

EVALUATION OF LARGE SCALE RELEASE PROGRAMS WITH SPECIAL REFERENCE TO BASS FISHING TOURNAMENTS¹

B. E. May, Fishery Biologist
Florida Game and Fresh Water Fish Commission
Fisheries Research Laboratory
Eustis, Florida 32726

ABSTRACT

A study was conducted to assess the effectiveness of an extensive release program conducted in conjunction with the B.A.S.S. (Bass Anglers Sportsman Society) Tournament held on Lake Kissimmee and adjoining lakes, Osceola County, Florida. Largemouth bass (*Micropterus salmoides*) caught by tournament participants were to be released into Lake Kissimmee following weighing and counting by tournament officials. Fish in poor condition and mortalities incurred prior to release were included into an initial mortality estimate of 15.6% by number and 13.7% by weight. A sample of fish to be released was taken and held for observation in anchored cages for 14 days to estimate delayed mortality resulting from hooking, handling, and related stresses. Control fish captured by non-angling methods were held simultaneously. Mortality incurred subsequent to release (delayed mortality) was estimated at 15.0% by number for a six day period. A total mortality estimate of 30% was projected to this particular tournament. A second study was initiated, under more controlled conditions, to evaluate bass survival over extended periods of time. Recommendations based on tournament observations and study findings were formalized to aid in future large scale release programs.

INTRODUCTION

Establishment of regulatory statutes in various states requiring release of fish because of size restriction or creel limit has presented to the fishery biologist a challenge of estimating mortality subsequent to release. This prospect of unobserved mortalities has been accentuated by recent fishing tournament release programs. To gain better public and political support some tournament sponsors have incorporated the release of all tournament caught fish into their rules and regulations. Bass Anglers Sportsman Society (B.A.S.S.) has adopted as a motto, "Don't Kill Your Catch" to encourage Society members to release any bass not kept for eating or trophy purposes.

The biological success of such release programs can only be evaluated if initial mortality (any mortality incurred prior to release) and delayed mortality (mortality subsequent to release) are combined into a total mortality estimate. To assess the success of large scale release programs, a study was carried out by Florida Game and Fresh Water Fish Commission in conjunction with the 1972 Florida National B.A.S.S. Tournament held during March on Lake Kissimmee and other nearby lakes.

Mortality estimates resulting from hooking have been conducted on a number of cold-water species (Marnell and Hunsaker, 1970; Mason and Hunt, 1967; Horak and Klein, 1967; Klein, 1965). Resultant effects and mortality estimates varied greatly indicating that variation in angling techniques, physio-chemical composition of the environment, and species tested all play an important part in regulating mortality resulting from hooking stresses. Relatively little is known, however, about the mortality of warm-water species that have been hooked and

¹Paper number 6 of the Eustis Fisheries Research Laboratory, Florida Game and Fresh Water Fish Commission.

then released. This was evident by the lack of information needed to project a survival figure for released tournament bass. Consequently an experiment was designed to evaluate survival characteristics under conditions existing in Florida waters. Study findings include tournament results and preliminary data obtained from a more controlled experimental design to evaluate hooking stresses and survival of released fish.

TOURNAMENT BACKGROUND

Tournament rules were very stringent and all participants were subject to exclusion or point reduction if violations occurred. Participants were restricted to five lakes in which to fish during tournament hours (6:00 a.m. to 4:00 p.m. daily). Tournament lakes included Lake Kissimmee, Lake Hatchineha, Lake Cypress, Lake Tohopekaliga, and Tiger Lake. All lakes were located in the Kissimmee river basin; their similarity in limnological characteristics were:

Tournament Lake	Surface Area (acres)	Elevation (ft. msl)	pH	Specific Conductance r mho cm ⁻¹
Cypress Lake	4,100	52	--	--
Lake Hatchineha	6,600	52	--	--
Lake Kissimmee	35,000	49	7.5*	113*
Tiger Lake	2,200	50	--	--
Lake Tohopekaliga	18,800	53	6.9*	124*

*Value mean of five samples

Contestants were required to leave and return in pairs to a specific marina designated as official weigh-in area for the tournament.

