Fisheries Session

Effects of Brush Reefs on Distribution of Fish in a Florida Lake

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Abstract: This study describes a method of constructing inexpensive, durable, shallow-water reefs in freshwater lakes with whole Australian pines (*Casuarina* spp.). Snorkel observations demonstrated that largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and redear sunfish (*L. microlophus*) abundance was significantly higher on reef areas as compared to between-reef areas, or control areas. A creel survey measured improved catch rates for largemouth bass and lower catch rates for sunfish on reef areas. The use of on-site materials during lake construction should be considered an economical method of concentrating certain sport fish species for the purpose of improving angler success.

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Previous studies have addressed the positive benefits of artificial reefs in freshwater lakes (Wilbur 1978, Johnson and Stein 1979, Paxton and Stevenson 1979, Wege and Anderson 1979, Mitzner 1981). Tires, stakes, and brush have become the most common materials used to construct freshwater artificial reefs. However, agencies regulating water quality have recently prohibited the use of tires for underwater structures in many states. In addition, high labor and material costs often prevent construction of stake beds (Wilbur 1974). Brush reefs, while being cost efficient to build, become increasingly expensive as distance traveled to acquire brush increases. They may also be prohibited by local water authorities due to the boating hazard they present during periods of low water.

The ability of artificial reefs to concentrate game fish is often related to both habitat and materials selected. Prince and Maughan (1979) found largemouth bass and sunfish more prevalent on deep-water and shallow-water reefs, respectively. Wilbur (1974) reported that the type of material used in construction determined, to a great extent, which species colonized a given reef.

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Brush clearing is a common practice in the development of parks, recreation, and wildlife management areas. Because lakes are often included in these projects to develop fisheries and other water-oriented recreational use, an abundant supply of brush can be easily procured to enhance lake habitat. The present study concerns development of brush reefs in Lake Okeeheelee, Florida. A readily available, but previously untested reef material, the exotic Australian pine, was used. Our objective was to test the success of artificial reefs at concentrating sport fish, specifically largemouth bass, bluegill, and redear sunfish.

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Methods

The study area, Lake Okeeheelee, is a 63.6-ha, oligotrophic, man-made lake in eastern Palm Beach County, Florida. Lake construction, completed in 1980, was a byproduct of shellrock mining activities. The lake contains a uniform sand bottom with little structure and is located entirely within a county park. In 1985, 2 0.1-ha, deep-water artificial reefs (brush type) were constructed in the lake to provide fish habitat and concentrate sportfish. Predominant fish species in the lake include largemouth bass, redear sunfish, and bluegill. Electrofishing data collected during 1987 and 1988 indicated that these 3 species comprised 80%–90% of the total number of fish captured.

Artificial reef placement sites were selected in shallow (1–3 m) nearshore locations. Whole Australian pine trees obtained during clearing of the county park were used as reef materials, with 2 or 3 trees set perpendicular to the shoreline used to create each reef. The trees required no securing or attachment to the hydrosoil due to their negative buoyancy. Eight reef study areas from 12–19 m in length, 7 between-reef study areas from 50–75 m in length, and 8 control study areas 50 m in length were established. All reef and between-reef study areas were located on the northeastern shore of the lake due to proximity of materials and lack of shallow-water structure in this area. Control areas were located randomly throughout the lake.

Use of artificial reefs by fish was determined by snorkel observations and a roving creel survey. Snorkel observations were made in 4 reef, 4 between-reef and 4 control areas that were randomly selected and surveyed on 3 November 1986, 24 April 1987, 10 July 1987, and 25 July 1988. During each survey counts of largemouth bass and sunfish (redear and bluegill) were made while moving parallel to the shore; fish within 3 m of the reef were considered to be inhabiting that reef.

Lake Okeeheelee anglers were interviewed from July 1986 through February 1987. Interviews were conducted on 2 randomly selected days per week and both weekend days per week. The angler surveys were conducted during a 4-hour period

Table 1. Underwater counts of the number per meter (mean ± SD) of largemouth bass and bluegill and redear sunfish at 3 site types in Lake Okeeheelee, Florida (N = 4).

