

# AN ECONOMIC EVALUATION OF THE 1970 FISHERY IN LAKE TOHOPEKALIGA, FLORIDA

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## ABSTRACT

In 1970 the Florida Legislature provided for a table of values for fish killed by water pollution. These data were applied to standing crop estimates to determine the monetary value of the 1970 fishery in 22,700 acre Lake Tohopekaliga. The limnetic portion of the fishery was valued at \$4,335,120 or \$321.12 per acre. The littoral portion was valued at \$12,266,636 or \$1,333.33 per acre. Although the littoral zone has a considerably higher value and is vital for the renewal of the fishery resource, it is continually subjected to accelerated encroachment and piecemeal destruction by a variety of means. Monetary estimates such as these enable biologists to express biological facts in terms of more conventional market pricing techniques when considering water-use policies.

The fish values were also applied to harvest estimates derived from a concurrent creel survey to obtain an annual net value returned to fishermen of \$560,008 emphasizing the importance of managing the fishery and habitat as a renewable resource. On the average, fishermen harvested 17.3 fish per acre per year valued at \$24.35. Based on standing crop estimates, this represents a low utilization of the fishery present and the potential exists for a much higher net return.

These monetary estimates are considered to be conservative and represent only a portion of the fishery. They do not include tangible fisherman costs, or the value of other organisms and uses dependent on the fishery or habitat.

## INTRODUCTION

The inability or unwillingness to develop realistic cost figures for recreational natural resources is one factor which permits accelerated exploitation of lands and water held in public trust, both by private interests and agencies involved in "public works" projects. After all, it is presently much easier to justify, economically, construction of a highway through a lake than to go around it.

As stated by Wennergren (1964), "It is commonly argued that the recreational experience is not amenable to traditional economic analysis. Satisfaction generated by intangibles such as the aesthetic values associated with the scenic outdoors or pleasures derived from a picnic or boating experience are judged difficult, if not impossible, to quantify. Furthermore, it is argued that many recreational uses of our natural resources are not regulated by conventional market pricing and therefore are not subject to formal prices or fees. Consequently, usage appears to be free, at least in the sense normally ascribed to other market commodities.

Unfortunately, arguments of this nature have relegated the problem of valuing outdoor recreational resources to a special case classification imbued with fallacies. The unique significance attached to the importance of aesthetic values is perhaps the greatest of these fallacies."

An increasing need has developed in Florida for assigning monetary values to what is often erroneously referred to as "marginal lands." These include shallow, often intermittently wet and dry, heavily vegetated wetlands, marshes and zones of fluctuation in natural lakes. With particular regard to lakes, the zone of

rooted aquatic vegetation, described as the "littoral zone," is the area where much of the basic productivity to support a desirable sport fishery originates. Paradoxically, it is this area which is generally regarded as useless, mosquito-infested, snake-ridden wasteland, the value of which lies only in its potential for dredging and filling for urban and industrial development. This misguided philosophy is the rule, rather than the exception, and nearly always destructive to the aquatic environment. In Florida the environmental necessity and importance of littoral areas has been known by professional biologists for many years, but only meager attempts have been made to place a monetary value on such areas.

The 1970 Florida Legislature amended Chapter 70-141, Section 403.141, Florida Statutes to provide for a table of values for fish killed by pollution. This action has, in fact, created a market price for freshwater fish. If one assumes that live fish are worth at least as much as the cost assigned to replace dead ones, then a monetary value derived for the fishery in the littoral zone represents a part of the value of the "marginal land" which sustains that fishery. The new table of fish values, applied to standing crop and fisherman harvest estimates, has afforded an opportunity to estimate a partial monetary value for the 1970 fishery in Lake Tohopekaliga.

Tohopekaliga is a 22,700 acre lake located in western Osceola County, Florida. It is one of the larger lakes in the Kissimmee chain of lakes, a major source of water for Lake Okeechobee and southern Florida. The Central and Southern Florida Flood Control District has regulated the level of the lake since early 1964. At regulation high pool stage of 55 feet MSL (mean sea level) the zone of rooted vegetation (littoral zone) comprises 9,200 acres or approximately 40 percent of the total surface area. The remaining 13,500 acres is limnetic or open water habitat.

The objectives of this paper are to define the importance and approximate monetary value of littoral and limnetic segments of the fishery standing crop, and to assign a value to that portion of the fishery harvested by fishermen in Lake Tohopekaliga during 1970.

## MATERIALS AND METHODS

Fish population data were obtained by one-acre blocknets and "Noxfish" applied at 2 ppm for estimates of the fish standing crop in both littoral and limnetic areas of the lake. Varying habitat types, bottom types, and water depths were sampled in the spring and fall of 1970, to obtain estimates representative of the fish population in the lake, with one exception. No sampling was done in areas having a water depth less than one foot. In such areas the tremendous production of smaller fishes which make up the forage base for larger predatory fishes would greatly increase the value of our littoral estimates. Therefore, the data presented for littoral standing crop are believed conservative.

