Effects of Dummy Radio Transmitters on the Behavior of Largemouth Bass[1]

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Abstract: Twenty largemouth bass (*Micropterus salmoides*), 10 containing dummy radio transmitters and 10 control, were studied in hatchery ponds to determine the effects of implanted transmitters on swimming, feeding, spawning and catchability behavior. Eight additional bass were subjected to buoyancy compensation tests under laboratory conditions. Pond studies indicated no significant difference in swimming movement or catchability between transmitter and control bass. Both transmitter and control bass were observed feeding and spawning. All transmitters were encapsulated in a skin-like sac within the body cavity at study termination. Laboratory experiments indicated the negative buoyancy of the transmitters affected bass temporarily, and fin beats increased only during the time it took bass to adjust to the effect of the transmitter.

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Although use of biotelemetry, as a tool to evaluate fish behavior, has been in existence for over 20 years, little information is available concerning relative effects of transmitters on an individual fish's behavior. Clugston (1973) believed transmitters had little effect on behavior, as largemouth bass he tagged moved freely and fed. Lorio, et al. (1973) assumed behavior to be normal when tagged bass were observed feeding and Winter (1977) also reported transmitters had no influence on behavior after observing transmitter bass breaking the surface while exhibiting feeding behavior.

Results of earlier, as well as ongoing biotelemetry studies, may be questionable because it was not obvious that behavioral impairment might have occurred following transmitter implantation. This study evaluated the effects

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of implanted dummy radio transmitters on the swimming movement, feeding, spawning, catchability and buoyancy compensation behavior of largemouth bass.

Methods

Twenty largemouth bass, 0.96 kg to 2.70 kg, were collected by electrofishing from Lake Dora near Tavares, Florida. Dummy radio transmitters (57 g and 28 g), comparable in size and weight to transmitters used in Florida field experiments (Crumpton and Jenkins 1978, Crumpton et al. 1979), were implanted into 10 bass. The remaining 10 bass were used as controls.

Prior to implantation bass were anesthetized with 0.6 cc/liter Quinaldine. Immobility usually occurred within 5 to 10 minutes. Sex, total length and weight were recorded following immobilization. The fish was placed, ventral side up in a holding tank with the abdomen protruding above the water surface. The incision site was located just forward of the urogenital pore and anus, and upward toward the ribs. Scales were removed and a 25 to 50 mm incision was made vertically between muscle myomeres. The transmitter was placed in the body cavity. After closing the incision, Calphomycin, a form of terramycin in a clay base, was applied to the incision, similar to a mudpack. Terramycin, in a lidocaine base, was injected hypodermically into the dorsal musculature (1 cc/kg body weight).

Hatchery Segment

Transmitter and control bass were stocked, separately, into 2 0.1 ha ponds at Richloam Hatchery, Florida. Observations were made concerning swimming movement, feeding, spawning and catchability. Each pond was divided into 15 sections (grids) approximately 6.4 × 6.4 m in size, and an observation tower (6.0 m high, with a 1.2 × 1.2 m platform) was constructed between ponds. The study covered a 224-day period between November 1978 and July 1979. Both ponds were supplementally stocked with minnows (*Pimophales* sp.), golden shiners (*Notemigonus crysoleucas*) and bluegill sunfish (*Lepomis macrochirus*) twice during the study period. Stockings totaled in excess of 260 kg/ha. Three treatments for vegetation control using Cutrine (0.4 ppm) were attempted during the study.

Largemouth bass in both ponds were tagged in the back musculature, on the left and right sides of the dorsal fin, using 1 to 3 yellow plastic spaghetti Floy tags. Tags were set using specific configurations, making it possible to identify individual fish from the observation tower with the aid of binoculars.

Largemouth bass were observed during daylight hours in each pond for 30-min periods. A 30-minute period was considered to be 1 observation.