Size limit was restricted to fish 12 inches or larger, and creel limits were in compliance with state regulations being set at 10 fish per day. There was no tournament restriction placed on maximum numbers that could be caught and released by each contestant.

All boats utilized during the tournament had to be at least 14 ft. long and were required to have an aerated livewell in which to keep daily catches; no qualifications in regard to size, volume, or extent of aeration were made. Tackle limitations included the use of artificial lures with conventional spin-casting techniques. Trolling, live or prepared baits, and use of more than one fishing rod were prohibited.

METHODS AND MATERIALS

Largemouth bass caught during allotted hours were held in aerated livewells aboard each participating boat and then brought to the docking area for enumeration and weighing. The actual time fish were held in livewells aboard the boats ranged from 1 to 9 hours. Each fisherman's catch was required to be on separate stringers for the weigh-in. Upon completion of necessary data compilation by tournament officials, the fish were immediately placed in compartments of a minnow transport truck or a livebox located on a pickup truck

for return to the lake. All compartments were well aerated and contained approximately 1.0 mg/ l acriflavin to retard bacterial and fungal infection. Special care was taken to exclude fish which did not appear to have a better than average chance of survival. All fish were individually inspected at the time of release for signs of stress or physical damage and again only fish appearing to have a high probability of surviving were actually released. All fish not released were recorded and discarded.

The initial mortality (mortalities incurred prior to release) included fish that were dead at the end of each tournament day along with those judged unable to survive. All other fish caught during the tournament were released. To estimate delayed mortality (mortality incurred subsequent to release) a stratified random sample of fish was removed and held in two 64-ft³ cages anchored in Lake KISSIMMEE. Cages consisted of a wooden frame made from 2 in. x 2 in. cedar covered by 1 in. mesh wire; the shape was cubic with each side measuring 4 ft. Samples were stratified over the three day period with each subsample being weighted equally. Twenty fish were removed randomly from each daily catch and divided equally between two cages. A total of 60 test fish were held (30/ cage) to evaluate post tournament mortality and survival. For a control, 60 fish were collected by a non-angling method (electro-fishing) and held at the same number per cage. The intended length of detainment was 14 days; this was later reduced to a six day period because of experimental problems.

Hooking Experiment

To compensate for lack of information relating to hooking mortality of warm-water fish and to better evaluate delayed mortality, a second more controlled study was undertaken. Test fish for this experiment were all captured using plastic worms and spinning gear. All fish were "played" until they could be easily handled for hook removal. Care was taken to reduce the amount of contact by holding the fish, when possible, by the lower lip. Hook location was noted in each fish and removal was completed with as much care as possible. Length measurements were taken to evaluate mortality in relation to size groups. All fish were hooked in the mouth region except one test group in which all specimens were hooked deep in the throat or stomach. Detainment varied from 7 to 23 days with each fish being checked prior to release for fungal infection and other external damage. Test fish were held briefly in livewells mounted in fishing boats then transferred to the same cages utilized during the tournament. Again, control specimens were obtained by electro-fishing and held simultaneously.

RESULTS

Tournament Findings

Tournament contestants (approximately 308) caught and recorded 1,422 largemouth bass during three days of fishing on Lake KISSIMMEE and other adjoining lakes. Daily catches were 463, 527, and 433 fish for the three tournament days; with adverse weather conditions being responsible for the generally low success. Of the 1,422 fish caught, 222 (15.6%) were dead or in such poor condition that survival was considered unlikely. As can be seen in Table 2 initial mortality for each tournament day declined as release techniques became more efficient and anglers took more precautions to avoid unnecessary damage to the fish. Initial mortality by weight was 416.6 lbs. and comprised 13.7% of total harvested biomass; this value, although lower, was not considered to be significantly different from initial mortality by number.

