
101-200	1 (1)
>200	3 (2)
Total	136 (100)

Table 5. Types of problems encountered with tagging programs.

Types of problems	No. (%) of respondents
Inadequate instruction on tagging procedure	6 (26)
Tags not working well	14 (23)
Problems with tagging apparatus (not tags)	13 (21)
Slow feedback, problems getting new tags, not enough tags	16 (19)
Not sure of survival of fish	12 (10)
Don't know who to contact for more tags	1 (1)
Total	62 (100)

Table 6. Species of tagged fish recaptured.

Species	No. (%) of respondents
Shark	46 (18)
Striped bass	35 (14)
Tuna	22 (8)
Billfish	22 (8)
Flounder	14 (5)
Bluefish	4 (2)
Black sea bass	4 (2)
Fluke	3 (1)
None	97 (37)
Other	12 (5)
Total	259 (100)

Table 7. Problems identified as inhibiting the return of tags.

Problem	No. (%) of respondents
Lack of knowledge or training in tagging	6 (24)
Lack of understanding of the importance of tagging	4 (16)
Concern over what happens with the data	4 (16)
Concern over lack of returns/participation by commercial interests	2 (8)
Lack of knowledge of existing programs	2 (8)
Laziness/lack of desire	1 (4)
Lack of awareness of existing programs	1 (4)
Too many different tag programs	1 (4)
Mailing costs for returning tags	1 (4)
Need for incentive to return tags	1 (4)
Fear of traumatizing fish	1 (4)
Total	25 (100)

Table 8. Reasons for not trying tag-and-release fishing.

Reasons	No. (%) of respondents
Knew programs existed but did not know who to contact	131 (49)
Did not know tagging programs existed for anglers	22 (8)
Fish for fun/don't want to be bothered with tagging	22 (8)
Concerned about injury to fish	19 (7)
Concerned about how tagging data are used	19 (7)
Not comfortable with tagging fish/too awkward	13 (5)
Not enough/too small fish caught	10 (4)
Keep catch for personal consumption	9 (4)
Do not fish for big game fish	7 (3)
Too much trouble to keep up with tags and record data	7 (3)
Haven't sent for tags	4 (2)
Just fish commercially	1 (-)
No tags readily available	1 (-)
Did not know what tagging programs are for	1 (-)
Total	266 (100)

Table 9. Ways mentioned by respondents to encourage tag-and-release fishing.

Actions mentioned	No. (%) of respondents
Communication, education, exposure for program	98 (33)
Encourage tagging through incentive programs, tournaments	65 (22)
More information on how to get tags and on how to tag	37 (12)
Educate about benefits of the program	35 (12)
Explain results of the program	27 (9)
Make tags readily available	17 (6)
Provide information on resources, life history, etc.	9 (3)
Encourage/demand that commercial fishermen return tags	4 (1)
Information about depletion of the stocks	3 (1)
Design programs to explain the handling of fish for release	3 (1)
Study fish mortality resulting from tagging	1 (-)
Better coordination among tagging programs	1 (-)
Provide measuring tapes, length-weight conversion charts, etc., for ease in completing tag card data	1 (-)
Total	301 (100)