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RELATIVE EFFECTIVENESS OF DAY AND NIGHT TRAWLING IN LAKE WINNEBAGO

By

Gordon Priegel

WISCONSIN CONSERVATION DEPARTMENT
Research and Planning Division
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Introduction

Small otter trawls have been used successfully in Lake Winnebago since 1952 to sample 0-age fish. Trawling has provided information which is useful in determining relative population abundance, growth, survival, and other information essential to completing life history studies. Lake Winnebago is ideally suited for trawling. It is 137,708 acres in size with an average and maximum depth of 15.5 and 21.0 feet, respectively. The bottom of Lake Winnebago is an extensive plain broken only by reefs on the west shore, while its greatest area consists of finely-divided, soft mud or sand overlaying a clay base.

Fish sampling by trawling has been conducted over all suitable areas of the lake during the summer and early fall. Trawl samples have always been obtained during daylight hours, except for night trawling mentioned in this paper. This paper presents a comparison between night and day trawling during July and August, 1960-61.

Materials and Methods

The otter trawls used were 12 feet in width and are made of one and one-half-inch stretch-mesh cotton twine. The wings and body are made of 9 thread and the bag (cod end) of 18 thread. A liner of nylon bobbinet is sewed into the cod end for sampling 0-age fish. Otter boards used with this net were made of 1-inch pine, 12 x 24 inches in size. A 30-foot bridle attached to a single-tow cable is used with these trawls.

The trawls were pulled from a 30-foot steel launch propelled with a 165 hp. inboard engine at 1,450 rpms (approximately 3-4 miles per hour). The length of each haul was 7 minutes. After each haul, all fish are identified, counted by species and age groups (0-age or adult), and then either preserved in formalin or returned to the water, depending upon information sought. Usually all 0-age fish are preserved for later examination in the laboratory, and the adults are measured when caught and released.

This paper is based on an evaluation of six species taken abundantly in the trawl: freshwater drum, Aplodinotus grunniens Rafinesque; walleye, Stizostedion vitreum vitreum (Mitchill); sauger, Stizostedion canadense (Smith); white bass, Roccus chrysops (Rafinesque); yellow perch, Perca flavescens (Mitchill) and troutperch, Percopsis omiscomaycus (Walbaum). In addition to these, twelve other species are taken at infrequent intervals (Table 1).

Results

Since 1952, trawling to sample the fish populations in Lake Winnebago has been performed during daylight hours. Trawling hours were between 8:30 a.m. and 4:00 p.m. In July 1960, night trawling was tried to determine if the catch of adult freshwater drum could be increased. Drum are being removed in Lake Winnebago by commercial fishermen trawling only during daylight hours. Night trawling is considered as that period when artificial light is necessary. All night trawling was done in the same area and on the same date to coincide with day trawling.

The percentage composition of adult freshwater drum in the catch increased at night for all sampling periods. During July 1960, adult drum comprised 7 percent of the day catch as compared to 39 percent of the night catch while in August 1960, 14 percent of the day catch was adult drum as compared to 57 percent at night (Fig. 1). Adult drum comprised 49 and 77 percent of the day catch in July and August, 1961, respectively, as compared to 71 and 85 percent of the night catch in July and August, 1961, respectively.

The catch per haul of adult freshwater drum increased at night for all sampling periods except during August 1961 (Table 2). During July 1960, 21.5 adult drum per haul were taken in the day, and the catch per haul increased to 81.8 adult drum at night. The catch per haul of adult drum increased from 29.6 drum during the day to 112.8 drum at night during August 1960, while during July 1961, there was an increase from 16.5 drum for day trawling to 37.5 drum at night. During August 1961, the day catch per haul of 93.3 drum decreased to 63.9 drum at night.

The percentage composition of adult sport fish in the catch -- walleye, white bass, yellow perch and sauger -- decreased at night during July and August in both years. The adult sport fish comprised 19 and 13 percent of the catch during the day in July and August 1960, but only 6 and 5 percent of the night catch. During July and August 1961, the catch of adult sport fish was 37 and 14 percent during the day and 16 and 3 percent at night, respectively.

The catch per haul of adult sport fish also decreased at night for all sampling periods. In 1960, the catch per haul of adult sport fish decreased during the day from 58.9 and 27.1 fish to 13.7 and 10.1 fish at night during July and August, respectively. The catch per haul of adult sport fish decreased from 21.9 and 14.4 fish during the day to 8.1 and 2.4 fish at night for the periods of July and August 1961, respectively.

There was a decrease in the percentage composition of the catch for 0-age sport fish at night for all sampling periods. During July and August 1960, the percentage of 0-age sport fish in the catch during the day was 8 and 2 percent, respectively, as compared to 1 percent at night for these two months. In July 1961, the percentage of the catch was 7 percent during the day and 2 percent at night. No 0-age sport fish were taken during August 1961 during day or night trawling.