Remaining fish in relatively good condition were released at daily rates of 377, 447, and 376 fish for the three tournament days, respectively. A sample of 60 fish (20 per day) was detained in cages to evaluate delayed effects. Signs of delayed

mortality began on March 11, 1972 when two losses were sustained in cages containing hooked fish. Losses continued at a moderate rate until March 14, 1972; this trend changed on the following day when five test fish and two control fish died. On March 16, 1972, all quantitative aspects of the study were abandoned because of interference by inquisitive individuals. On several occasions, subsequent to March 16, 1972, individuals were found tampering with the cages. Of 60 bass held in cages, 52 (85%) survived six days of confinement. Control fish, for the same time period, exhibited 95% survival with only three fish dying.

Visual comparisons between control and test fish revealed a marked difference in fungus infection. In almost all cases hooked fish demonstrated more intense and accelerated fungal disorders. Increased handling with its resultant mucilage disruption was considered a major reason for the increased infection. All control and test fish were subjected to some external damage from abrasion against the cage materials. This was evident by tissue damage to the mouth region of both control and test fish. A decrease in activity of test fish was noted and could have been directly related to exhaustion produced from angling or indirectly from stresses of confinement.

Hooking Study

Preliminary findings from the more controlled study revealed an overall mortality of 25% resulting from capture with plastic worms. Control fish, for the same time period, sustained no mortality or significant adverse effects. Mean total length of captured largemouth bass was 12.5 inches (S.D. + 2.6) with a range of 9.0 to 20.0 inches. Hooking mortality ranged from 0 to 66.7% for categories based on hook location (Table 3).

A significant difference in mortality was detected among bass caught deep in the throat and those caught in the lip (X^2 l.d.f. = 8, 0.05 level). In nearly all cases damage resulting from swallowing the hook was responsible for bleeding and rapid mortality (66.7%); death generally took place within a 24 hour period subsequent to capture. No mortality occurred among control fish. There was no indication that mortality increased with increased detention time. All mortality occurred during a five day period and more generally during the first day. There was also no indication that mortality was related to size class or maturity.

DISCUSSION

It has become standard for anglers to hook and release fish that are under a certain preferred size limit, or after the daily limit is reached, or if angling is strictly for pleasure with total catch being released. Tournament fishing has also adopted release procedures as part of their regulations to aid in fishery management and to gain public support.

Largemouth bass caught during the 1972 Florida National B.A.S.S. Tournament held on Lake Kissimmee and adjoining lakes sustained an initial mortality of approximately 15%. This was thought to be low, considering the number of variables influencing bass survival (i.e., type of gear, hook location, handling and transport). Delayed effects and mortalities are extremely important in determining the overall effect of hooking on any fish species. Tournament bass detained in 64 ft.³ cages for six days sustained an additional 15% mortality. A total mortality estimate of 30% was projected to bass caught during this particular tournament. Post release mortalities may have resulted directly from tissue damage and loss of blood or indirectly from fatigue and stress. Tournament fishing on Lake Kissimmee and surrounding lakes resulted in a very low harvest (Table 4) considering the area and fishing quality. Weather conditions were felt to be primarily responsible for the low yield. Because of the low harvest it was felt that tournament fishing had very little effect upon largemouth populations and/or bass fishing in the tournament lakes and the

release program, although probably not necessary, did reduce detrimental effects by returning the majority of captured fish to the aquatic environment.

Until more information on hooking mortality of warm-water species is available, some generalized comparisons with cold-water studies might be valuable. Rainbow trout caught on single baited hooks may sustain mortalities ranging from 30 to 95 percent, with mortalities depending on location and penetration of the hook (Stringer, 1967; Mason and Hunt, 1967). Cutthroat trout from Yellowstone Lake experienced a 73% mortality when hooks were swallowed (Hunsaker, et al., 1970). Preliminary data for largemouth bass, which swallowed plastic worms indicated that mortalities (66.7%) were similar to cold-water species.

Increases in water temperature could be a major factor influencing mortality. Increases in water temperature were felt to have some effect on cold-water species survival (Klein, 1965; Benson and Bulkley, 1963). A total of 100 smallmouth bass (*Micropterus dolomieu*) were caught with hook and line methods during winter months in northern Alabama. Water temperature was approximately 44°F and it was felt that the low temperature was responsible, in part, for the zero initial mortality and zero delayed mortality (Spencer, S. L., Personal Communication²). Preliminary findings have given no indication that water temperature should or should not be deleted as an influence on mortality.

