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Priegel, Gordon R.

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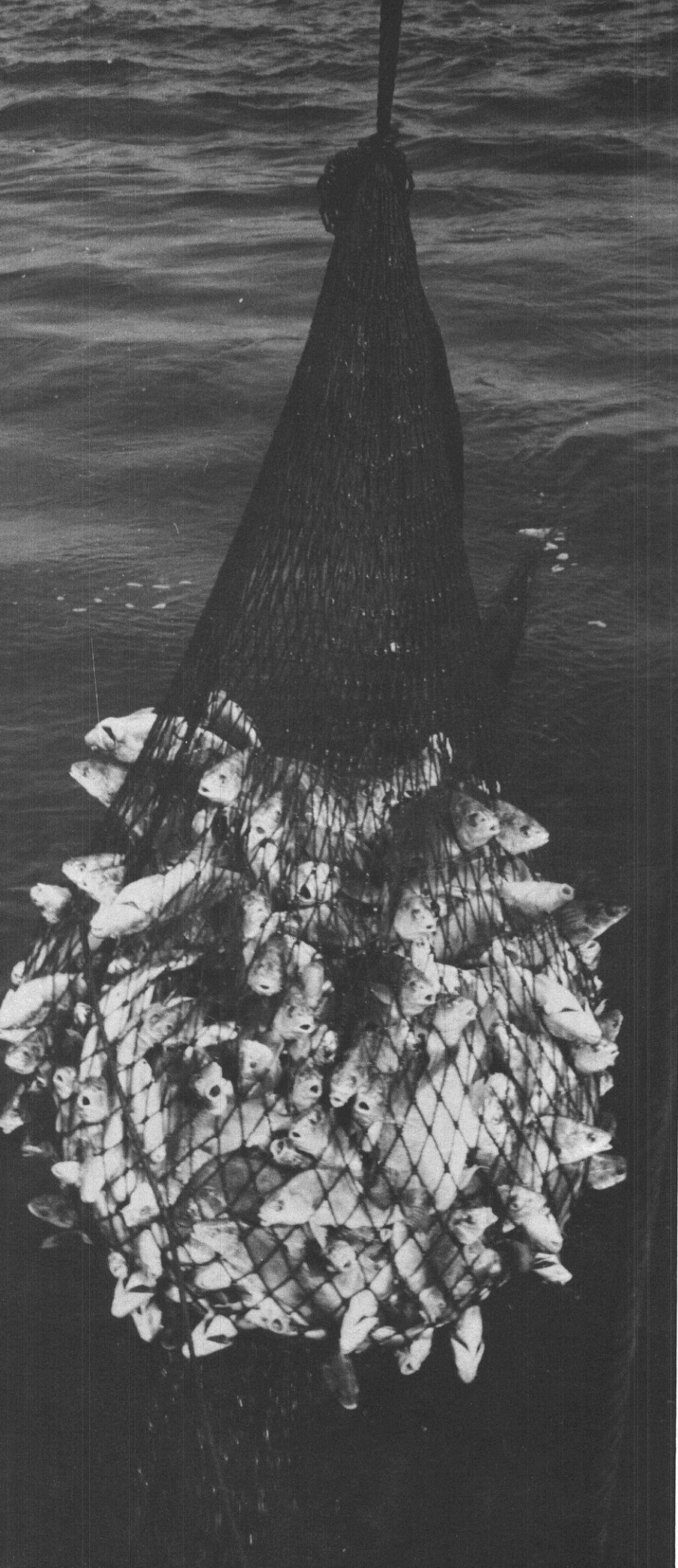
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**EVALUATION
OF
INTENSIVE
FRESHWATER
DRUM
REMOVAL
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LAKE
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WISCONSIN,
1955-1966**

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FRESHWATER DRUM REMOVAL IN
LAKE WINNEBAGO, WISCONSIN,
1955-1966

By Gordon R. Priegel

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The author is a fishery biologist with the Bureau of Research in Madison.

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ABSTRACT

An intensive freshwater drum removal program was undertaken on Lake Winnebago with the assistance of qualified commercial fishermen in 1955. A 12-year evaluation study, 1955-1966, was initiated at the start of the intensive removal program to evaluate the effects of freshwater drum removal on the freshwater drum population and other fish species.

From 1955 through 1966, 35.5 million pounds of commercial fish were removed from Lake Winnebago. Of this total, 33.4 million pounds were freshwater drum.

Initial heavy removal, 11.8 million pounds of freshwater drum in 1955-57, resulted in a decided change in the condition of the freshwater drum; however, the improvement in condition that was evident early in the study tended to be lost later.

The commercial harvest was intensive enough to crop off the larger and older freshwater drum by 1962 so that the harvest after 1962 was composed of smaller and younger fish even though the rate of growth remained the same.

Selected trap net sets during April-June and trawling during the summer and autumn were effective methods of removing freshwater drum.

To keep the freshwater drum population at an optimum size in Lake Winnebago, 2.5-3.0 million pounds should be removed annually. Since the freshwater drum is a very prolific fish and occupies a favorable habitat, the population would soon consist of many slow-growing, old-age fish, which was the situation before the program began in 1955, if maximum effort is not maintained.

There were benefits to the sport fishery that appeared to result from the freshwater drum removal program; however, no positive correlation could be demonstrated. After 1959, the catch of white bass and black crappie in nets definitely increased. Walleye, sauger and yellow perch populations fluctuated in abundance but the catch in nets after 1959 increased, especially that of the sauger. There was no indication that commercial removal of freshwater drum was detrimental to any game or panfish population.

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INTRODUCTION

The control of undesirable fish populations by removal is a basic tool used by fish managers in many states, and has resulted in increases in the abundance of game fish and in improved sport fishing.

Many examples of this type of management have been reported, including work at Bass Lake, Indiana by Ricker and Gottschalk (1941); East Okoboji Lake, Iowa by Rose and Moen (1953); Lake Eustis and Lake Harris, Florida by Dequine (1952); Lake Mattamuskeet, North Carolina by Cahoon (1953), several Alabama lakes by Byrd (1958) and four southern Minnesota lakes (Scidmore and Woods, 1961).

A 12-year evaluation program was undertaken on Lake Winnebago at the start of a period of intensive removal of freshwater drum *Aplodinotus grunniens* Rafinesque. The objective was to evaluate the effects of freshwater drum removal on the freshwater drum population and other fish species. To meet this objective, it was necessary to know the total catch and catch per effort for freshwater drum and all other fish species, condition changes in individual freshwater drum, changes in species composition and any noticeable changes in growth, age and age composition of the freshwater drum population.

Since methods used to remove undesirable fish populations in ponds and small lakes are not practical on large lakes like Lake Winnebago, new fishing methods had to be tried. A secondary objective of this study was to evaluate various methods of removal used (hoop nets, trap nets and trawls).

DESCRIPTION OF AREA

Lake Winnebago, located in east central Wisconsin is the largest inland lake in Wisconsin, containing 215 square miles (137,708 acres) of very fertile water. This roughly rectangular-shaped lake, 28.0 miles long and 10.5 miles at its widest point, has a maximum depth of 21.0 feet and an average

depth of 15.5 feet. The bottom of Lake Winnebago is an extensive plain broken only by reefs on the west shore. Except for these

reefs and the rock, gravel and sand shorelines, the bottom is finely divided, soft mud (Wirth, 1959).

METHODS AND MATERIALS

Contract Fishermen

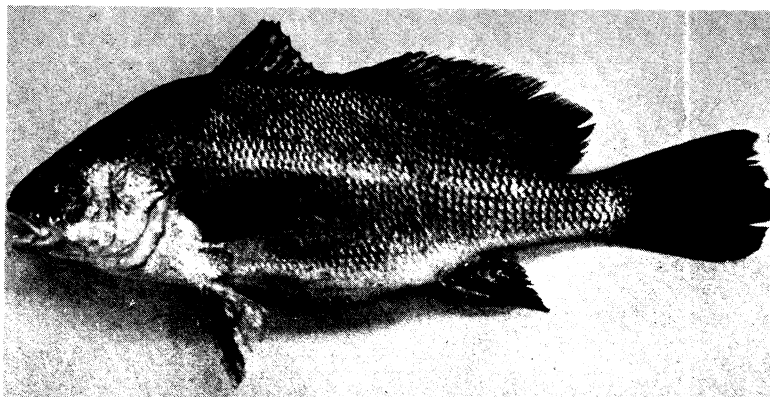
The contract fishermen who were eventually selected to fish on Lake Winnebago were screened on the basis of their past performance as commercial fishermen on the Great Lakes. The major criteria were their desire to fish on Lake Winnebago, absence of previous law violations, and the respect shown to them by other commercial fishermen.

Contract

A contract for the removal of commercial and detrimental fish from inland waters of Wisconsin as provided under the provisions of the Wisconsin Statutes was issued to each contract fisherman for a one-year period: January 1–December 31, of a given year.

Each contract fisherman was required to take out a bond, and the conditions covering the bond are described in Section 10 of the contract which reads as follows: "The party of the second part (fisherman) shall give a bond to the party of the first part (State) in favor of the State of Wisconsin in the sum of one thousand dollars (\$1,000.00) with corporate surety, conditioned on the faithful carrying out of the provisions to be by him performed, and subject to approval as provided by law for the bonds of contractors for the doing of public work.

"Upon any default or non-performance of the terms of this contract by said second party, except wherein the said first party has waived, in writing, such default or breach of contract, the amount for which said bond is



Freshwater drum.

given shall become due and payable forthwith to the party of the first part."

A one-thousand-dollar bond was required for each contract, and this sum remained the same for all contract fishermen throughout the 12 years of the study. During this time, there was no forfeiture of a bond.

Waters Fished

The contracts provided for the commercial removal of fish only from Lake Winnebago. Contract fishermen were allowed to remove carp, *Cyprinus carpio* Linnaeus; freshwater drum; bowfin, *Amia calva* Linnaeus; gar, *Lepisosteus* sp.; burbot, *Lota lota* (Linnaeus); quillback, *Carpionodes cyprinus* (LeSueur) and mooneye, *Hiodon tergisus* LeSueur. In 1958, suckers, *Catostomus* sp. and redhorse, *Moxostoma* sp. were added to the list but were removed in 1962 as it was felt that these two species were important forage species for the wall-eye, *Stizostedion vitreum* (Mitchill) and sauger *Stizostedion canadense* (Smith).

Gear Restrictions

There were no restrictions on the amount of gear used but restrictions were placed on type of gear, mesh size, sites, marking of gear and lifting requirements.

Trap and Hoop Nets. 1955-57: A 2½-inch stretch measure mesh in the crib or dipping section was required. The nets had to be equipped with 3 marker flags extending 3 feet above the surface of the water, one at each end of the net and one near the center. The nets had to be lifted once each week in the winter and at least 3 times each week during the open-water season.

1958-59: No part of the net or lead was to be set within 3 feet of the lake's surface to allow boats to pass over the net without entangling the boat's prop in the webbing. The lead could contain no mesh larger than 6-inch stretch measure. Each marker staff must bear 2 flags, red on top and yellow below with the yellow flag clearly marked with the 3 initials of the fisherman. No nets were allowed to be set within 1,000 feet of the north shore between May 20 and September 3.

1960-66: All boats had to be rigged with

chutes for the release of game fish instead of just throwing the fish overboard. Every operator had to have a small boat along with him during all open-water operations and as the net is being lifted, a man will occupy that small boat and immediately remove all gilled fish. All nets and marker flags had to be numbered.

Trawls. 1961: Contract fishermen were allowed to trawl only under constant supervision of a full-time state employee. The contract fisherman had to pay a fee towards the salary and expense of the state employee.

1962-66: Contract fishermen were allowed to trawl after July 15. Supervision charges were set at 10 dollars a day for up to 7 hours on the water or 15 dollars per day for any day that the supervisor is on the water over 7 hours. A guarantee by the contract fishermen that a fee for 5 days of trawl supervision at 10 dollars per day will be paid whether the entire 5 days are spent trawling or not was required. Trawling was limited to daylight hours only with a limit of 11 hours per day. All fish had to be unloaded at the docks before dark. Trawls up to 50 feet (topline) could be used but No. 42 thread or larger had to be used in the cod end.

Proceeds of Sales

The contract fishermen, after the sale of commercial or detrimental fish, had to pay the State of Wisconsin a certain percentage of their sales. In 1955 this assessment was 10 percent of sales obtained from fish sold for over 3 cents per pound. This payment remained the same until 1962 when it was changed to 2 percent of sales obtained from fish sold for over 5 cents per pound.