Date	Site Type	Largemouth Bass (N/m) Mean ± SD	Sunfish (N/m) Mean ± SD
3 Oct 1986	Reef	0.25 ± 0.19	0.31 ± 0.42
	Between	0.02 ± 0.04	0.06 ± 0.04
	Control	0.03 ± 0.03	0.09 ± 0.13
24 Apr 1987	Reef	0.31 ± 0.16	0.42 ± 0.28
	Between	0.05 ± 0.05	0.14 ± 0.05
	Control	0.03 ± 0.03	0.08 ± 0.05
10 Jul 1987	Reef	0.19 ± 0.26	0.17 ± 0.27
	Between	0.01 ± 0.01	0.02 ± 0.04
	Control	0.05 ± 0.03	0.14 ± 0.18
25 Jul 1988	Reef	0.38 ± 0.16	1.05 ± 0.70
	Between	0.03 ± 0.02	0.22 ± 0.06
	Control	0.03 ± 0.04	0.13 ± 0.11

each interview day; however, time period (AM or PM) and starting time were not randomly selected. Composite catch rates (fish/angler-hour) for reef and non-reef areas were determined for both largemouth bass and sunfish.

A Kolmogorov-Smirnov test determined the number of bass and sunfish were not normally distributed by species or location ($P < 0.001$). Therefore, the Kruskal-Wallis test was used to detect differences in abundance in reef, between-reef, and control areas. The Mann-Whitney U-statistic was used to determine any differences in abundance between pairs of treatments (Wilkinson 1988).

Results

The 8 near-shore artificial reefs installed in Lake Okeeheelee on 24 February 1986 averaged 63 m^2 in size, were located in water void of natural cover, and were easily accessible to bank fishermen. Snorkel counts indicated that largemouth bass were significantly more abundant on reefs than at either control or between-reef areas ($P < 0.001$), whereas there was no difference in abundance of bass for control and between-reef areas ($P = 0.419$, Table 1). Similarly, sunfish abundance was significantly greater at reef sites than at controls ($P = 0.014$) and between-reef areas ($P = 0.012$), and there was no difference in sunfish abundance between control and between-reef sites ($P = 0.449$, Table 1).

Interviews with 44 anglers fishing reef areas and 126 anglers fishing non-reef areas also indicated that reef areas supported greater numbers of largemouth bass. Catch rates (fish/angler-hour) of largemouth bass for reef and non-reef areas were 1.46 and 1.03, respectively. Conversely, sunfish catch rates were higher in non-reef areas (2.73) than reef areas (0.75).

Discussion

Throughout the 29 months of the study, underwater observations revealed substantially more largemouth bass in reef areas than in either of the other 2 areas (Table 1). Other studies using underwater observation and electrofishing have produced similar conclusions (Prince and Maughan 1979, Mitzner 1981). Likewise, many angling studies have produced significantly greater catches of largemouth bass in structured areas (Wilbur 1978, Wege and Anderson 1979).

Snorkel observations during this study indicated significantly greater use of reef areas as opposed to non-reef areas by sunfish (Table 1). Prince and Maughan (1979) found significantly greater numbers of bluegill and redbreast sunfish (*L. auritis*) on reef areas as opposed to non-reef areas during underwater observations. Although Paxton and Stevenson (1979) and Wege and Anderson (1979) indicated that significantly more bluegill were caught in structured habitats, our data indicated greater angling success for sunfish in non-reef areas. Similarly, Mitzner (1983) found no significant difference in bluegill abundance between brush and control areas for median electrofishing or angler catch. Wilbur (1978) concluded that fishing success for sunfish (bluegill, redear, and warmouth (*L. gulosus*) was generally superior at attractors, but the results were not statistically significant.

It should be noted that our observation on angling for sunfish on reef areas may be misleading. Discussions with anglers conducted after the survey was completed indicated that approximately 10% of the total angling effort was directed at sunfish. If this was true for our survey dates, we would have interviewed only 4 sunfish anglers fishing artificial reefs, an inadequate sample size on which to base conclusions.

Although largemouth bass and certain sunfish species show a preference for artificial reefs, this preference is most readily observed when the remainder of the habitat is devoid of structure (Prince and Maughan 1978, Wege and Anderson 1979, Smith et al. 1980, Mitzner 1981). With no natural bottom structure, Lake Okeeheelee provided a perfect environment for successful application of artificial reefs.

Regardless of the benefits a fisheries management technique provides, the cost and availability of labor, materials, and equipment limit its implementation (Prince and Maughan 1978). We hope this research will prompt biologists to work cooperatively with developers and other governmental agencies, and to utilize previously unproven but locally available materials to provide effective, inexpensive, artificial reefs.

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