Mortality among bass hooked in anterior mouth regions was significantly lower than those deeply hooked. In almost all mortalities, death occurred within a 24 hour period subsequent to hooking. This pattern was consistent with results found for cold-water species and indicates that tissue damage and loss of blood are probable factors. Further delay in mortality past this first critical period, as happened on the sixth day following the tournament and in one instance of the hooking study, could indicate conditions of progressive shock. Bouck and Ball (1966) demonstrated progressive shock in rainbow trout that were hooked and electroshocked. Excessive lactate buildup and sluggish circulatory conditions were cited as possible causes for *in vivo* clotting and delayed death.

Preliminary findings indicate further study is needed to fully evaluate the role of hooking related stresses on mortality of largemouth bass subsequent to release. Delayed mortality of largemouth bass resulting from tissue damage, behavior differences, or circulatory shock would depend to a great extent on angling gear and angling methods.

²Alabama Department of Conservation and Natural Resources, Montgomery, Alabama.

Table 2. Mortality and release data for the 1972 Florida National Bass Tournament held on Lake Kissimmee and adjoining lakes.¹

	March 9, 1972	March 10, 1972	March 11, 1972	3-Day Total
Number of fishermen	318	310	300	308 (Average)
Total fish caught	463	526	433	1,422
Total weight (lbs.)	799.1	1,473.7	768.6	3,041.4
Number Released	377	447	376	1,200
Weight Released (lbs.)	629.2	1,351.3	644.4	2,624.8
Percent Released by Number	81.43%	84.99%	86.84%	84.39%
Percent Released by Weight (lbs.)	78.74%	91.70%	83.84%	86.31%
Initial Mortality by Number	86	79	57	222
Initial Mortality by Weight (lbs.)	169.9	122.4	124.3	416.6
Percent Mortality by Number	18.57%	15.01%	13.16%	15.61%
Percent Mortality by Weight (lbs.)	21.26%	8.30%	16.16%	13.69%

¹Cypress Lake, Lake Hatchineha, Tiger Lake and Lake Tohopekaliga

Table 3. Hooking Mortality of the Florida largemouth bass¹

Test Series	Control	Hooked (swallowed)	Hooked (not swallowed)
I	---	3(3)	0(2)
II	0(3)	0(1)	0(6)
III	0(10)	---	1(3)
IV	---	---	0(2)
V	---	1(2)	0(1)
Totals	0(13)	4(6)	1(14)
Percent Mortality	0.0	66.7	7.1

¹Figure indicates number of mortalities and number in sample in parentheses

Table 4. Harvested biomass and average catch for the 1972 Florida National Bass Tournament held on Lake Kissimmee and adjoining lakes.

	March 9, 1972	March 10, 1972	March 11, 1972	3-day Total
Number/acre Lake Kissimmee (35,000 acres)	0.013 fish/acre	0.015	0.012	0.040
Weight/acre Lake Kissimmee	0.022 lbs/acre	0.042	0.021	0.086
Number/acre all lakes (66,700 acres)	0.007 fish/acre	0.008	0.006	0.021
Weight/acre all lakes	0.012 lbs/acre	0.022	0.012	0.046
Average number per fisherman	1.45	1.69	1.44	(3-day Average) 4.60
Average Weight per fisherman	2.51	4.75	2.56	9.84

RECOMMENDATIONS

A recommendation section was included to give generalized ideas on areas of improvement for future tournament release programs. This section was not meant to supply all the answers to questions generated from fishing tournaments; its intent was to emphasize areas where more study is needed to enable constructive comments to be made.

1. Angling methods should be encouraged that would not allow fish to swallow the lure. This problem is sometimes associated with use of plastic worms and allowing the fish to "run" prior to "setting" the hook. Top and deep water plugs, spinning lures, and similar type lures are generally swallowed less often.