State Crews

The state crews for the most part operated under the same rules and regulations governing the contract fishermen; however, the state crews were more flexible. State crews were allowed to experiment with different size mesh and twine in trap nets and trawl, trawl during months when the contract fishermen could not and generally experiment with different types of gear and methods of using the gear. The results obtained from the state's commercial fishing

crews were used to regulate the contract fishermen and allow for the maximum harvest of freshwater drum without harming or killing desirable game fish species.

Methods of Fishing

Hoop Nets

Traps with hoop net pots were used only during the open water season on Lake Winnebago in 1955-56 and the winter season in 1955, 1956 and 1960. The hoops were 5 feet in diameter, with 2½- to 3-inch stretch mesh. The hearts were 12 feet deep with 5-inch stretch mesh. Leads were usually 500 feet long, 12 feet deep with 5-inch stretch mesh.

Trap Nets

The Lake-Erie-type trap nets were used from 1955 through 1966 and were the most important gear used until 1962 when trawling accounted for a greater percentage of the catch.

The entire trap and leads were usually 10 feet deep and were supported with anchors and buoys. A general description of a trap net used is:

Leads. The leads were 400 feet long but usually 2 or 3 leads were used on one set. Mesh sizes were never larger than 6-inch stretch.

Hearts. There was no covering of webbing over the hearts. The hearts were 75 feet long on the outside and 55 feet long on the inside with 5-inch stretch mesh.

Slope. The slopes were 36 feet long with 5-inch stretch mesh. The width of the slope across the net was 42 feet.

Cod End. The cod ends were composed of two sections. The first section was 16 feet long with 3½-inch stretch mesh, while the last section or dipping section was 22 feet long with 2¼- to 2½-inch stretch mesh.

"Windows" were incorporated into the upper corners of the dipping section to allow white bass and other small game fish species to escape. The "windows" were made of 5- or 6-inch stretch mesh and they proved very effective in allowing game fish but not the drum to escape.

Trawls

State crews began trawling in 1957, while contract operators were not allowed to trawl

until 1961. Trawl size based on the topline varied from 30 to 50 feet, but a typical trawl could be described as follows:

Size. A 45-foot trawl would have a 45-foot topline or cork line and a 60-foot bottom line or lead line. There would be 20 feet of line between the trawl and the otter boards. The otter boards would be fastened with cable to the winch on the boat. Usually 80-100 feet of cable would be let out during actual trawling operations.

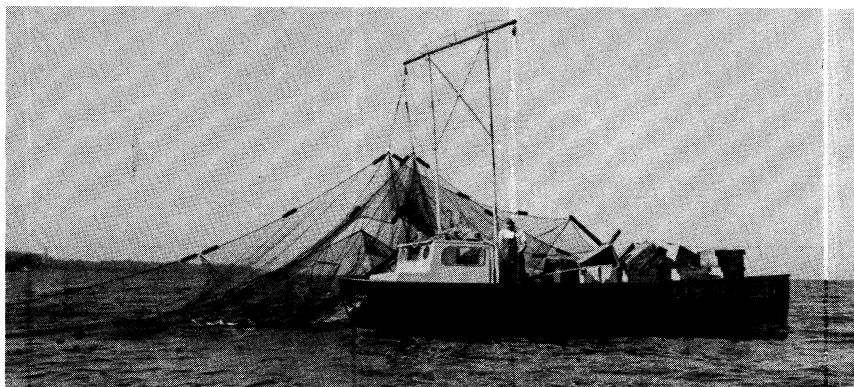
Mesh Size. The wings and body of the trawl were of 6-inch stretch mesh. The cod end was 3- or 3½-inch stretch mesh. No. 42 thread or larger was used in the cod end.

Otter Boards. In general usage otter boards of 2½ feet in length and 2½ feet high were used on trawls up to 50 feet in width. The boards were usually made of pine one-inch thick. On most of the boards the bridle was chain but solid steel rods were also used. All otter boards were equipped with iron runners or shoes curved upward at the leading edge.

Reporting Methods

Statistics of production and operation of the Lake Winnebago fishery were maintained from 1955 through 1966. The catch and other pertinent data were recorded on the following forms: individual net catch report, trawl catch report and form Fi-29, daily reports (Figs. 7-9, App. B).

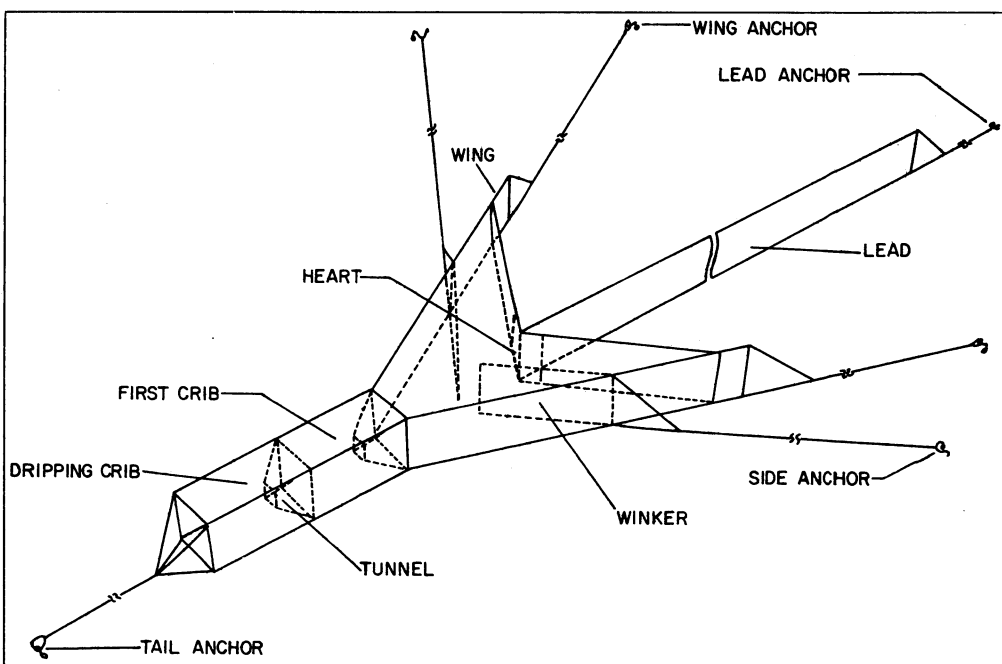
Individual net catch reports for hoop and trap net catches were provided on forms printed to meet our objectives, and included information on: fisherman's name, date, weather conditions, water temperature, location of net set on the lake, net number, type of net, mesh size, nights fished, water depth and bottom type. The commercial fish data reported included total number of each species taken per lift and the average length. When a few fish of a species were taken, the actual number was recorded. When large numbers of one species were taken, an estimate was made by counting the number of fish necessary to fill a standard fish box and comparing this number to the actual number of fish boxes taken per net lift. For game fish species, the total number per lift, the length range and average length were recorded. Data on length were obtained by measuring a sample of the fish taken.



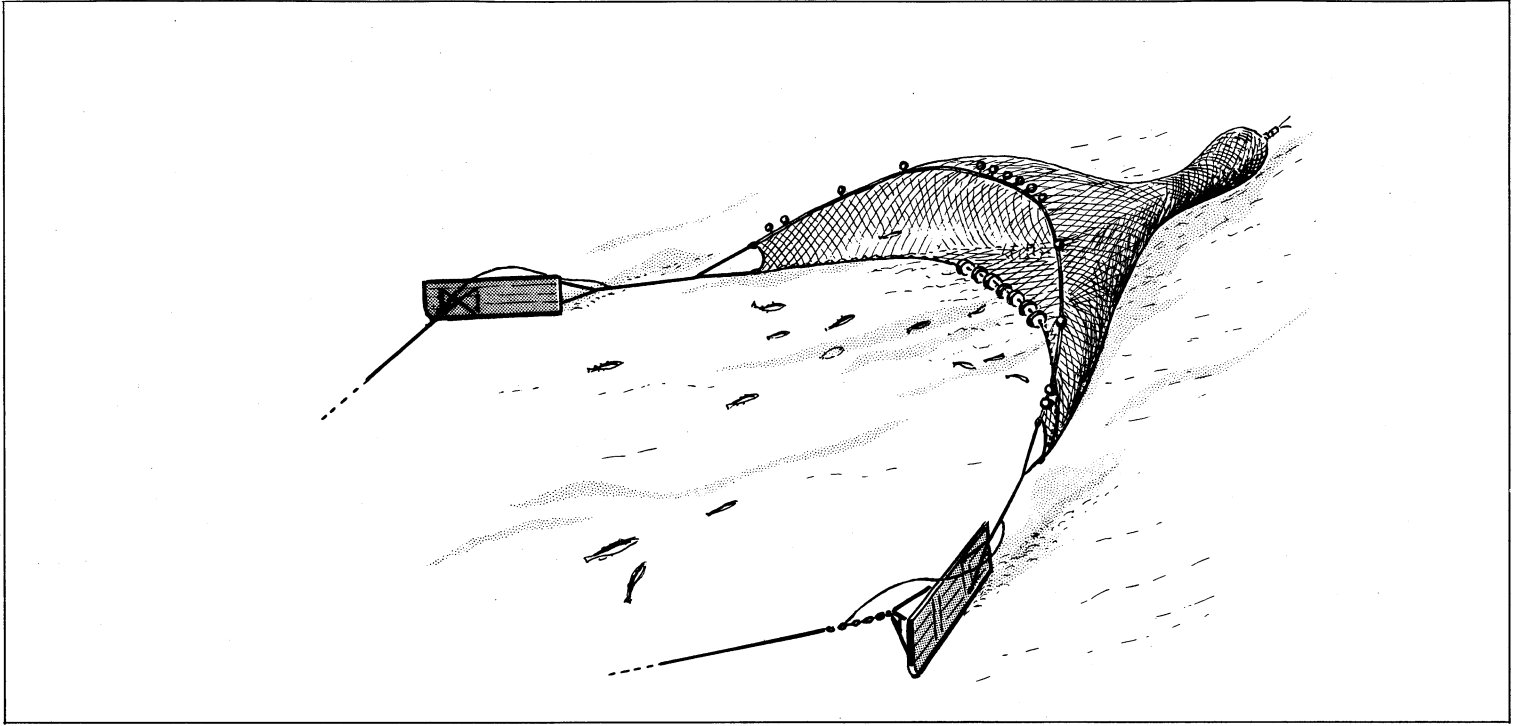
Lifting a trap net.



Removing fish from a trap net.



Ten-foot Wisconsin-type trap net



Trawl



Lifting the cod end of trawl into the boat to remove fish.



Releasing the trawl to continue fishing. Otter boards keep the trawl on the bottom and spread the trawl out.

RESULTS

Trawl catch reports were designed to include the data from 12 individual trawl hauls. The data reported by each fisherman included the name of the fisherman, date, water temperature, size of trawl (head rope length), mesh size of trawl proper and cod end, length of each haul in minutes, time of day trawled, area of lake trawled and the number of each fish species taken. The recording of average lengths and length range of the game fish species taken were omitted on the trawl forms. These data were not very reliable since the trawls were designed to eliminate the catching of game fish species. The estimates on the number of freshwater drum taken per haul was determined essentially as described for trap nets.

Form Fi-29 is a form provided by the Wisconsin Department of Natural Resources which is used statewide to record the daily catch during commercial fish removal by contract and state fishermen. These forms were used along with our individual catch reports and provided figures on the poundage of commercial fish removed each day.

Calculating Fishing Effort

Since trap nets were used continuously throughout the period 1955-1966, a trap net lift was selected as a unit of fishing effort. Trap nets were usually lifted after two nights of fishing but on occasions three or four nights of fishing may occur before they were lifted because of rough weather or other unforeseen circumstances. No correction for this possible increase in efficiency has been attempted. Both the trap nets and the technique of setting trap nets over the years have been improved, but the mesh size of 2½-inch stretch in the cod end has remained the same so a trap net lift used as a unit of fishing effort should therefore furnish reliable data for determining catch per unit of effort with trap nets.

To determine fishing effort for trawling, a trawl haul was selected as a unit of fishing effort. The majority of hauls were of 15 minutes with a few at 10 minutes if large numbers of fish were being taken in one area but no correction for this possible discrepancy was attempted.

Total production of a fishery is sometimes used as an index to abundance of a species, but Hile, Eschmeyer and Lunger (1951) held

that under certain conditions (over limited periods of years and with no major changes in fishing methods or regulations) production statistics indicated but did not measure changes in abundance of some Great Lakes stocks. They urged caution in this use of production records. All estimates of abundance have been calculated on the basis of the average number of fish caught in a single trap net lift or trawl haul as determined from the total number of lifts and the total production during any season.