Harvest data were obtained from a stratified creel survey using non-uniform probability sampling developed by Dr. Don Hayne of the Institute of Statistics, North Carolina State University.

Cost estimates were derived from a publication entitled *FISH VALUES*, published by the Florida Department of Air and Water Pollution Control (1971). An amendment of Chapter 70-141, Section 403.141, Florida Statutes, by the 1970 Legislature, provided for a table of fish values for fish killed by water pollution.

## RESULTS AND DISCUSSION

Table 1 illustrates major fish species, various length and weight categories and assigned values for littoral and limnetic populations. The fish population data are expressed as averages per acre, either by number or weight, depending on which is required by the table of values. The limnetic standing crop is averaged from 12 one-acre samples; the littoral from 14 samples.

The largemouth bass is generally considered Florida's most prized sportfish, but panfish, principally bluegill and redear sunfish, constitute the bulk of the standing crop and monetary value. Among the sport-fish only black crappie, a predominantly pelagic species, assumes a greater abundance and value in the limnetic area compared to the littoral.

Of the forage species, gizzard and threadfin shad assume major importance in limnetic water and golden shiners in littoral areas. Collected in large numbers, their biological importance tends to be over-shadowed by the assignment of low individual values. The value of remaining forage species from littoral areas appears low but this reflects predator cropping. As mentioned previously, considerably larger populations exist in vegetated areas having water less than a foot deep where predator cropping is less severe, but where no sampling occurred.

The values derived for various species generally do not appear disproportionate relative to the actual population structure. A minor anomaly is the assigned size and weight criteria for major centrarchids other than largemouth bass. It is probable that bluegill heavier than 1.5 pounds occur so rarely in a natural fish population as to make this category superfluous; similarly for shellcrackers over 2 pounds.

The importance and value of the fishery in the vegetated portion of the lake (\$1,333.33 per acre) compared to the open water area (\$321.12 per acre) is clearly demonstrated. Expanding the calculated estimates to the lake's total surface area, 22,700 acres, an estimated value for the littoral segment (9,200 acres) represents \$12,266,636, and the limnetic (13,500 acres) \$4,335,120., a total value of \$16,601,756. for Lake Tohopekaliga. This includes only a portion of the fishery and does not include the value of other organisms or uses dependent on the fishery or the habitat.

Obviously the littoral zone accounts for the greatest proportion of the fishery value. Yet it is this area, vital for the continuing renewal of the fishery resource, which is subjected to accelerated encroachment and piecemeal destruction by a variety of means. These include dredging and filling, channelization, beach enhancement, unnecessary chemical and mechanical vegetation control, water level stabilization, and drainage. Of a more insidious nature is man-generated eutrophication resulting from a general lack of understanding and genuine concern for quality water and aquatic habitat.

The value of the fishery in Lake Tohopekaliga will undoubtedly vary from year to year as species composition and standing crop change in response to natural and artificial population pressures. However, calculations such as those presented in Table 1 offer a useful tool for the biologist, permitting him to express biological facts in terms of more conventional market pricing techniques when considering water-use policies.

Table 2 presents the value of fish species harvested from Lake Tohopekaliga in 1970 based on numerical creel estimates. The creel program as presently operated does not provide data on length or weight of fish harvested. However, the state-adopted fish value list requires that either length or weight be known in order to compute a total value for a given species. The size categories assigned to the various species in Table 2 include what we consider the minimum size of fish caught and creeled by fishermen. Panfish (bluegill and redear) and crappie were computed based on the catchable size class 6" or larger for panfish and 7" or

Table 1. The monetary value of fish in littoral and limnetic areas of Lake Tohopekaliga, computed from average standing crop per acre in 1970.

Species*	Size	Table Value	Limnetic			Littoral		
			Avg. No.	Avg. Wt. (lbs.)	Value	Sub Total	Avg. No.	Avg. Wt. (lbs.)
Largemouth bass	0"-6"	\$ .50	12.82		\$ 6.41		63.41	\$31.70
	7"-12"	1.75	2.16		3.78		10.49	18.36
	over 12"	2.50 lb.		4.79	11.97			78.58
Chain-pickrel	over 8 lbs.	10.00 lb.		1.43	14.30			-
	0"-7"	.25			-		.84	.21
	8"-14"	1.00			-		.08	.08
Black crappie	over 14"	3.50 lb.		.93	3.25			39.66
	over 4 lbs.	5.00 lb.		.36	1.80		1.04	5.20
	0"-6"	.30	183.42		55.03		61.00	18.30
Bluegill	7"-12"	1.25	5.75		7.19		8.50	10.62
	over 12"	2.50 lb.		1.17	2.92			2.82
	over 2 lbs.	5.00 lb.		-	-		113	-
Redear sunfish	0"-5"	.25	318.14		79.53		2608.50	652.12
	6"-10"	1.25	40.58		50.72		269.66	337.08
	over 10"	3.00 lb.		-	-		-	-
Channel & white catfish	over 1½ lbs.	5.00 lb.		-	-		-	-
	0"-5"	.25	95.10		23.77		211.07	52.77
	6"-10"	1.25	23.50		29.37		37.67	47.09
Brown &	over 10"	3.00 lb.		.34	1.02			3.15
	over 2 lbs.	5.00 lb.			-		1.05	-
	0"-7"	.10	10.25		1.02		.08	.01
Brown &	8"-14"	.50	.67		.33		.33	.16
	over 14"	1.00 lb.		-	-		-	-
Brown &	0"-6"	.10	-		-		.91	.25