A decrease in the catch per haul of 0-age sport fish at night was noted for all sampling periods. During July 1960, the catch per haul of 0-age game fish decreased from 24.9 fish during the day to 1.5 fish at night while in August 1960, there was a decrease from 3.6 fish per haul during the day to 1.2 fish at night. The catch per haul of 0-age sport fish during July 1961 decreased from 8.8 fish during the day to 1.6 fish at night. No 0-age sport fish were taken during August 1961.

The percentage composition of adult or 0-age troutperch in the catch decreased at night during July and August 1960: 66 and 71 percent of the catch during the day as compared to 54 and 37 percent of the catch at night: During July and August 1961, the catch of this species increased at night: 7 and 9 percent of the day catch as compared to 11 and 12 percent of the night catch.

The catch per haul of adult and 0-age troutperch decreased at night during July and August, 1960: 208.1 and 155.1 fish per haul during the day as compared to 112.5 and 73.5 fish at night. During July and August 1961, the catch per haul of adult and 0-age troutperch decreased from 29.1 and 10.6 fish during the day to 9.1 and 8.6 fish at night.

Night trawling in July 1960 demonstrated that the catch of freshwater drum increased as soon as it got dark. In August 1960, trawling was done throughout the entire night to see whether the composition of the trawl catch would change as it got light in the morning. At daybreak, the same number of drum per haul was taken as during night hours; but, as it became lighter, the drum catch decreased and the catch of other species (adult and young-of-the-year) increased. This is just the opposite effect obtained when it became dark.

Factors that might be responsible for the increased catch of adult drum during night trawling are: movement of fish into the trawling area; a tendency of drum to rest near the bottom at night; more active feeding of drum on the bottom at night (Chironomid larvae major food item); or fish may not see the trawl at night as readily as in the daylight.

The decrease of young-of-the-year fish and most adult sport fish during night trawling may be correlated with vertical daily migrations of zooplankton. The 0-age fish following the zooplankton to the surface may be accompanied by an attendant movement of predator fishes to seek the 0-age fishes as forage.

Commercial Application of Night Trawling

On a very limited basis, night trawling was tested by state commercial fishing crews during the summer of 1963 and 1964 to see if they could increase the catch of drum during night trawling. The otter trawls used were 30 feet in width. Mesh sizes used in the wings and body ranged from 4 to 6 inches, and in the cod end mesh sizes ranged from 2 to $3\frac{1}{2}$ inches. The length of each haul was approximately 15 minutes.

In 1963 the crews made 107 night hauls as compared to 130 day hauls (5 sampling periods). The average catch per haul during the day was 206 drum, while at night 291 drum per haul were taken, an increase in the number of drum per haul of 29.2 percent at night.

Trawling in 1964 showed a greater increase of drum taken during night trawling. The crews made 314 day hauls as compared to 149 night hauls (13 sampling periods). The catch per haul of drum during the day was 140 drum as compared to 498 drum per haul at night, which was an increase of over 200 percent.

Night trawling with larger mesh trawls on a commercial basis to remove drum would be very practical since the catch of adult drum would increase while a decrease in the catch of adult sport fish would occur. This would greatly eliminate the handling of game fish, decrease sorting operations, and would allow for greater fishing intensity.

Operational limitations to night trawling are: artificial light is necessary; shadows create unrealism and decrease visibility of operators; and, obstacles in the water such as buoys, set-lines, etc., create hazards which must be carefully reconnoitered during daylight trawling.

Summary

1. The catch per haul of adult freshwater drum increases during night trawling.

2. The catch per haul of adult sport fish decreases at night. If night trawling were put on a commercial basis, this would result in a reduction in the number of game fish handled during trawling operations.

3. A decrease in the catch of 0-age sport fish also occurs at night.

TABLE 1

List of Fish Species Taken While Trawling in Lake Winnebago With 12-Foot Bait Trawls

Taken Abundantly

Troutperch	Percopsis omiscomaycus (Walbaum)
White bass	Roccus chrysops (Rafinesque)
Yellow perch	Perca flavescens (Mitchill)
Walleye	Stizostedion vitreum vitreum (Mitchill)
Sauger	Stizostedion canadense (Smith)
Freshwater drum	Aplodinotus grunniens (Rafinesque)

Taken at Infrequent Intervals

Chestnut lamprey	Ichthyomyzon castaneus Hubbs and Trautman
Lake sturgeon	Acipenser fulvescens Rafinesque
Carpsucker	Carpiodes carpio (Rafinesque)
Common white sucker	Catostomus commersoni (Lacepede)
Carp	Cyprinus carpio Linnaeus
Lake emerald shiner	Notropis atherinoides Rafinesque
Channel catfish	Ictalurus punctatus (Rafinesque)
Brown bullhead	Ictalurus nebulosus (Le Sueur)
Burbot	Lota lota (Linnaeus)
Yellow bass	Roccus mississippiensis (Jordan & Eigenmann)
Black crappie	Pomoxis nigromaculatus (Le Sueur)
Bluegill	Lepomis macrochirus Rafinesque

TABLE 2

The Average Catch Per 7-Minute Haul With 12-Foot Otter Trawl During July-August, 1960 and 1961, in Lake Winnebago.