Biological Methods

Each month when trap nets were fished, a sample of 400 to 500 freshwater drum from one trap net lift were weighed to the nearest 0.01 pound and measured to the nearest 0.1 inch in total length. Average weights and condition factors were computed for each inch group. Sexes were combined.

Beginning in 1959, a sample of approximately 1,000 freshwater drum was obtained after September 15 each year with trawls. The average weights and condition factors were computed for each inch group according to sex.

The coefficient of condition "c" was used to determine the well-being or relative plumpness of the freshwater drum, where:

$$c = \frac{W^{105}}{L^3}$$

W = weight in pounds
and L = total length in inches

Scales for age data were taken above the lateral line midway between the lateral line and the first dorsal spine. Three scales were impressed on cellulose acetate slides, 0.03 inch thick by a roller press similar to that described by Smith (1954). The examination and measurements of scales were made by means of a micro-projector at 44x magnification. The length of each scale and the distance from the focus to each annulus were measured along the anterior radius most nearly collinear with the focus as described by Hile (1954). The scale method for freshwater drum has been validated by Butler and Smith (1950).

Total Catch

During freshwater drum removal on Lake Winnebago, 35 species of fish were taken (Table 11, Appendix B). Priegel (1967a) listed 76 species being present or having been reported in the past in Lake Winnebago. Total catch by hoop nets, trap nets and trawls are shown in Tables 12 through 16 (App. B) for all species.

Total catch of commercial fish from 1955 through 1966 has fluctuated widely in response to changes in abundance of fish and in fishing intensity. The total harvest of all commercial fish removed was 35,549,099 pounds during this period; however, it varied from a high of 4,432,026 pounds in 1957 to a low of 1,531,165 pounds in 1966 (Table 1). Freshwater drum have been predominant in the commercial harvest, since all of the effort was focused at freshwater drum removal. The total harvest of freshwater drum was 34,266,258 pounds during this period; it varied from a high of 4,275,347 pounds in 1957 to a low of 1,431,450 pounds in 1966 (Table 1). The harvest of carp declined, but began to increase again in 1963. The catch of quillback decreased, suckers increased and other species fluctuated considerably.

Pounds per acre of all commercial species removed varied from a high of 32.2 pounds per acre in 1957 to a low of 11.1 pounds per acre in 1966 (Table 2). Pounds per acre of freshwater drum removed ranged from a high of 31.0 pounds per acre in 1957 to a low of 10.4 pounds per acre in 1966.

Annual Fluctuations

Freshwater Drum

Fluctuations in freshwater drum harvest have been governed by abundance and fishing effort. Previous to the intensive removal program which began in 1955, the annual freshwater drum harvest varied from 229,409 pounds (1.7 lbs/acre) in 1950 to 1,407,324 pounds (10.2 lbs/acre) in 1954 (Fig. 1). From the beginning of the intensive program in 1955 until 1959, drum harvest averaged 3,976,328 pounds (28.8 lbs/acre). After 1959, there was a sharp decline and annual harvest fluctuated about a mean of approximately 2,200,000 pounds (16.2 lbs/acre).

The percentage of freshwater drum in the

TABLE 1

Total Pounds of Commercial Fish Removed From Lake Winnebago, 1955-1966

Year	Total Catch	Freshwater Drum	Carp	Sucker	Burbot	Quillback	Bowfin	Longnose Gar	Mooneye
1955	3,687,120	3,566,480	91,701	0	15,620	12,934	150	215	20
1956	4,112,876	3,911,733	172,455	0	10,107	18,202	75	7	297
1957	4,432,026	4,275,347	108,475	760	10,099	36,206	100	145	894
1958	4,179,539	3,994,700	145,563	5,049	13,927	19,202	115	96	887
1959	3,470,061	3,348,740	83,607	9,048	19,258	8,641	0	200	567
1960	1,934,163	1,851,516	32,910	11,229	29,611	8,503	30	6	358
1961	2,377,379	2,296,315	20,815	26,174	25,835	7,765	0	11	465
1962	2,985,898	2,944,652	11,434	13,808	7,351	8,493	115	0	45
1963	2,984,924	2,949,968	15,720	0	10,425	8,461	300	25	85
1964	2,024,115	1,951,710	44,298	421	23,595	4,051	5	15	20
1965	1,829,833	1,743,647	59,115	0	21,905	5,160	0	0	8
1966	1,531,165	1,431,450	57,392	0	36,015	5,695	45	0	505
Total	35,549,099	34,266,258	843,485	66,489	223,748	143,313	935	720	4,151

total catch from 1955 through 1959 was high (from 84.7 to 96.2%), while from 1960 to 1966 it was less, ranging from 67.8 to 85.4 percent (Table 3).

TABLE 2

Pounds Per Acre of Freshwater Drum, All Other Commercial Species and Total Commercial Species Removed From Lake Winnebago, 1955 - 1966.

Year	Freshwater Drum	All Other Commercial Species*	Total
1955	25.9	0.8	26.7
1956	28.3	1.5	29.8
1957	31.0	1.2	32.2
1958	29.0	1.3	30.3
1959	24.3	0.9	25.2
1960	13.4	0.7	14.1
1961	16.7	0.5	17.2
1962	21.4	0.3	21.7
1963	21.4	0.2	21.6
1964	14.1	0.5	14.6
1965	12.6	0.6	13.2
1966	10.4	0.7	11.1

* Includes carp, sucker, burbot, quillback, bowfin, longnose gar and mooneye.

All Other Commercial Fish

From 1955 through 1959, the annual harvest for all other commercial fish fluctuated about a mean of approximately 157,000 pounds. A sharp decline occurred in 1960 resulting in an average annual harvest of 62,000 pounds from 1960 through 1966.

The percentage of all other commercial fish in the total catch of trap nets during the open-water season from 1955 through 1966, did not change considerably (0.3-2.2%, Table 3).

Fishing Effort

Gear used in the removal of all commercial fish over the 12-year period did change. Hoop nets used only in 1955 and 1956 accounted for only 14.1 and 2.4 percent, respectively, of the freshwater drum removed in those years (Table 4). In 1955, trap nets accounted for 85.9 percent of the freshwater drum removed and this increased to a high of 99.2 percent in 1958. Hoop nets were abandoned since they would only hold

up to 1,000 pounds of freshwater drum while trap nets would hold between 8-10,000 pounds. By 1964, only 14.2 percent of the freshwater drum removed were taken with trap nets. The use of trawls increased rapidly so that by 1962, 60.9 percent of the freshwater drum harvested were removed with trawls. The success of trawls in removing freshwater drum, cheaper operating costs and improved public acceptance of trawling has accounted for the increase in use of this method of commercial fishing.

Trap Nets (Open Water)

The total number of trap net lifts increased from 2,724 in 1955 to 4,430 in 1958, the year of maximum effort (Table 5). Fishing effort with trap nets then decreased so that by 1965 only 224 lifts were made.

A comparison of fishing effort for the periods of April-June and August-November shows that fishing effort during the April-June period increased until in 1964 all of the open water fishing effort with trap nets was confined to this period (Table 5). Trap netting effort during the August-November period began to decrease drastically in 1961 because the contract fishermen were allowed to trawl for the first time during this period in 1961.

The catch per unit of effort for freshwater drum in numbers and pounds during the April-June period was also greater than for the August-November period. After 1958, this difference was not as great since the contract fishermen and state crews became more selective instead of fishing many nets at numerous locations during the August-November period.

Trap Nets (Winter)

The winter trap net fishery reached a peak in 1956 when 787 trap net lifts were recorded with 690 pounds of freshwater drum per lift being taken (Table 6). Fishing effort decreased rapidly after the 1956 season so that by 1962 there was no winter fishery except for 20 net lifts in 1963.

Trawls

Fishing effort with trawls from 1957-1960 was on an experimental basis by state crews. In 1961 when private commercial fishermen were allowed to trawl, fishing

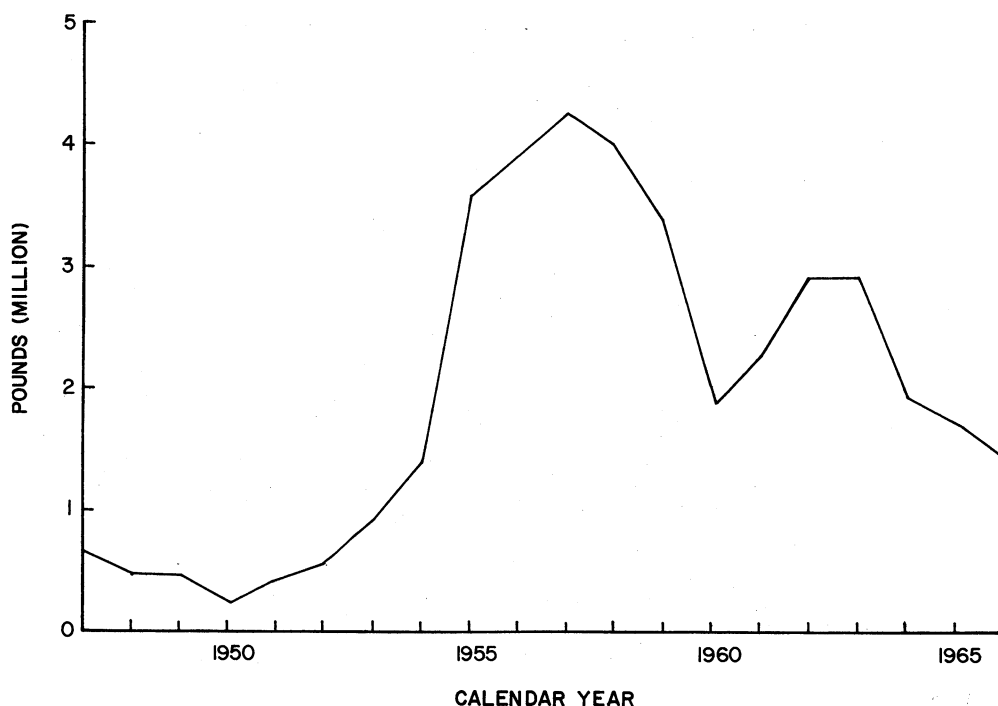


FIGURE 1
Pounds of freshwater drum removed from Lake Winnebago, 1947-1966.

TABLE 3

The Percentage of Freshwater Drum and All Other Commercial and Game Fish Taken in Trap Nets During the Open Water Season on Lake Winnebago, 1955 - 1966.

Year	Freshwater Drum	All Other Commercial Species	All Game Fish
1955	95.5	0.3	4.2
1956	96.2	0.3	3.5
1957	94.6	0.7	4.7
1958	91.6	0.4	8.0
1959	84.7	0.4	14.9
1960	68.6	0.5	30.9
1961	67.8	0.7	31.5
1962	72.5	0.4	27.1
1963	76.9	0.6	22.5
1964	80.1	1.5	18.4
1965	85.4	2.2	12.4
1966	81.7	1.3	17.0

* Includes carp, sucker, burbot, quillback, bowfin, longnose gar and mooneye.

TABLE 4

Percentage of Freshwater Drum Removed by Various Types of Gear in Lake Winnebago, 1955 - 1966

Year	Hoop Net	Trap Net	Trawl
1955	14.1	85.9	---
1956	2.4	97.6	---
1957	---	98.1	1.9
1958	---	99.2	0.8
1959	---	97.5	2.5
1960	---	90.3	9.7
1961	---	63.4	36.6
1962	---	39.1	60.9
1963	---	32.7	67.3
1964	---	14.2	85.8
1965	---	16.1	83.9
1966	---	36.0	64.0

effort with trawls increased from 2,661 hauls in 1961 to 8,387 hauls in 1963 and then a gradual decrease until only 3,314 hauls were made in 1966 (Table 6).

Hoop Nets

Hoop nets were fished only in 1955 and 1956, and harvested 402 and 434 pounds per lift, respectively during the open water season. During the winter season 64 and 203 pounds per lift were taken in 1955 and 1956 (Table 7).

Changes in the Freshwater Drum Population

Condition

Changes in the condition of the freshwater drum were followed to determine the effect of a large-scale removal program. Theoretically we could expect weight and condition improvements in the individual freshwater drum if the population which has reached a density higher than optimum is harvested to the optimum size or lower.

Condition factors during the year varied with the highest conditions usually noted in late fall and the lowest conditions in mid-summer. The latter is closely tied in with annual spawning which usually occurs in late May and early June, but may extend into August. At this time weights of mature freshwater drum decrease rapidly. Evidently reproduction requires the expenditure of enormous energy, and up to three months are required before average weights again reach the prespawning levels. The changes in average monthly condition factors and weights for the years 1957-59 are illustrated in Figure 2. Average condition factors and weights parallel each other quite closely.

