

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.

INTRODUCTION

Public as well as scientific interest in the concentration of mercury in marine organisms has markedly increased since the confiscation of large quantities of swordfish and, to a lesser extent, tuna based on the U.S. Food and Drug Administration ruling that fish for human consumption may contain no more than 0.5 parts per million (ppm) mercury. Analyses of the tissues of swordfish and tuna obtained from museum collections indicate that high mercury concentrations have been present in both of these fishes over a period of at least the past ninety years (Miller, *et al.*, 1972). The presence of mercury in excess of 0.5 ppm may in some cases be due to mercurial pollutants but in many cases appears to be a natural phenomenon. Mercury accumulates in the nervous tissue of humans and while it appears to be normally present in low concentrations (Glomski, Brody, and Pillay, 1971), the Japanese Minamata Bay disaster of the 1950's demonstrated that devastating effects can occur when humans are chronically exposed to high levels of dietary mercury.

In the spring of 1971, an adult bottlenose dolphin (*Tursiops truncatus*) was made available to our institution by a local citizen. The animal was found washed ashore in Wassaw Sound, Georgia. Three bullet holes were found in the animal as well as several lacerations apparently resulting from the animal having been struck by a power boat. Appearance and texture of the internal organs indicated that the animal was freshly killed. There were no indications of bacterial decomposition.

The animal weighed approximately 150 kilograms and measured approximately 2.5 meters in length. The citizen who found the animal reported that he had opened the abdominal cavity to inspect the stomach for food. Upon receipt of the animal, we found the stomach and intestines intact; however, there was no trace of reproductive organs. We surmised that the animal was a female and that the supposed dissection of the stomach in fact involved the uterus.

MATERIALS AND METHODS

Samples were obtained from various organs and tissues throughout the animal and were frozen immediately following dissection. Mercury was determined by flameless atomic absorption spectrophotometry on samples which had been thawed, and wet digested after the procedures described by Windom, Taylor and Stickney (1972). Mercury was calculated on the basis of ppm dry weight in the individual tissues or organs.

RESULTS AND DISCUSSION

Mercury values obtained for various tissues and organs of the bottlenose dolphin are presented in Table 1. With few exceptions, the levels of mercury in samples from the dolphin exceeded 1.0 ppm. The highest concentrations of mercury were found in the kidneys and liver, while significant, but lesser concentrations of this metal were present in the brain, tongue, heart, stomach wall, muscle and lungs. While the bottlenose dolphin is not often consumed by humans in the United States, it is edible and has meat similar in appearance to beef. The values for mercury in all edible tissues of the animal exceeded the standards set by the U. S. Food and Drug Administration.

The high levels of mercury which were found in the kidney and liver but not in the nervous tissue of this rather highly evolved mammal open questions of comparative physiology between marine mammals and humans. Determinations of mercury in various fish species along the Georgia coast (many of which would be suitable food for *Tursiops truncatus*) demonstrated little indication of food chain magnification. Distribution of mercury in fishes and various invertebrates

appears to be random with respect to trophic level (Windom, Stickney, Smith, White and Taylor, submitted for publication). It is recommended that studies aimed at evaluating the mercury concentrations available to the bottlenose dolphin in its food as well as the mechanisms by which mercury is concentrated in this animal be initiated. Comparative studies on other marine mammals should also be undertaken to establish baseline values for mercury. It is becoming increasingly clear that some organisms naturally contain high levels of mercury (e.g. swordfish), thus, the values reported here may not be abnormally high for this species. If the levels of mercury found in *Tursiops truncatus* are not within the normal range, studies designed to delimit the effects of this heavy metal on behavior, fecundity and survival should be undertaken.

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Table 1. Mercury concentrations in various tissues and organs of *Tursiops truncatus*.

Sample Description	Hg Concentration (ppm dry weight)
Medulla oblongata	0.96
Brain (Rt. lobe)	1.24
Bone (Skull)	0.34
Tongue	4.26
Heart	4.34
Esophagus	4.48
Stomach wall	2.21
Kidney (Rt.)	22.0
Kidney (Lt.)	19.6
Liver (Rt. lobe)	34.7
Liver (Lt. lobe)	18.3
Lung (Rt.)	1.65
Lung (Lt.)	1.85
Muscle (Dorsal to Rt. pectoral fin)	4.72
Muscle (Base of dorsal fin)	3.27
Skin and subcutaneous tissue (Base of dorsal fin)	0.51
Skin and subcutaneous tissue (Behind head on dorsal surface)	0.12