A minimum of 10 observations, per pond, were taken during any observation day (0500 hours and 1700 hours). During each observation period, an observer recorded the number of times an individual bass moved from one grid to another. A student t-test was used to compare grid movement between transmitter and control bass.

Transmitter and control bass were subjected to catchability tests following swimming movement observations. Attempts were made to harvest bass using various types of spinning and casting equipment. Techniques used were the same as described by Crumpton and Smith (1975). Statistical comparisons of catch rates using t-tests were made between transmitter and control ponds.

Surviving transmitter fish were dissected to observe the condition of reproductive organs and effects of the modules in the body cavity at termination of the study.

Laboratory Segment

Eight largemouth bass, collected by electrofishing from Lake Dora, weighing 1.0 to 3.7 kg, were subjected to buoyancy compensation tests at Eustis Fisheries Research Laboratory. Bass were observed through portholes in a 0.6- × 0.6- × 1.8-m aerated holding tank. All bass were used in both control and transmitter sequences.

In control sequences, 2 bass at a time were tranquilized (0.6 cc/liter Quinaldine) and placed in the observation tank. When an upright attitude by the bass was achieved, they were observed until neutral buoyancy was attained.

The bass were then tranquilized a second time, implanted with dummy radio transmitters, and placed in the observation tank. When an upright attitude was achieved, bass were observed until neutral buoyancy was attained.

In control and transmitter sequences, observations were conducted for 30 seconds every 15 minutes from time of recovery from the effects of the tranquilizer until neutral buoyancy was achieved.

Gallepp and Magnuson (1972) indicated pectoral fin movement was important in countering negative buoyancy in bluegill until the air bladder compensated for the added weight. In this study, pectoral movement (fin beats) were observed and recorded. A fin beat, from the appeased position (against the body) forward and back, was counted as 1 pectoral movement. Since bass leaving and returning to the bottom used more rapid fin movements than hovering (neutral) fish, only periods in which bass spent the entire 30 seconds suspended were used to compute fin beat frequencies.

Results

Seven of 10 transmitter bass and all 10 control bass survived the study. The deaths of 2 transmitter fish were attributed to predators. The third fish was in an advanced stage of decomposition when discovered and cause of death could not be determined.

In spite of 2 supplemental stockings of minnows, golden shiners, and bluegill, and 3 chemical treatments for vegetation control, both transmitter and control fish lost weight during the study (Table 1). Weight loss was attributed to spawning and an inability of the bass to feed effectively due to excessive submergent vegetation. Similar occurrences were observed in Trout Lake, Florida by Crumpton (unpub. data) when largemouth bass tagged prior to spawning were recaptured after spawning. Bass exhibited weight losses of as much as 1.49 to 15.00 g/day over a period of 40 to 206 days. In earlier Richloam pond studies, Crumpton (unpub. data) observed largemouth bass lost weight and exhibited skeletal shrinkage (negative growth rates) during study segments. Spawning and the inability of bass to feed effectively as the cause for weight loss in bass from both ponds was corroborated by t-test comparisons of initial stocking weights, recovery weights, and average weight loss per day between transmitter and control bass. No significant differences ($P > 0.05$) were found for any of these parameters.

A total of 50 observations (5 observation days) were made in each pond for swimming movement (Table 2). Largemouth bass in both ponds were more active during morning hours than afternoon hours. Transmitter bass crossed more grids (31.2) per morning observation than control (30.4), but control bass crossed more grids (24.6) in afternoon observations than did transmitter fish (21.7). T-test results comparing morning, afternoon and overall movements of transmitter and control fish were non-significant ($P > 0.05$).