The average condition factors and weights for the month of October, 1955-1964 are illustrated in Figure 3. The month of October was used because the drum are usually in the best condition at this time.

Little change in condition was noted until October, 1957, when a noticeable increase occurred. This increase is also reflected in the April, 1958 sample. The removal of 11.8 million pounds of freshwater drum in 1955-57 must have had a significant effect on the freshwater drum population. The freshwater drum population could hardly be replaced by recruitment as rapidly as they were removed as the majority in the commercial harvest (over 80%) were freshwater drum 4 or more years of age (over 12 inches). Initial heavy removal resulted in a

TABLE 5

Fishing Effort and Catch Per Unit of Effort for Freshwater Drum Taken in Trap Nets During the Open Water Season in Lake Winnebago, 1955-1966.

Year	April-June				August-November				Total Open Water Season		
	No. Lifts	Percent	Fish/ Lift	Pounds/ Lift	No. Lifts	Percent	Fish/ Lift	Pounds/ Lift	No. Lifts	Fish/ Lift	Pounds/ Lift
1955	1,362	50.0	1,214	1,602	1,362	50.0	484	639	2,724	849	1,125
1956	1,231	34.9	1,104	1,568	2,294	65.1	300	426	3,525	760	1,083
1957	1,511	42.0	1,504	1,970	2,086	58.0	445	583	3,597	891	1,166
1958	2,206	49.8	881	1,110	2,224	50.2	539	680	4,430	706	894
1959	1,415	47.5	1,008	1,290	1,561	52.5	719	921	2,976	857	1,097
1960	1,212	51.5	756	892	1,139	48.5	438	517	2,351	602	711
1961	881	71.5	1,093	1,235	350	28.5	930	1,051	1,231	1,046	1,181
1962	669	75.1	1,239	1,325	222	24.9	1,114	1,192	891	1,205	1,292
1963	651	78.6	1,129	1,241	177	21.4	804	884	828	1,051	1,165
1964	338	100.0	787	820	0	---	---	---	338	787	820
1965	224	100.0	1,248	1,253	0	---	---	---	224	1,248	1,253
1966	278	100.0	2,022	1,854	0	---	---	---	278	2,022	1,854

decided change in the condition of the freshwater drum; however, the improvement in condition that was evident early in the study tended to be lost later.

Even though 4 million pounds of freshwater drum were removed during 1958, the average condition factors did not increase after April, 1958 and there was a noticeable decrease by October, 1958. Average condition factors declined until they were at their lowest in April and October, 1960. In 1961 and 1962, average condition factors steadily increased so that by October, 1963, they had reached the high obtained in April, 1958. The April, 1964 sample began showing a decline.

Freshwater drum in the 12-inch group usually were in the best condition for the 10-year period. They had either not reached sexual maturity as would be indicated in the April samples or were mature for the first time in the October samples. No weight and energy loss due to sexual activity or production of sexual organs is probably responsible for their well-being.

Trawl samples taken each year after September 15, 1959-1965 demonstrated the same trends for average condition factors and weights as shown for trap nets. The average weights and condition factors were slightly greater for freshwater drum sampled from trawls than trap nets since the freshwater drum are processed immediately when taken in the trawls while they may be entrapped in the trap nets from 2-4 nights, resulting in a slight weight loss.

Age Composition

A decrease in the age of the individuals in a fish population has long been regarded as an indication of a decrease in numbers as long as the rate of growth remains the same (Rounsefell and Everhart, 1953). Age data collected in four years of the study indicated a decrease in the age of the freshwater drum available to the commercial fishery (Table 8). Rate of growth during this period remained relatively stable (Priegel, 1969).

In 1955 age groups VI and VII were the major support of the fishery (55.1% of the sample). By 1960 age groups V and VI were the major support of the fishery comprising 61.1 percent of the sample. In 1963, age group IV accounted for 55.4 percent of the

TABLE 6

Fishing Effort and Catch Per Unit of Effort for Freshwater Drum Taken in Trap Nets During the Winter, 1955-1963 and Trawls, 1957-1966 on Lake Winnebago.

Year	Fishing Effort		No. Fish Caught		Pounds of Fish	
	No. Lifts	No. Hauls	Per Lift	Per Haul	Per Lift	Per Haul
1955	286	0	368	---	486	---
1956	787	0	486	---	690	---
1957	502	430	302	158	396	189
1958	358	233	42	117	53	137
1959	258	546	92	121	118	153
1960	178	784	38	195	45	229
1961	54	2,661	2	280	2	316
1962	0	5,784	---	288	---	310
1963	20	8,387	78	214	86	236
1964	0	7,860	---	204	---	213
1965	0	6,996	---	209	---	209
1966	0	3,314	---	307	---	276

TABLE 7

Fishing Effort and Catch Per Unit of Effort for Freshwater Drum Taken in Hoop Nets During the Open Water and Winter Season in Lake Winnebago, 1955 - 1956

Year	Season	No. Lifts	Fish/Lift	Pounds/Lift
1955	Open Water	1,127	309	402
	Winter	872	57	64
1956	Open Water	137	310	434
	Winter	237	145	203

TABLE 8

Age Composition of Freshwater Drum by Percent in the Commercial Catch on Lake Winnebago.

Year	Age Groups										Total Sampled
	I	II	III	IV	V	VI	VII	VIII	XI	X	
1955	0	6.0	20.2	2.2	6.5	30.5	24.6	7.5	1.8	0.7	604
1960	0	7.6	1.9	6.2	24.5	36.6	19.6	2.9	0.8	0	971
1963	0	0.1	4.3	55.4	14.1	13.5	8.4	3.7	0.5	0	786
1965	14.5	45.1	0.4	2.6	3.6	24.4	7.1	2.1	0.2	0	532

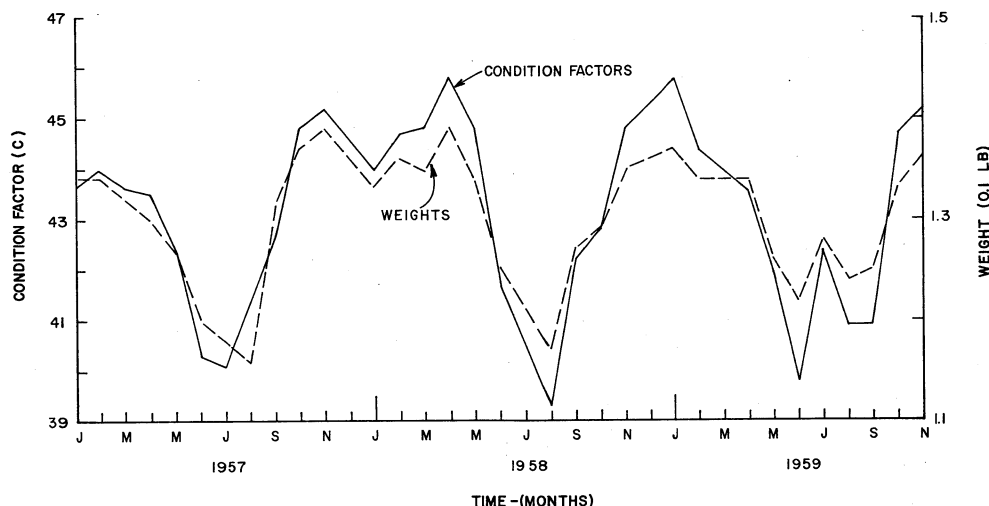


FIGURE 2
Monthly average condition factors (c) and weights
(0.1 lb.) of freshwater drum samples from trap
nets in Lake Winnebago, 1957-59.

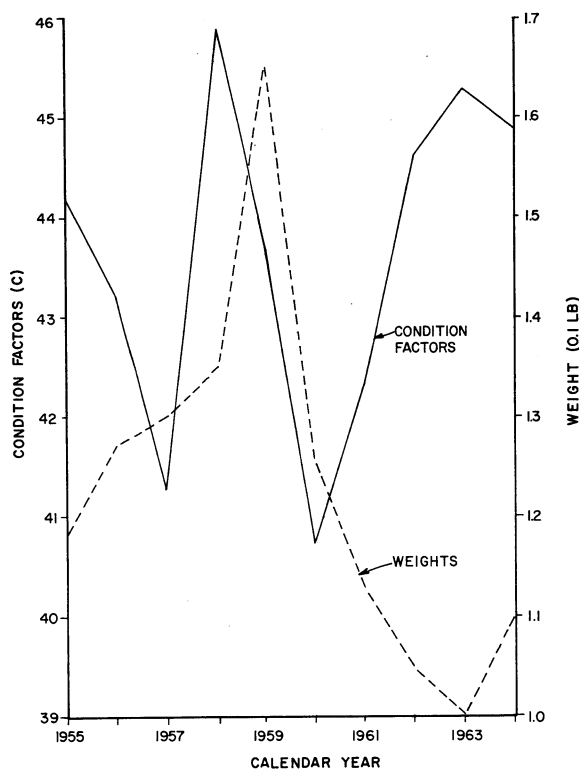


FIGURE 3
Average condition factors and weights for freshwater
drum sampled from trap nets during October in
Lake Winnebago, 1955-63.

fish in the sample. By 1965, age groups I and II accounted for 59.6 percent of the catch. The percent of freshwater drum in age groups VII-X available to the commercial fishery in 1955 was 34.6 while in 1960, 1963 and 1965 it was 23.3, 12.6 and 9.4 percent, respectively.

Size Composition

The length-frequencies of freshwater drum taken from trap nets in April or early May indicate the size of the drum available to the commercial fishery at the beginning of each open water season. As with age, a decrease in the size of the individuals in a fish population can be regarded as an indication of a decrease in numbers as long as the rate of growth remains the same (Rounsefell and Everhart, 1953).

From 1955 through 1961, the presence of freshwater drum in the samples over 14 inches in total length ranged from 51.1 to 90.2 percent (Table 9). In 1962 the drum over 14 inches in the sample was 39.7 percent, a decrease of 29.2 percent from 1961. The percentage of drum in the sample over 14 inches in 1963 and 1964 was 34.0 and 42.3 percent, respectively. Evidently the commercial harvest was intensive enough to crop off the larger fish by 1962 so that in 1962-64 the harvest was composed mainly of smaller fish.

Changes in Abundance of Other Fish Species

It is generally assumed that when species of fish compete for food and room, decrease in abundance of one will be reflected by an increase in one or more other species. In Lake Winnebago, as the freshwater drum population began to decrease, there was a noticeable increase in the game fish species. The average catch per trap net lift during the open-water season is used to show the changes in abundance of other fish species. Trap nets were fished throughout the 12-year period (Table 10); catch data for trawls is not reliable since the trawls were designed to eliminate the catch of game fish species and trawling data are only available from 1957-1966.

The reported catch of game and panfish species would have been greater but con-

tinuous effort was made to develop methods to reduce the take and to eliminate the handling of these species, especially walleyes, saugers and yellow perch.

White bass showed the greatest increase in abundance (Fig. 4). In 1956, only 11.1 white bass per trap net lift were taken as

compared to a high of 406.5 in 1961. Since 1959 the catch of white bass per trap net lift has been over 100 fish.

Black crappies never exceeded 1.5 fish per trap net lift from 1955-59 but since that time the catch has varied from 5.9-44.9 fish

per lift (Fig. 5). There has been a definite increase in the black crappie population.

Yellow perch (Fig. 5) and walleyes and saugers (Fig. 6) have shown greater fluctuations in abundance, but the catch since 1959 has increased for these species, especially for the sauger.

TABLE 9

Length - Frequencies in Percent of Freshwater Drum Sampled from Trap Nets, Lake Winnebago, 1955 - 1964.

