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Vertebrates Removed by Mechanical Weed Harvesting in Lake Keesus, Wisconsin

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INTRODUCTION

Mechanical weed harvesting has been used to control nuisance vegetation in Lake Keesus since 1979[3]. Fish, turtles, and amphibians often become entangled in the vegetation and are incidentally removed from the lake while harvesting weeds. Mechanical harvesting removed 2 to 8% of the standing crop of juvenile fish in harvested areas in Saratoga Lake, New York (Mikol 1985) and 32% of the fish population in harvested areas in Orange Lake, Florida, representing an estimated replacement value of $6,000 per ha (Haller et al. 1980). Engel (1990) found mechanical harvesting removed 21,000 to 31,000 fish per year from Lake Halverson, Wisconsin, representing 25% of the fry in the lake. Little other current information has been published concerning aquatic vertebrate removal by mechanical weed harvesting in Wisconsin, though it is a commonly used management tool. Additionally, only Engel (1990) reported information on the removal of turtles relative to weed harvesting, but none on amphibians. The objective of this study was to document the number, species, and size of vertebrates removed by mechanically harvesting weeds in Lake Keesus.

MATERIALS AND METHODS

Lake Keesus is a spring-fed, 96-ha lake located in Waukesha County, about 25 km northwest of Milwaukee, Wisconsin (43°10' N Lat., 88°30' W Long.). It includes 3 shallow bays and has a maximum depth of 12.8 m. Strong populations of largemouth bass (*Micropterus salmoides* Lacepède), bluegill (*Lepomis macrochirus* Rafinesque), and black crappie (*Pomoxis nigromaculatus* Lesueur) exist in the lake. Northern pike (*Esox lucius* L.) are common and walleye (*Stizostedion vitreum* Mitchill) are present. The lake chubsucker (*Erimyzon sucetta* Lacepède), which was a state threatened species during the study and is now listed as a species of special concern, also inhabits the lake. Eurasian watermilfoil (*Myriophyllum spicatum* L.) and curly-leaf pondweed (*Potamogeton crispus* L.),

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both exotic plants, occur in dense stands throughout the littoral zone. Native vegetation present includes coontail (*Ceratophyllum demersum* L.), muskgrass (*Chara* sp.), elodea (*Elodea canadensis* Michx.), pondweeds (*Potamogeton* sp.), slender naiad (*Najas flexilis* Willd.), bladderwort (*Utricularia vulgaris* L.), and water celery (*Vallisneria americana* L.). The lake's watershed of 1,045 ha contains 57% agricultural lands, 17% residential or commercial development, and 14% marsh or lake surface. Much of the shoreline is developed, and high recreational use of the lake includes water skiing, jet skiing, sailing, and fishing.

Ten samples of harvested vegetation were collected 26 June to 6 August 1996 by an Aquarius Systems model HM-420 weed harvester with a 2.43-m cutting bar and a maximum cutting depth of 1.68 m. Collection methods mimicked normal harvesting operations, except that a mat was placed on the storage conveyor belt before each sampling to prevent vertebrates from falling through the mesh belt to become crushed and lost from the sample. Vegetation was then harvested until 1 m^3 of weeds was collected on the mat, as determined by measurements on the mat. This served as the sampling unit.

Sample harvesting began where normal harvesting ended that day, and continued until 1 m^3 of vegetation was collected. Dates of samples were selected objectively by amount of time available on that particular day to sort through the sample effectively. Harvesting was halted momentarily to release turtles collected in samples, as is usually done in normal harvesting operations. For sampling purposes, turtles were identified by species, their shells measured from the anterior to the posterior edge, and then released.

Once collected, the entire sample was brought to shore, unloaded onto a tarp, and sorted through by hand by shaking the vegetation over a second tarp. Vertebrates fell from the vegetation and were easily collected, identified by species when possible, measured, and recorded in 2-cm size classes. Fry too small to be identified easily by species were grouped. Species and length of fish taken from the sample by common grackles (*Quiscalus quiscula* L.) during harvest were recorded as unknown.

RESULTS AND DISCUSSION

I collected 387 vertebrates in ten samples (Table 1) with a mean of 38.7 vertebrates per 1 m^3 sample. If multiplied by the total volume of vegetation removed during the harvesting season (late May to mid August), harvesting removed about 39,000 fish from Lake Keesus. Bluegills, predominantly between 4 and 10 cm in length, were the most common and comprised 46% of the fish removed. The longest size class (10 to 12 cm) contained 2% of the total number of bluegills harvested. Largemouth bass, unidentified fry, and black crappie comprised 24%, 16%, and 8% of the total removed, respectively. Largemouth bass were mainly between 2 and 6 cm in length, with the largest size class being 6 to 8 cm and representing 3% of the total number of largemouth bass removed.

The most common size class represented by all species collectively was the 2 to 4-cm class, comprising 30% of the cumulative total. The 4 to 6-cm and the 6 to 8-cm size classes followed with 27% and 20% of the total respectively.

Turtles were harvested and released in samples seven times, representing the removal of about 700 turtles during the 1996-harvesting season. But this number represents only the frequency of turtles caught, since turtles harvested were returned to the population and individual turtles were most likely harvested again. Snapping turtles (*Chelydra serpentina* L.) comprised 57% of the turtles harvested and had a mean shell length of 16.7 cm. Painted turtles (*Chrysemys picta* Gray) comprised the remaining 43% and had a 10.9-cm mean shell length.

No amphibians, chubsuckers, or fish >12 cm long were present in samples, although mud puppies (*Necturus maculosus* Rafinesque), adult and immature bullfrogs (*Rana catesbeiana* Shaw), lake chubsuckers, black crappies 12.7 to 20.3 cm long, and northern pike up to 55.8 cm long were occasionally harvested during normal harvesting operations.

The actual number of vertebrates removed in 1996 is probably higher than that found in this study, since samples did not include animals injured while escaping the harvester or animals that fell through the mesh conveyor and landed on the edges of the harvester. However, results appear gener-

TABLE 1. CUMULATIVE VERTEBRATES REMOVED IN TEN HARVESTED SAMPLES OF VEGETATION IN LAKE KEESUS, WI 1996 AS DIVIDED BY SIZE CLASS.

	Size classes (cm)						
Species	0-2	2-4	4-6	6-8	8-10	10-12	Total
Bluegill	0	3	60	67	42	3	175
Pumpkinseed	0	0	0	0	1	1	2
Black crappie	0	3	1	2	4	21	31
Warmouth	0	1	1	0	0	0	2
Yellow perch	0	0	0	0	1	1	2
Largemouth bass	0	49	39	3	0	0	91
Northern pike	0	0	1	2	1	0	4
Unidentified fry[a]	7	54	0	0	0	0	61
Unidentified	4	4	0	0	0	0	8
Unknown[b]							4
Painted turtle		(Shell lengths: 17.8, 15, 10)					3
Snapping turtle		(Shell lengths: 35, 10.5, 10, 11)					4
Totals	11	114	102	74	49	26	387

[a]Fish fry were not identified to species.
[b]Represents fish taken from samples by birds that were not measured or identified.

ally consistent with previous studies. Engel (1990), Haller et al. (1980), Mikol (1985), and Wile (1978) found that harvesting removed predominantly small sunfish (*Lepomis* sp.) or yellow perch (*Perca flavescens* Mitchill).

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