Species	Size	Total Value	Limnetic				Littoral			
			Avg. No.	Avg. Wt. (lbs.)	Value	Sub Total	Avg. No.	Avg. Wt. (lbs.)	Value	Sub Total
yellow bullhead	7"-12" over 12"	.35	-	-	-	-	.58	.20	-	.20
Florida gar	9"-16" over 16"	.15	-	-	-	.16	.02	.06	.15	.51
Bowfin	over 13"	.25 lb.	-	-	-	-	.83	.21	.83	.23
Warmouth	all	.25 lb.	7.59	-	-	-	3.79	.95	3.79	.95
Gizzard shad	all	.40	199.68	3.04	3.04	28.17	11.27	11.27	28.17	11.27
Threadfin shad	all	.05	287.00	9.98	9.98	12.99	.65	.65	12.99	.65
Lake chubsucker	all	.20	.24	.05	.05	13.35	.55	.55	13.35	.55
Golden shiner	all	.03	14.26	.43	.43	452.01	2.67	2.67	452.01	2.67
Atlantic needlefish	all	.10	3.00	.30	.30	1.07	13.56	13.56	1.07	13.56
Seminole killifish & golden topminnow	all	.03	.75	.02	.02	19.42	.11	.11	19.42	.11
Taillight shiner & <i>Notropis spp.</i>	all	.03	9.83	.29	.29	8.57	.59	.59	8.57	.59
Brook silverside	all	.10	-	-	-	5.42	.26	.26	5.42	.26
Bluespotted sunfish	all	.25	-	-	-	1.58	.54	.54	1.58	.54
Swamp darter	all	.10	-	-	-	.17	.39	.39	.17	.39
Tadpole madtom	all	.10	2.49	.25	.25	31.25	.02	.02	31.25	.02
TOTAL VALUE						\$321.12			\$1,333.33	

\*Bailey (1970)

Table 2. The monetary value of fish species harvested from Lake Tohopekaliga in 1970.

Species	Size	Table value	1970 Harvest estimates	Species value
Largemouth bass*	over 12"	\$2.50/lb.	16,157	\$ 80,785.00
Black crappie	7" to 12"	1.25/fish	121,126	151,407.50
Panfish	6" to 10"	1.25/fish	250,791	313,488.75
Catfish	7" to 12"	.35/fish	2,414	844.90
Chain pickerel*	over 14"	3.50/lb.	1,926	13,482.00
<b>TOTAL</b>			<b>392,414</b>	<b>\$560,008.15</b>
<b>Average/acre/year</b>			<b>17.3</b>	<b>\$24.35</b>

\* = computed on an average of 2 lbs./fish.

larger for crappie. Bass were computed using an average size of 2 lbs., determined by a recent field survey, which is thought to be a conservative estimate. Chain pickerel were assigned an average weight of 2 lbs. based on long-term field observation of fishermen creel on the lake.

Bluegill and redear sunfish made up the bulk of the fish standing crop so it is not surprising that they also made up the bulk of the annual harvest value (56%). Although a highly seasonal fishery, black crappie provided 27% of the annual net value in Lake Tohopekaliga. The highly prized largemouth bass accounted for only 14%.

The calculated total harvest value of \$560,008 for Lake Tohopekaliga in 1970 is a measure of annual net return to the fisherman and, being a substantial sum, emphasizes the importance of managing the fishery and habitat as a renewable resource. On the average, fishermen harvested 17.3 fish per acre per year having a value of \$24.35. Based on average standing crop estimates, this is a fairly low utilization of the fishery present and the potential for a much higher net return exists.

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### MERCURY CONCENTRATION IN VARIOUS TISSUES OF THE BOTTLENOSE DOLPHIN (*TURSIOPS TRUNCATUS*)

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#### ABSTRACT

The mercury concentrations in various tissues of an adult bottlenose dolphin, *Tursiops truncatus*, were determined by flameless atomic absorption spectrophotometry. Mercury was concentrated in the kidneys and liver at levels in excess of 18 parts per million (dry weight basis). One sample from the right lobe of the liver contained 34.5 ppm mercury. With the exception of skin and subcutaneous tissue, a sample from the medulla oblongata and a bone sample (skull fragment), all samples run exceeded 1.0 ppm mercury. Studies as to the prevalence of high mercury levels in *Tursiops truncatus* and other marine mammals as well as the effects such levels have on behavior, fecundity and survival are recommended.