Year	Month	Length Groups (Total Length in Inches)		Number In Sample
		Under 14	Over 14	
1955	April	48.8	51.2	438
1956	April	27.2	72.8	458
1957	April	17.5	82.5	454
1958	April	30.8	69.2	416
1959	April	9.8	90.2	326
1960	May	23.5	76.5	412
1961	April	43.9	56.1	504
1962	May	60.3	39.7	684
1963	April	66.0	34.0	578
1964	April	57.7	42.3	472

TABLE 10

The Average Catch Per Trap Net Lift During the Open Water Season for Five Important Game Fish Species in Lake Winnebago, 1955 - 1966

Year	Walleye	Sauger	White Bass	Yellow Perch	Black Crappie
1955	7.9	3.6	21.2	0.8	1.0
1956	6.7	4.3	11.1	0.6	1.5
1957	7.9	5.1	25.8	1.0	0.5
1958	7.4	4.4	44.7	1.4	0.5
1959	11.3	14.2	115.2	2.9	0.5
1960	12.2	29.9	217.1	1.6	5.9
1961	12.2	9.3	406.5	5.1	44.9
1962	4.2	5.5	390.5	8.8	34.5
1963	5.0	18.9	247.2	16.8	13.6
1964	9.3	43.7	103.2	10.3	6.3
1965	7.9	12.5	196.2	5.1	26.4
1966	11.8	7.6	252.1	1.7	13.8

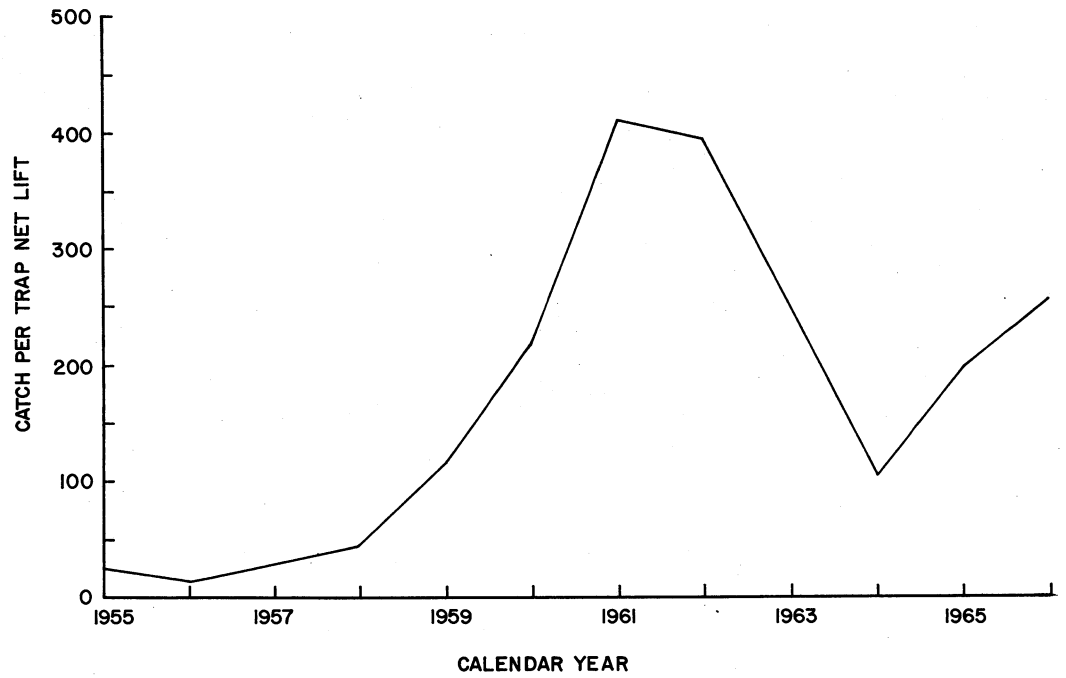


FIGURE 4
The average catch per trap net lift from April–November, 1955-1966 for white bass.

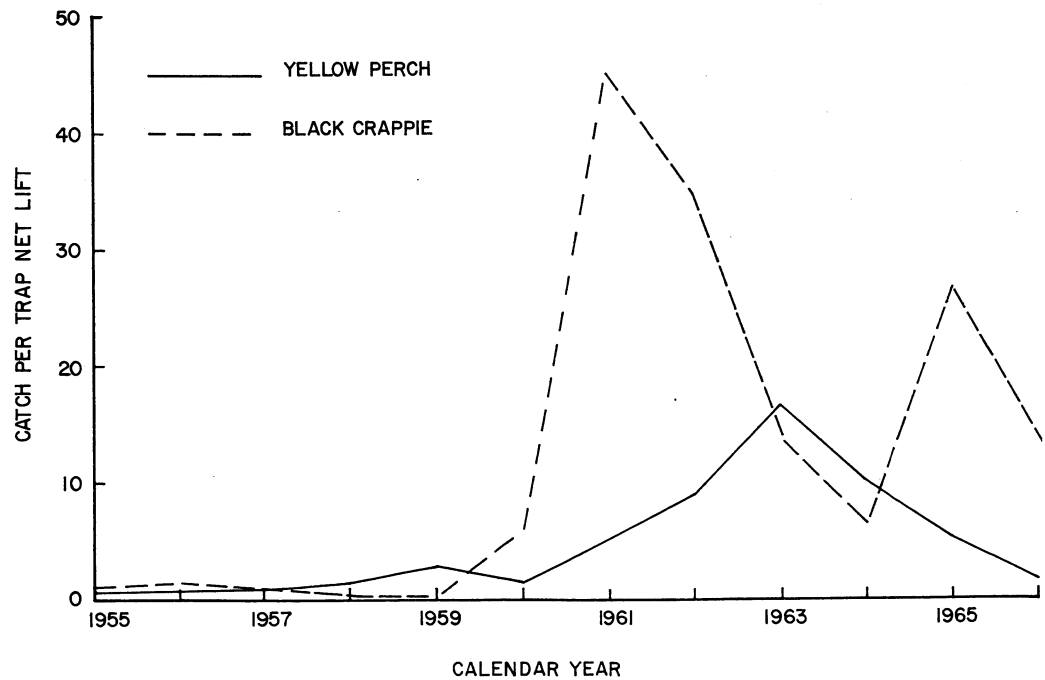


FIGURE 5
The average catch per trap net lift from April–November, 1955-1966 for the black crappie and yellow perch.

DISCUSSION

The freshwater drum harvest declined drastically in 1960. The decline was related to the increased removal of freshwater drum from 1955 through 1959. Because of the change in age class structure of the freshwater drum by 1960, it is concluded that fishing was the primary cause. The 5, 6 and older year classes of fish were no longer present in the abundance that they were formerly. Natural reproduction was not sufficient to replace the losses of older fish. Large year classes of freshwater drum did occur in 1959 and 1963; however, fishing was intensive enough to begin harvesting these fish as 2-, 3- and 4-year-old fish from 1961 through 1965.

The decline in the harvest of freshwater drum in 1960 was also reflected in the catch in nets of game and panfish species which showed a definite increase in abundance. Although walleye, sauger and yellow perch populations showed greater fluctuations in abundance after 1959 than white bass and black crappies, there was a definite increase in the number of these species in the net catches after 1959. Commercial fishing on Lake Winnebago had no detrimental effect on the sport fishery.

Although there was an increase in game and panfish populations in Lake Winnebago after the freshwater drum population had been reduced, there are, however, conflicting opinions in the literature as to the benefits derived following the removal of undesirable fish species. Ricker and Gottschalk (1941) in Indiana and Rose and Moen (1953) in Iowa reported improved angling and increases in populations of game fish in warmwater lakes after populations of coarse fish in the lakes had been reduced with seines. On the other hand Moyle, Kuehn and Burrows (1950), who studied lakes from which some rough fish had been removed annually for 25 years, concluded: "In general, rough fish appear to have little effect on the total poundage of game fish in southern Minnesota lakes." In a later paper, Moyle and Clothier (1959) suggested that the decline in carp in Lake Traverse, Minnesota, might be related to the increase that occurred in crappies and bullheads in that lake.

A concept of fish management in warmwater lakes is based upon the hypothesis that an inverse ratio exists between the density of a population and the growth rates

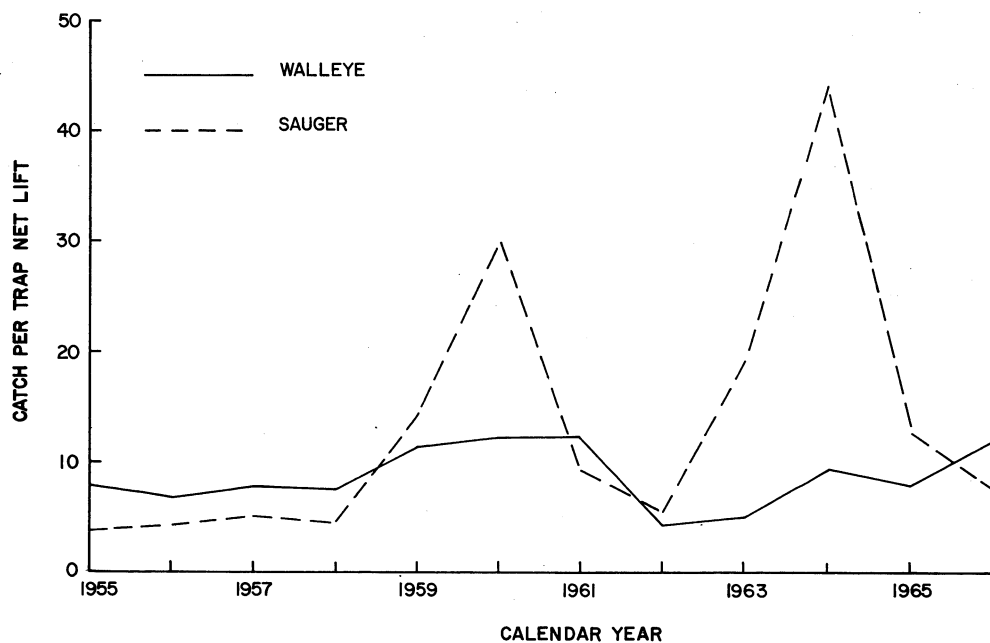


FIGURE 6
The average catch per trap net lift from April–November 1955–1966 for the walleye and sauger.

MANAGEMENT IMPLICATIONS

of individuals in that population, and that growth rates therefore can be increased by reducing the density through removal of individuals from the population. In Lake Winnebago there was a decrease in the age of the freshwater drum available to the commercial fishery in later years; however, the rate of growth during this period remained relatively the same. On the other hand in Massachusetts, Grice (1958) found that fyke netting of panfish and other nongame fish increased the growth rates of the species being thinned. Where removal was intensive, growth rates of panfish increased markedly.

Initial heavy removal on Lake Winnebago resulted in a decided change in the condition of the freshwater drum. However, the improvement in condition that was evident early in the study tended to be lost later. Starrett and Fritz (1965) also reported that at the end of 4 or 5 years of their study on Lake Chautauqua, the condition of freshwater drum showed improvement and could have been correlated with the increased removal of commercial fishes from the lake. By continuing the study over a longer period they found a decrease in the condition of freshwater drum.

One factor that possibly affected the condition of the freshwater drum in Lake Winnebago was the increase in abundance of white bass, black crappies, yellow perch, saugers and walleyes that occurred after 1959, following initial heavy removal. If the increase in abundance of these species did affect the condition of the freshwater drum in Lake Winnebago it could not be documented.

Another factor that may have affected the condition of the freshwater drum in Lake Winnebago was competition for food. The midge larva, principally *Chironomus plumosus*, is the most important item in the diet for all size freshwater drum over 1.6 inches (Priegel, 1967b). The midge larva is also a major food item of young and older walleyes (Priegel, 1963, 1969a, and 1970), sauger (Priegel, 1963 and 1969b) and yellow perch.

The freshwater drum removal program on Lake Winnebago must be considered a success on two accounts. By removing the freshwater drum, a species considered undesirable to the sport angler, more space in the lake for more favored sport fish has been provided. Lake Winnebago has always been known for its walleye, sauger and white bass fisheries, but when the removal program began those fish populations increased and the yellow perch and black crappie fisheries also flourished. The commercial harvest of freshwater drum has had no detrimental effect on any game or panfish species.

Secondly, we have certainly utilized a valuable natural resource which would have been wasted. The 34.3 million pounds of drum removed from 1955-1966 were valued at \$1,012,843.74.

There is no question that private commercial fishermen are desirable in a commercial removal program. Private commercial fishermen represent a considerable saving to the state and the state should promote the use

of commercial fishermen in all situations that would normally require state crews.

The future should call for maximum harvest of the freshwater drum. Without this, all efforts over the last 12 years to reduce the freshwater drum population to as low a level as possible will be wasted. Since the freshwater drum is a very prolific fish and occupies a favorable habitat, the population would soon consist of many slow-growing, old-age fish, which was the situation before the program began in 1955. To keep the population at an optimum size in Lake Winnebago, approximately 2.5 to 3.0 million pounds should be removed annually.

Selected trap net sets during April-June and trawling during the summer and autumn have been effective methods of removing freshwater drum; however, new methods and improvements on existing methods must be continuously sought. The use of sonar gear, electro gear, mid-water trawls and trawling at night are some techniques that should be investigated further.

SUMMARY

From 1955 through 1966, 35.5 million pounds of commercial fish were removed from Lake Winnebago. Of this total, 33.4 million pounds were freshwater drum.