2. It was noted that livewells aboard boats used in the tournament, were generally too small to support the daily catch of two fishermen. The average livewell capacity is approximately 10 gallons and would be 1 gal/fish, if the daily catch for one individual was held. Effort should be made to increase the size of livewells. The inside surface should be as smooth as possible to reduce damage to the fish.

3. Aeration should also be improved so that dissolved oxygen concentrations would remain at levels consistent or greater than those in the lake or river.

4. Water recirculation between livewell and lake would greatly improve conditions. This can be accomplished by use of a small electric bilge pump with an outside pickup. Water containing metabolic by-products could be removed and new water replaced. Water temperatures could also be moderated by replacement with cooler water from lower lake depths or by addition of ice.

5. Another problem associated with conditions existing in the livewells was draining that occurred as the boats moved from one area to another. Excessive damage could be reduced by placement of a standpipe to hold an adequate water level.

6. Handling should be minimized as much as possible to reduce mucus disturbance. Holding the fish by the lower lip could prove to be an effective way to minimize contact. Weighing and measuring methods should also be revised to reduce handling and holding time.

7. Use of a bacterial-fungal retardant placed in the livewell would give the fish a better chance of surviving after being released back into the aquatic environment.

ACKNOWLEDGEMENTS

Thanks are due to Mr. Phil Chapman, Regional Fishery Biologist, Florida Game and Fresh Water Fish Commission for use of equipment and assistance during the bass tournament. Mr. Sam L. Spencer, Chief of Fisheries, Alabama Department of Conservation and Natural Resources, Dr. Robert T. Lackey, Associate Professor of Fishery Biology, Virginia Polytechnical Institute, and F. G. Banks, Assistant Chief of Fisheries, Florida Game and Fresh Water Fish Commission are acknowledged for reviewing the manuscript and offering many helpful suggestions. I am grateful to Mr. Ray Scott, President of Bass Anglers Sportsman Society, for cooperation during the tournament portion of the study.

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A SUMMARY OF FINDINGS ON THE NEMATODE, *GOEZIA* SP. IN THE SOUTHEASTERN UNITED STATES

Dr. John L. Gaines, Jr., Forrest J. Ware, and Dr. W. A. Rogers

Goezia was first detected in North America at Lake Hollingsworth in Central Florida during June, 1969 (Ware, 1970). A recently introduced population of striped bass, *Morone saxatilis*, was found to be infected by the nematode. The following year, three additional populations of striped bass were parasitized, located in Lakes Bentley, Parker, and Hunter in the same general area of Florida.

The introduction of this parasite into Florida was at first believed to be related to the striped bass stocking program (Gaines and Rogers, 1971). *Goezia* was reported as a marine nematode and the young stripers had been fed a diet of marine herring during hatchery culture. A similar means of infection had been reported in France (Dollfus, 1935). Later investigations, however, found the worm to be wide-spread in Central Florida and it was apparently endemic to certain watersheds connected with marine environs. The lakes and streams of the St. John River System, which drains to the Atlantic, and the Peace and Hillsborough watersheds of the Gulf Coast were all verified positive for *Goezia*. Conversely, some landlocked lakes in the same area were negative. A portion of these waters that were positive for worms had never received striped bass. Plus, two of the introduced striper populations were found to be parasite-free, Lakes Talquin and Julianna. Additional fishes diagnosed as positive hosts were largemouth bass, *Micropterus salmoides*, black crappie, *Pomoxis nigromaculatus*, redear sunfish, *Lepomis microlophus*, brown bullhead, *Ictalurus nebulosus*, and *Tilapia aurea*.

Fish kills associated with *Goezia* infections have been limited to the two reported populations of striped bass (Ware, 1970): (1) An estimated 90% kill in Lake Hollingsworth in 1969, and (2) an approximate 90% kill in Lake Hunter during 1970. In both cases, mortality was related to the presence of *Goezia* under stress conditions created by a low food supply. Following the kill in Lake Hunter, striped bass were reintroduced but at a much lower stocking rate. Although these fish became parasitized, they survived in good numbers as have fish from subsequent stockings. In this respect, a comparison between the physical condition, K (Hile), of an infected striper population (Lake Hunter)