Sampling period	No. of hauls	Drum: adult	Sport fish: adult	Sport fish: 0-age	Troutperch: adult and 0-age
July, 1960					
Day	12	21.5	58.9	24.9	208.1
Night	9	81.8	13.7	1.5	112.5
August, 1960					
Day	12	29.6	27.1	3.6	155.1
Night	9	112.8	10.1	1.2	73.5
July, 1961					
Day	11	16.5	21.9	8.8	29.1
Night	11	37.5	8.1	1.6	9.1
August, 1961					
Day	7	93.3	14.4		10.6
Night	7	63.9	2.4		8.6

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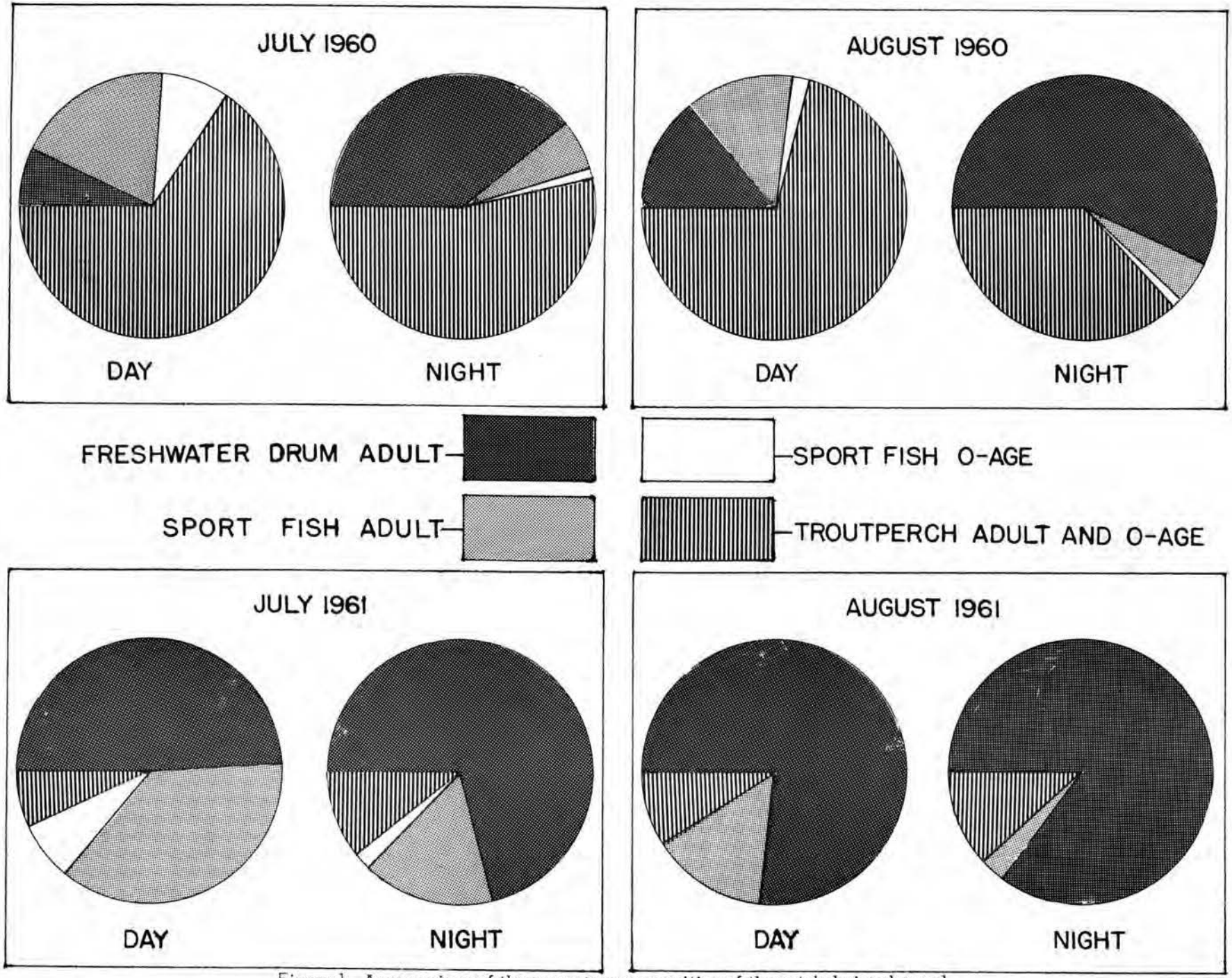

Figure 1. A comparison of the percentage composition of the catch during day and night trawling, July and August, 1960-61, in Lake Winnebago.