Fluctuations in freshwater drum harvest have been governed by abundance and fishing effort. From 1955 until 1959, the harvest averaged 3.9 million pounds while after 1959, there was a sharp decline and annual harvest fluctuated about a mean of 2.2 million pounds.

The annual harvest of all other commercial fish from 1955 through 1959 was 157,000 pounds. After 1960 the annual harvest declined to 62,000 pounds.

During the April-June period, trap nets were the most efficient piece of gear for freshwater drum removal.

The success of trawls to remove freshwater drum, cheaper operating cost, considerable reduction in the catch of game and panfish species and improved public acceptance of trawling accounted for the increased use of trawls after 1961.

There was little change in condition of freshwater drum until October, 1957 when a noticeable increase occurred. The removal of 11.8 million pounds of freshwater drum in 1955-57 must have had a significant effect on the population. Initial heavy removal resulted in a decided change in the condition of the freshwater drum; however, the improvement in condition that was evident early in the study tended to be lost later.

The commercial harvest was intensive enough to crop off the larger and older freshwater drum by 1962 so that the harvest after 1962 was composed of smaller and younger fish even though the rate of growth remained the same.

After 1959, the net catch of white bass and black crappie definitely increased. Walleye, sauger and yellow perch populations fluctuated in abundance but the net catch after 1959 increased, especially that of the sauger.

There was no indication that commercial removal of freshwater drum was detrimental to any game or panfish population.

APPENDIX A History of Commercial Fishing

Statewide

Commercial fishing in Wisconsin had its beginning on July 15, 1899, when the members of the Board of Fish Commissioners adopted a resolution authorizing the Executive Committee to prepare rules and regulations for and to supervise the removal of "deleterious fish", and to grant permits therefore at the expense of the applicants. On April 27, 1900, it was voted by the Fish Commission members that James T. Joyce of Eau Claire and George Early of Chippewa Falls be furnished by the Commission with suitable nets and authorized to take and destroy gar fish and other deleterious fish in Long Lake and adjacent waters; the work to be done under their own personal control; they were to be made personally responsible for the proper and lawful use of the nets and to return the nets to the Commissioners in as good condition as when received. Similar action was taken for Captain Scuddler, R. Brookings, and C. Draper of Oconomowoc (Wis. Conserv. Dep., 1963).

The use of nets to control or take deleterious fish was limited, and no further applications were received after 1900. It was not until 1915 that greater emphasis was noted on commercial fish control.

On August 25, 1915, the newly created Conservation Commission voted that the Secretary draw up contracts for the taking of commercial fish in inland waters on a basis of one cent per pound to be paid the state for all fish caught in seines; one-half cent per pound for commercial fish caught in fyke nets; fishermen to give a bond of \$200 and pay the supervising warden \$2.50 per day and all necessary expenses. The price per pound may be changed if conditions indicate a revision necessary or proper. The Conservation Commission considered the applications on file for commercial fishing licenses on August 27, 1915 and issued 19 contracts for removing commercial fish from the Rock River, Lake Waubesa, Koshkonong Lake, Crawford River, Puckaway Lake, Beaver Dam Lake, Lake Kegonsa, Lake Monona and Carp Lake (Washington County).

The matter of the collection of one cent per pound on commercial fish caught by the carp fishermen under contract with the Commission was thoroughly discussed at the December 6, 1915 meeting. Owing to the

poor catches being made in almost every instance, and considering that the market price on commercial fish had been very low, the collection of one cent per pound was a hardship on the fishermen and they were operating at a loss. It was voted to reduce the collection to one-half cent per pound on all contracts on which the reports and records showed that the Commission was placing a heavy burden on the fishermen and causing a financial loss in demanding the one cent per pound.

From 1915 to 1935, many contracts were granted to private commercial fishermen by the Conservation Commission to remove commercial fish from various waters throughout the state.

In 1935 a group of sportsmen of the Fox River Valley Group of Sportsmen's Clubs sought legislative action to improve fishing in Winnebago land waters because sport fishing was declining rapidly. The legislature passed under Chapter 539, Laws of 1935, a new subsection to be added to Section 20.20 of the Statutes to read: (20.20) (9), \$150,000 transferred from the general fund to the conservation fund, and in addition thereto all monies received from the sale of commercial fish and paid into the conservation fund, to be used for carrying on commercial fishing operations. The Conservation Commission, in cooperation with the state relief agency, may set up commercial fish removal projects. The Commission may provide funds for the leasing of such privately owned equipment as may be necessary under such projects, either with or without supervision, or it may enter into such contracts for commercial fish removal on a bounty basis as it may deem advisable, using relief labor as far as possible. The Conservation Commission from time to time shall transfer from this appropriation to the general fund such monies as are not deemed necessary to carry on commercial fishing operations until the \$150,000 has been repaid to the general fund.

Under this chapter, the Conservation Department using relief help began intensive removal of commercial fish throughout the state. Twenty-seven commercial fish stations were established principally to control carp, which had reached high population levels in the 1930's.

Lake Winnebago

Before 1935, there was limited commercial fish removal on Lake Winnebago by private commercial fishermen under contract with the Conservation Commission. The Department of Natural Resources became involved in commercial fish removal on Lake Winnebago in 1936 through the legislative passage of Chapter 539, Laws of 1935. Commercial fish stations were established at Fond du Lac, Calumet Harbor, Stockbridge, and Asylum Bay. From 1936 through 1948, state crews operated primarily with little assistance from private commercial fishermen, as there was a low market price for commercial fish, especially carp and freshwater drum. Carp were kept under control in Lake Winnebago during this period by state crews using relief help (W.P.A.). Large seines were used to remove carp in all of the known carp spawning areas; but, freshwater drum were not harvested to any extent.

Commercial fishing in Lake Winnebago was questioned in 1948, and strenuous objections by sport fishermen led to a public hearing which was called on September 2, 1948 by Judge McEssey of Fond du Lac, who presided over the official public hearing to obtain facts, under oath, regarding commercial fish control objectives and operations. The hearing brought out much information on the history and reasons for the program, with little information by objectors under oath. Judge McEssey concluded that there was no reason to change programs or methods. Commercial fishing to control carp with seines continued until again in 1954 sport fishermen began to complain, but this time that sport fishing was declining and a program to remove freshwater drum should be initiated.

During January, 1954, public meetings were held in Oshkosh and Chilton to gain support of a much needed intensive removal program aimed at control of the freshwater drum population. The Department of Natural Resources publicly proposed and received approval for an intensive commercial fish removal program, using contracted and bonded fishermen on Lake Winnebago. It was agreed to evaluate the removal program over a 10-year period; and, at the end of this time, to reschedule public meetings to discuss the results of the program.

Five years after the intensive program

Additional Reference Data on Freshwater Drum Removal

18

Fisherman: _____

Size of trawl: _____

Date: _____

Mesh size-throat: _____

Water temperature: _____

Mesh size-cod: _____

Hauls	Length of cast	Time of day	Area	Carp	W. carp	Drum	Suckers	Eelpout	Mooneye	Walleye	Sauger	Catfish	Bullheads	Crappies	White bass	Y. perch	Sturgeon					
																	0-19	20-29	30-39	40-49	50-59	60 +
1																						
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

List other fish species taken that are not
recorded above

Remarks and recapture fish data

FIGURE 8
Trawl Catch Reports for 12 Individual Hauls.

WISCONSIN CONSERVATION DEPARTMENT
Madison, Wisconsin

Fi-29

CONTRACT AND STATE FISHERMAN'S DAILY REPORT

No.		Date	
NAME OF FISHERMAN		STREET ADDRESS AND CITY	
NAME OF WATERS FISHED		COUNTY WHERE LOCATED	
LOCATION OF OPERATION			
OPERATION BEGAN: A.M. P.M.		OPERATION COMPLETED: A.M. P.M.	
WATER TEMPERATURE			
PURPOSE OF FISHING			
SEINE HAULS			
Number of Hauls.....		Length Feet	
Size of Mesh Bag..... Inches		Seine Proper Inches	
		Depth of Webbing..... Feet	
		Wings..... Inches	
TRAP NETS			
Number Lifted.....		Size of Mesh Pots..... Inches	
		Wings..... Inches	
		Hearts..... Inches	
		Leads..... Inches	
GILL NETS			
Number Lifted.....		Length..... Feet	
		Size of Mesh..... Inches	
		Depth..... Feet	
ROUGH FISH ESTIMATE		GAME FISH RECORD	
Species	Total Pounds	Average Length	Species
Carp, Jumbo (7lbs. up)			Walleye
Carp, No. 1 (5 to 7 lbs.)			Sauger
Carp, No. 2 (3 to 5 lbs.)			Smallmouth Black Bass
Carp, No. 3 (2 to 3 lbs.)			Largemouth Black Bass
Carp (under 2 lbs.)			Northern Pike
White Carp			Muskellunge
Buffalo Jumbo			Catfish
Buffalo No. 1			Sturgeon
Buffalo No. 2			Bullheads
Buffalo No. 3			Crappie
Sheepshead			White Bass
Suckers			Bluegill
Bullheads No. 1*			Perch
Bullheads No. 2**			Buffalo
Bullheads No. 3***			Suckers
TOTAL POUNDAGE			TOTAL NUMBER
DISPOSITION OF FISH			
Pounded Lbs. Where			
Cribbed Lbs. Where			
Direct Sale Lbs. To Whom			
Other			
REMARKS			
(Note: Describe any unusual observations on game fish, lake developments, or any other occurrence of public interest on back of report, and also state what was done with dead game fish.)			
NOTED: Area Supervisor		SIGNED: Fishing Inspector	

* 2 or less fish to a pound
 ** 3 to 4 fish to a pound
 *** 5 or more fish to a pound
 REV. 11-64

FIGURE 9
Contract and State Commercial Fisherman's Daily
Report (Fi-29).

TABLE 11

List of Fish Species Taken During Commercial
Removal of Freshwater Drum in Lake Winnebago,
1955-1966

Common Name	Scientific Name
Chestnut Lamprey	<u>Ichthyomyzon castaneus</u> Girard
Silver Lamprey	<u>Ichthyomyzon unicuspis</u> Hubbs and Trautman
Lake Sturgeon	<u>Acipenser fulvescens</u> Rafinesque
Bowfin	<u>Amia calva</u> Linnaeus
Longnose Gar	<u>Lepisosteus osseus</u> (Linnaeus)
Gizzard Shad	<u>Dorosoma cepedianum</u> (LeSueur)
Mooneye	<u>Hiodon tergisus</u> LeSueur
Rainbow Trout	<u>Salmo gairdneri</u> Richardson
Brook Trout	<u>Salvelinus fontinalis</u> (Mitchill)
Northern Pike	<u>Esox lucius</u> Linnaeus
Muskellunge	<u>Esox masquinongy</u> Mitchill
Bigmouth Buffalo	<u>Ictiobus cyprinellus</u> (Valenciennes)
Quillback	<u>Carpiodes cyprinus</u> (LeSueur)
Northern Redhorse	<u>Moxostoma macrolepidotum</u> (LeSueur)
White Sucker	<u>Catostomus commersoni</u> (Lacepede)
Carp	<u>Cyprinus carpio</u> Linnaeus
Channel Catfish	<u>Ictalurus punctatus</u> (Rafinesque)
Flathead Catfish	<u>Pylodictis olivaris</u> (Rafinesque)
Black Bullhead	<u>Ictalurus melas</u> (Rafinesque)
Brown Bullhead	<u>Ictalurus nebulosus</u> (LeSueur)
Yellow Bullhead	<u>Ictalurus natalis</u> (LeSueur)
Burbot	<u>Lota lota</u> (Linnaeus)
White Bass	<u>Roccus chrysops</u> (Rafinesque)
Yellow Bass	<u>Roccus mississippiensis</u> (Jordan and Eigenmann)
Largemouth Bass	<u>Micropterus salmoides</u> (Lacepede)
Smallmouth Bass	<u>Micropterus dolomieu</u> Lacepede
Black Crappie	<u>Pomoxis nigromaculatus</u> (LeSueur)
White Crappie	<u>Pomoxis annularis</u> Rafinesque
Rock Bass	<u>Ambloplites rupestris</u> (Rafinesque)
Bluegill	<u>Lepomis macrochirus</u> Rafinesque
Pumpkinseed	<u>Lepomis gibbosus</u> (Linnaeus)
Yellow Perch	<u>Perca flavescens</u> (Mitchill)
Walleye	<u>Stizostedion vitreum</u> (Mitchill)
Sauger	<u>Stizostedion canadense</u> (Smith)
Freshwater Drum	<u>Aplodinotus grunniens</u> Rafinesque

TABLE 12

Total and Average Catch per Hoop Net Lift for All Fish Species
Taken by All Commercial Fishermen on Lake Winnebago,
During the Open Water Season, 1955-1956

Fish Species	1955		1956	
	Total	Average	Total	Average
Freshwater Drum	348,322	309	42,516	310
Carp	1,944	2	133	1
Quillback	895	1	41	T
Burbot	274	T	25	T
Sucker	250	T	52	T
Redhorse	54	T	4	T
Mooneye	396	T	1	T
Longnose Gar	9	T	2	T
Walleye	6,448	6	293	2
Sauger	2,874	3	83	1
Yellow Perch	1,006	1	55	T
White Bass	15,408	14	2,165	16
Yellow Bass	9	T	0	0
Channel Catfish	1,141	1	97	1
Flathead Catfish	2	T	0	0
Bullhead	471	T	21	T
Northern Pike	44	T	7	T
Muskellunge	1	T	0	0
Smallmouth Bass	5	T	0	0
Largemouth Bass	2	T	0	0
Black Crappie	585	1	7	T
Bluegill	29	T	0	0
Pumpkinseed	38	T	0	0
Lake Sturgeon	82	T	13	T
No. of Lifts	1,127		137	

T = less than 0.5 fish per lift. Any fraction greater than 0.5 was counted as 1.