Initially, feeding behavior of both transmitter and control bass was considered to be normal. Feeding in both ponds was heaviest in the early morning and late afternoon hours, but some sporadic feeding was observed throughout most of the observation days. Feeding success was observed to decrease

Table 1. Weight Loss of Control and Transmitter Largemouth Bass in Hatchery Ponds

	Control Pond	Transmitter Pond	All Bass Combined
Aver. Stocking Wt. (kg)	1.66	1.60	1.64
Aver. Recovery Wt. (kg)	1.32	1.21	1.27
Aver. Wt. Loss/Day (gms)	−1.52	−1.74	−1.65
No. Fish	7	7	14

Table 2. Average Movement of Largemouth Bass in Control and Transmitter Ponds

	Movement (grids/fish)	
	Control Pond	Transmitter Pond
A.M.	30.4	31.2
P.M.	24.6	21.7
Combined	55.0	52.9

as submergent vegetation increased. This observation further supports the belief that excessive vegetation contributed to weight loss in both transmitter and control largemouth bass.

Largemouth bass were observed spawning in transmitter and control ponds. At study termination, beds were observed in both ponds, 3 size classes of bass fingerlings (avg. 55.1, 64.0, and 118.5 mm) were recovered from the transmitter pond and 1 size class (avg. 39.4 mm) from the control pond. Upon dissection of the 7 surviving transmitter fish, 3 males were flowing milt, 2 females were in a spent condition and 2 females still contained some viable eggs.

Forty-eight "rounds" of fishing (24 transmitter, 24 control) using 12 different lures produced a total of 77 strikes (38 transmitter, 39 control). T-test comparisons of fishing results (Table 3) for numbers of strikes, numbers of bass hooked and lost, numbers of bass landed and total number of strikes for transmitter and control bass indicated no significant difference in hook and catch rates ($P > 0.05$). All 7 transmitter bass were "landed" the first fishing day, and 1 transmitter bass was landed 5 times during the study.

All transmitters in dissected bass were completely encapsulated within a skin-like, semi-transparent, sac which originated from the lower portion of the wall of the body cavity.

Following tranquilization both transmitter and control bass sank to the bottom of the observation tank, similar to the findings on bluegill by Gallepp and Magnuson (1972). Control bass returned to a neutrally buoyant state

Table 3. Numbers of Strikes, Hooks and Lost, and Catch Rates for Control and Transmitter Largemouth Bass in Hatchery Ponds

	Control Pond	Transmitter Pond
No. Strikes	14	15
No. Hooked and Lost	13	6
No. Landed	12	17
All Combined	39	38

within 4 to 6 hours following tranquilization. Fin beats for controls during compensation ranged from 31.0 to 45.0 beats/min, averaging 36.0 beats/min. Fin beat rates for neutrally buoyant control bass ranged from 18.0 to 32.0 beats/min, averaging 26.4 beats/min. Bass containing transmitters returned to neutral buoyancy within 8 to 13 hours of tranquilization. Fin beats ranged from 28.0 to 40.0 beats/min, averaging 34.0 beats/min. Fin beat rates for neutrally buoyant transmitter bass ranged from 20.0 to 32.0 beats/min, averaging 27.0 beats/min. A student t-test indicated no significant difference in fin beats or neutrally buoyant transmitter and control bass or that of transmitter and control fish during buoyancy compensation ($P > 0.05$).

Discussion

Although significant weight loss occurred in both transmitter and control largemouth bass during the study, the difference in the loss between transmitter and control bass was not statistically significant.

There was no significant difference in the amount of movement in ponds between transmitter and control bass when morning, afternoon and overall activity was compared.

Spawning occurred in both transmitter and control ponds. Dissection at study termination indicated that all transmitter males were still flowing milt and that all females had spawned or contained viable eggs.

A comparison of the results for hits, hook and loss, landings and strikes combined indicated no significant difference in the "catchability" of transmitter and control bass in ponds.

Laboratory tank tests indicated the negative buoyancy of dummy transmitters had a temporary effect on subject largemouth bass. Fish compensated for the effects of implanted transmitters within 8 to 13 hours of implantation. Due to the variations in compensation times, no relationship was observed between fish size and the time taken to adjust.

Overall study results indicated that implanted transmitters caused no lasting changes in the behavior characteristics tested.

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