TABLE 13

Total and Average Catch per Hoop Net Lift for All Fish Species
Taken by All Commercial Fishermen on Lake Winnebago, During the
Winter Season, 1955, 1956 and 1960

Fish Species	1955		1956		1960	
	Total	Average	Total	Average	Total	Average
Freshwater Drum	49,981	57	34,420	145	113	7
Carp	18	T	2	T	0	0
Quillback	86	T	10	T	0	0
Burbot	2,241	3	214	1	111	7
Sucker	28	T	8	T	0	0
Redhorse	18	T	3	T	0	0
Mooneye	154	T	4	T	10	1
Lamprey	5	T	1	T	1	T
Longnose Gar	2	T	0	0	0	0
Walleye	1,788	2	1,172	5	68	4
Sauger	96	T	177	1	14	1
Yellow Perch	619	1	409	2	10	1
White Bass	901	1	682	3	16	1
Yellow Bass	3	T	0	0	0	0
Channel Catfish	571	1	84	T	13	1
Bullhead	99	T	31	T	1	T
Northern Pike	30	T	5	T	0	0
Muskellunge	5	T	0	0	0	0
Smallmouth Bass	0	0	2	T	0	0
Largemouth Bass	0	0	2	T	0	0
Black Crappie	344	T	52	T	2	T
Rock Bass	1	T	0	0	0	0
Pumpkinseed	0	0	2	T	0	0
Lake Sturgeon	3	T	0	0	0	0
No. of Lifts	872		237		16	

T = Less than 0.5 fish per lift. Any fraction greater than 0.5 was counted as 1.

TABLE 14

Total Trap Net Catch of all Fish Species Taken by all Commercial Fishermen on Lake Winnebago, April-November, 1955-66

Fish Species	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Freshwater Drum	2,312,436	2,677,670	3,203,522	3,125,796	2,550,683	1,415,199	1,287,860	1,073,385	870,286	265,846	278,381	342,897
Carp	2,082	1,533	1,862	1,959	2,620	1,546	963	515	588	1,481	4,472	3,025
White Carp	2,695	4,430	15,414	4,546	1,773	1,578	1,130	1,342	984	327	875	1,535
Eelpout	1,069	689	1,527	1,378	4,830	3,567	5,857	1,155	158	259	238	652
Sucker	635	1,107	3,556	3,364	2,155	3,726	3,794	2,652	5,289	2,815	2,419	2,243
Redhorse	109	97	189	175	57	45	29	46	45	26	0	0
Mooneye	1,479	155	1,341	751	772	361	1,053	50	129	103	588	1,097
Lamprey	1	10	3	14	150	6	10	3	0	0	0	0
Longnose Gar	11	49	16	28	12	42	27	3	15	0	0	0
Bignmouth Buffalo	0	2	1	0	0	0	0	1	0	0	0	0
Bowfin	0	0	2	1	1	0	0	0	0	0	0	0
Gizzard Shad	0	0	0	0	1	0	0	0	0	0	0	0
Walleye	21,499	23,518	28,578	32,589	33,705	28,738	15,028	3,725	4,193	3,157	1,777	3,199
Sauger	9,868	14,979	18,471	19,465	42,339	70,259	11,450	4,939	15,725	14,777	2,795	2,106
Yellow Perch	2,055	2,018	3,644	6,399	8,497	3,709	6,301	7,799	13,944	3,482	1,135	1,028
White Bass	57,656	38,975	92,709	198,089	342,862	510,338	500,458	347,932	204,758	34,884	43,955	94,366
Yellow Bass	0	26	1,600	289	68	0	0	5	1	0	3	0
Channel Catfish	4,637	11,125	8,144	12,991	13,861	7,639	7,088	3,775	2,668	1,156	1,322	1,061
Flathead Catfish	11	1	10	5	0	0	0	0	0	0	0	0
Bullhead	908	1,860	1,042	1,232	1,391	265	477	644	302	111	120	84
Northern Pike	168	256	262	264	72	63	148	92	62	17	10	53
Muskellunge	3	10	27	20	14	9	21	9	0	1	0	0
Smallmouth Bass	9	40	33	90	33	21	25	1	3	10	3	5
Largemouth Bass	0	11	11	12	22	6	8	4	0	1	0	0
Black Crappie	2,758	5,413	1,712	2,035	4,296	13,829	55,236	30,758	11,222	2,137	5,905	3,836
Rock Bass	3	12	6	4	11	8	0	0	0	0	0	0
Bluegill	4	23	24	18	10	2	2	3	4	4	3	1
Pumpkinseed	3	3	5	4	5	3	1	1	1	0	0	0
Lake Sturgeon	358	614	1,072	1,004	982	1,543	1,695	2,013	1,684	1,100	1,072	682
Trout	0	0	0	2	0	0	0	0	1	0	0	0
No. of Lifts	2,724	3,525	3,597	4,430	2,976	2,351	1,231	891	828	338	224	278

TABLE 15

Total Trap Net Catch of All Fish Species Taken by All Commercial Fishermen on Lake Winnebago During the Winter Season, 1955-1961 and 1963

Fish Species	1955	1956	1957	1958	1959	1960	1961	1963
Freshwater								
Drum	105,376	382,662	151,431	14,857	23,770	6,777	103	1,550
Carp	38	5	0	3	1	6	1	1
Quillback	26	253	38	274	120	62	74	26
Burbot	678	203	860	868	174	1,547	1,351	146
Sucker	21	29	18	113	61	5	10	107
Redhorse	2	18	2	19	11	0	1	0
Mooneye	15	562	31	618	373	241	65	18
Lamprey	1	2	0	1	0	0	3	0
Longnose Gar	0	1	0	2	0	0	2	0
Walleye	1,731	3,327	2,305	4,403	1,254	1,146	142	227
Sauger	150	485	398	228	102	167	2	79
Yellow Perch	227	484	346	98	540	294	1	86
White Bass	1,029	2,314	1,677	613	625	1,314	40	665
Yellow Bass	1	0	0	0	3	0	0	0
Channel Catfish	392	519	784	929	175	544	35	62
Bullhead	11	62	16	4	2	11	5	2
Northern Pike	44	34	16	27	2	6	18	11
Muskellunge	1	0	0	10	0	1	2	0
Largemouth Bass	0	4	0	0	0	0	0	0
Black Crappie	563	365	41	28	12	90	8	463
Bluegill	0	2	0	0	0	0	0	0
Pumpkinseed	0	0	1	0	0	0	0	0
Lake Sturgeon	1	5	9	9	6	5	0	2
Rainbow Trout	0	0	1	0	0	0	0	0
No. of Lifts	286	787	502	358	258	178	54	20

TABLE 16

Total Trawl Catch of all Fish Species Taken by all Commercial Fishermen on Lake Winnebago, 1957-66

Fish Species	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966
Freshwater										
Drum	67,963	27,323	66,410	152,771	746,089	1,667,624	1,795,282	1,601,913	1,526,546	670,823
Carp	208	69	160	112	580	896	1,769	9,290	8,583	3,763
White Carp	109	32	77	108	307	459	610	852	708	215
Eelpout	11	5	20	51	45	109	118	345	717	259
Sucker	363	174	362	2,687	11,817	28,191	28,174	28,400	27,689	7,104
Redhorse	1	2	2	7	142	79	39	56	30	0
Mooneye	2	2	0	3	9	13	61	107	87	26
Lamprey	1	0	3	4	1	16	0	0	0	0
Longnose Gar	0	0	0	0	0	1	7	1	2	4
Walleye	246	369	414	1,395	2,174	6,078	12,631	9,170	9,207	5,173
Sauger	150	242	395	2,540	5,141	12,372	16,746	22,091	34,422	18,270
Yellow Perch	28	17	84	388	6,172	25,495	25,308	18,368	16,316	7,012
White Bass	2,317	1,778	1,742	3,477	28,565	131,550	144,853	99,348	99,268	57,247
Yellow Bass	0	0	0	0	0	11	0	0	16	0
Channel Catfish	30	17	63	65	398	541	661	661	574	559
Flathead Catfish	0	0	0	0	0	0	0	2	0	0
Bullhead	12	20	13	183	1,334	1,553	1,841	3,789	16,968	3,792
Northern Pike	0	0	0	0	3	5	1	17	9	4
Muskellunge	0	0	1	0	0	1	0	1	1	0
Smallmouth Bass	0	0	0	0	0	0	1	0	0	0
Largemouth Bass	0	0	0	0	2	0	1	0	0	0
Black Crappie	4	0	11	244	719	929	557	909	3,747	914
Rock Bass	0	0	0	0	1	0	2	0	0	0
Bluegill	1	0	0	0	0	3	0	1	2	0
Pumpkinseed	0	0	0	1	3	1	1	3	7	2
Lake Sturgeon	49	10	33	60	226	718	1,002	1,319	1,140	497
Gizzard Shad	0	0	0	0	0	0	0	0	0	13
No. of Hauls	430	233	546	779	2,661	5,784	8,387	7,860	6,996	3,314

TABLE 17

The Number of Freshwater Drum Removed from Lake Winnebago by Year, Seasons and per Acre, 1955-1966

Year	Hoop Nets		Trap Nets				Trawls	Total Catch	No. Per Acre
	April-Nov.	Winter	April-June	Aug.-Nov.	April-Nov.	Winter			
1955	348,322	49,981	1,653,468	658,968	2,312,436	105,376		2,816,115	20.4
1956	42,516	34,420	1,359,024	1,318,646	2,677,670	382,662		3,137,268	22.8
1957			2,272,703	930,819	3,203,522	151,431	67,963	3,422,916	24.8
1958			1,944,228	1,181,568	3,125,796	14,857	27,323	3,167,976	23.2
1959			1,426,523	1,124,160	2,550,683	23,770	66,410	2,640,863	18.5
1960			916,530	498,669	1,415,199	6,777	152,771	1,574,747	11.4
1961			962,861	324,999	1,287,860	103	746,089	2,034,052	14.7
1962			828,734	244,651	1,073,385	1,550	1,667,624	2,741,009	18.8
1963			734,751	135,535	870,286		1,795,282	2,667,118	18.6
1964			265,846		265,846		1,601,913	1,867,759	13.5
1965			279,655		279,655		1,463,992	1,743,647	12.6
1966			572,089		572,089		1,018,411	1,590,500	11.5
Total	390,838	84,401	13,216,412	6,418,015	19,634,427	686,526	8,607,778	29,403,970	213.5

TABLE 18

Pounds of Commercial Fish Species Removed by State and Contract Fishermen, Lake Winnebago, 1955-1966

Year	Coel	Peterson	Smith	Tuttle	Weborg	Swaer	LeClair	Total Contract Fishermen	State Crews	Grand Total
1955	714,731		1,405,314	547,385				2,667,430	1,019,690	3,687,120
1956	747,544		1,631,662	599,252	283,810			3,262,268	850,608	4,112,876
1957	747,383	405,960	1,167,517	505,755	856,002			3,682,617	749,409	4,432,026
1958	423,218	1,382,531	710,228	373,475	546,402			3,435,854	743,685	4,179,539
1959	417,472	990,405	401,547	342,232	553,695			2,705,351	764,710	3,470,061
1960	202,155	517,478	216,282	168,251	289,129			1,393,295	540,868	1,934,163
1961	283,897	706,971		298,735	109,400			1,399,003	978,376	2,377,379
1962	340,697	598,465		266,406	734,555			1,940,123	1,045,775	2,985,898
1963	865,580	410,995		201,430	348,393			1,826,398	1,158,526	2,984,924
1964	551,435	304,815				226,555		1,082,805	941,310	2,024,115
1965	263,468	199,725				234,040	288,374	985,607	844,226	1,829,833
1966	145,315						150,312	295,627	1,235,538	1,531,165
Total	5,702,895	5,517,345	5,532,550	3,302,921	3,721,386	460,595	438,686	24,676,378	10,872,721	35,549,099

TABLE 19

The Net Proceeds of Commercial Fish Species Sold by State and Contract Fishermen, Lake Winnebago, 1955-1966

Year	Coel	Peterson	Smith	Tuttle	Weborg	Swaer	LeClair	Total Contract Fishermen	Crews	Total
1955	\$ 20,836.35		\$ 39,389.63	\$17,965.07				\$ 78,191.05	\$ 26,228.98	\$ 104,420.03
1956	22,724.28		44,974.61	17,321.60	\$ 8,514.30			93,534.79	20,342.16	113,876.95
1957	24,090.64	\$ 12,181.40	37,745.64	16,328.76	25,680.06			116,026.50	21,092.36	137,118.86
1958	11,392.82	38,219.47	18,198.71	10,207.25	14,761.16			92,779.41	19,724.34	112,503.75
1959	13,533.12	28,763.26	11,602.18	10,003.38	15,938.71			79,840.65	21,853.85	101,694.50
1960	5,878.93	15,188.69	6,284.93	5,015.17	8,270.08			40,637.80	15,110.77	55,748.57
1961	8,525.65	21,209.13		8,962.05	3,282.00			41,978.83	28,673.28	70,652.11
1962	10,152.89	16,606.08		7,992.18	21,903.93			56,655.08	31,806.53	88,461.61
1963	21,608.05	10,274.90		5,049.30	8,709.86			45,642.11	29,801.68	75,443.79
1964	14,927.18	8,382.44				\$ 6,114.44		29,424.06	25,050.46	54,474.52
1965	7,207.94	5,492.45				6,408.61	\$ 7,931.71	27,040.71	25,275.81	52,316.52
1966	4,339.80						4,367.12	8,706.92	37,425.60	46,132.52
Total	\$165,217.65	\$156,317.82	\$158,195.70	\$98,844.76	\$107,060.10	\$12,523.05	\$12,298.83	\$710,457.91	\$302,385.82	\$1,012,843.73

TABLE 20

Percentage Effort and Harvest for Freshwater Drum Taken with Trap Nets During the Open Water Season for All Commercial Fishermen on Lake Winnebago, 1955-1966

Year	Net Lifts	State Crews		Coel		Peterson		Smith		Tuttle		Weborg	
		Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest
1955	2,724	32.0	20.3	17.0	22.9			40.2	48.6	10.5	8.2		
1956	3,525	25.7	13.1	15.9	17.8			32.4	41.9	18.9	17.6	0.7	9.6
1957	3,597	19.7	12.6	16.1	15.8	10.1	8.4	26.5	25.9	15.2	11.5	12.4	25.8
1958	4,430	21.0	12.8	13.8	9.5	22.1	33.3	16.7	17.8	10.4	9.9	16.0	16.6
1959	2,976	23.2	15.7	14.9	10.3	18.6	28.9	10.9	12.1	13.5	12.1	18.8	20.9
1960	2,351	22.3	19.1	14.5	9.1	20.5	29.5	12.2	11.9	13.7	11.7	16.6	18.6
1961	1,231	32.4	28.1	15.2	13.6	33.5	42.2			10.2	8.0	8.8	8.2
1962	891	25.5	22.8	11.2	12.1	41.0	42.4			10.0	9.0	12.6	13.6
1963	828	21.4	20.3	15.8	21.1	40.0	33.6			10.4	7.8	12.3	17.2
1964	338	46.4	49.4	26.6	25.0	27.2	25.6						
1965	224	71.4	77.3	28.6	22.7								
1966	278	82.7	84.5	17.3	15.5								

TABLE 21

Percentage Effort and Harvest for Freshwater Drum Taken with Trawls for All Commercial Fishermen on Lake Winnebago, 1957-66

Year	Trawl Hauls	State Crews		Coel		Peterson		Tuttle		Weborg		Swaer		LeClair	
		Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest	Effort	Harvest
1957	430	100.0	100.0												
1958	233	100.0	100.0												
1959	546	100.0	100.0												
1960	784	100.0	100.0												
1961	2,661	60.8	62.6	9.1	6.2			29.4	31.1						
1962	5,784	41.1	40.3	12.7	11.3	4.9	2.6	14.2	12.0	27.1	33.7				
1963	8,387	44.6	48.8	29.1	32.7	1.2	0.7	10.1	6.7	15.0	11.1				
1964	7,860	44.2	43.4	27.7	27.7	15.3	15.1					12.8	13.8		
1965	6,996	42.0	29.1	13.2	11.0	13.1	12.6					15.2	29.2	16.5	18.1
1966	3,314	74.9	70.6	7.6	8.4									17.5	21.0

TABLE 22

Average Condition Factors by One-Inch Groups (T. L.) of Freshwater Drum Sampled from Trap Nets During the Pre-Spawning Period, April or May, 1955-1964 in Lake Winnebago

Length Groups	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
7.0-7.9	0	0	0	0	0	36.1	36.0	0	0	0
8.0-8.9	37.9	0	38.7	0	42.6	37.2	36.4	0	0	0
9.0-9.9	42.9	0	36.8	0	0	0	39.8	41.3	52.5	0
10.0-10.9	42.1	41.6	39.1	41.0	44.9	0	41.8	41.6	45.0	46.7
11.0-11.9	48.1	43.3	0	46.1	40.6	41.7	46.1	44.4	44.5	45.4
12.0-12.9	50.3	44.4	39.2	48.0	40.3	43.3	46.6	49.1	48.0	45.6
13.0-13.9	46.2	45.6	42.5	48.6	46.5	43.0	45.1	47.2	47.2	46.8
14.0-14.9	41.6	43.1	41.2	45.8	43.5	40.3	42.2	44.5	45.4	44.4
15.0-15.9	40.7	41.4	41.0	43.7	42.2	40.0	41.0	41.5	41.7	42.6
16.0-16.9	45.5	42.1	43.3	44.4	43.7	39.3	43.0	43.0	41.7	43.8
17.0-17.9	45.2	43.2	43.1	49.2	46.8	47.5	38.2	49.2	46.8	51.2
18.0-18.9	0	0	0	52.9	49.1	0	0	0	0	45.8
19.0-19.9	49.4	0	48.8	0	62.0	0	58.4	0	0	0
Total Sample	438	458	454	416	327	412	504	684	578	472
Average "C"	44.2	43.2	41.3	45.9	43.7	40.7	42.3	44.6	45.3	44.9

TABLE 23

Average Weights (lbs.) by One-Inch Groups (T.L.) of Freshwater Drum Sampled from Trap Nets
During the Pre-Spawning Period, April or May, 1955-1964, in Lake Winnebago

Length Groups	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
7.0-7.9	0	0	0	0	0	0.2	0.2	0	0	0
8.0-8.9	0.3	0	0.3	0	0.3	0.2	0.2	0	0	0
9.0-9.9	0.4	0	0.3	0	0	0	0.4	0.4	0.5	0
10.0-10.9	0.5	0.5	0.4	0.5	0.6	0	0.5	0.5	0.5	0.6
11.0-11.9	0.8	0.7	0	0.7	0.7	0.6	0.7	0.7	0.6	0.7
12.0-12.9	1.0	0.9	0.8	1.0	0.8	0.9	0.9	1.0	1.0	0.9
13.0-13.9	1.1	1.2	1.1	1.2	1.2	1.1	1.1	1.2	1.2	1.2
14.0-14.9	1.2	1.3	1.3	1.4	1.3	1.2	1.3	1.3	1.4	1.4
15.0-15.9	1.5	1.5	1.5	1.6	1.6	1.4	1.5	1.5	1.5	1.5
16.0-16.9	2.0	1.8	1.9	1.9	1.9	1.7	1.9	1.9	1.9	1.9
17.0-17.9	2.4	2.2	2.5	2.6	2.5	2.4	2.0	2.4	2.4	2.6
18.0-18.9	0	0	0	3.4	3.3	0	0	0	0	2.9
19.0-19.9	3.5	0	3.5	0	4.8	0	4.1	0	0	0
Total Sample	438	458	454	416	327	412	504	684	578	472
Average Wt.	1.2	1.3	1.3	1.4	1.7	1.3	1.1	1.1	1.0	1.1

TABLE 24

Average Condition Factors by One-Inch Groups (T.L.) of Freshwater Drum Sampled from
Trap Nets During October, 1954-1963 in Lake Winnebago

Length Groups	1955	1956	1957	1958	1959	1960	1961	1962	1963
7.0-7.9	0	38.3	0	0	0	39.0	0	0	0
8.0-8.9	0	38.8	41.6	0	41.7	39.0	43.0	0	0
9.0-9.9	44.3	40.1	42.6	43.7	43.0	40.5	42.8	0	0
10.0-10.9	40.6	45.2	43.7	0	0	40.4	42.6	44.7	45.9
11.0-11.9	43.6	46.0	43.3	46.9	47.1	42.5	42.6	44.5	46.4
12.0-12.9	45.3	46.5	49.9	41.8	47.6	40.8	47.1	46.6	46.4
13.0-13.9	44.0	46.2	47.6	40.4	46.3	41.9	46.8	45.1	46.6
14.0-14.9	42.2	42.0	44.9	42.6	43.7	40.6	44.4	42.3	45.4
15.0-15.9	40.8	39.9	44.7	43.1	43.6	40.0	42.3	40.9	44.1
16.0-16.9	41.5	42.0	43.3	45.6	44.4	41.2	42.3	40.8	40.0
17.0-17.9	53.4	0	49.0	48.5	51.1	51.2	40.1	44.9	40.8
18.0-18.9	48.9	56.4	46.1	54.0	49.7	49.6	0	51.5	0
19.0-19.9	0	0	49.4	56.5	0	48.8	0	53.2	0
Total Sample	375	553	476	358	467	507	668	531	564
Average Wt.	42.4	43.9	45.3	43.5	44.5	40.5	43.7	43.1	45.9

TABLE 25

Average Weights (lbs.) by One-Inch Groups (T.L.) of Freshwater Drum Sampled from
Trap Nets During October 1954-1963 in Lake Winnebago

Length Groups	1955	1956	1957	1958	1959	1960	1961	1962	1963
7.0-7.9	0	0.2	0	0	0	0.2	0	0	0
8.0-8.9	0	0.3	0.3	0	0.3	0.2	0.3	0	0
9.0-9.9	0.4	0.3	0.4	0.3	0.3	0.3	0.4	0	0
10.0-10.9	0.5	0.6	0.5	0	0	0.5	0.5	0.5	0.6
11.0-11.9	0.7	0.7	0.6	0.7	0.7	0.7	0.6	0.7	0.7
12.0-12.9	0.9	0.9	1.0	0.8	0.8	0.8	0.9	0.9	0.9
13.0-13.9	1.1	1.1	1.2	1.0	1.2	1.1	1.2	1.1	1.1
14.0-14.9	1.3	1.3	1.4	1.3	1.3	1.2	1.3	1.3	1.4
15.0-15.9	1.5	1.4	1.6	1.6	1.6	1.6	1.5	1.5	1.6
16.0-16.9	1.8	1.8	1.9	2.0	2.0	1.8	1.9	1.8	1.7
17.0-17.9	2.9	0	2.5	2.5	2.6	2.8	2.0	2.4	2.1
18.0-18.9	3.3	3.8	2.7	3.4	2.9	3.0	0	3.2	0
19.0-19.9	0	0	3.6	4.2	0	3.6	0	3.9	0
Total Sample	375	553	476	358	467	507	668	531	564
Average Wt.	1.3	1.1	1.4	1.6	1.4	1.1	1.0	1.2	1.0

TABLE 26

Length-Frequencies (T.L. in Inches) in Percent of Freshwater Drum Sampled
from Trap Nets During April or May, Lake Winnebago,
1955-1964

Length Groups	1955	1956	1957	1958	1959	1960	1961	1962	1963	1964
7.0-7.9	0	0	0	0	0	0.5	0.8	0	0	0
8.0-8.9	0.2	0	1.5	0	0.3	1.2	10.3	0	0	0
9.0-9.9	0.5	0	1.3	0	0	0	2.2	7.6	0.7	0
10.0-10.9	4.6	0.4	0.2	2.6	0.3	0	1.4	16.5	21.7	1.3
11.0-11.9	0.9	5.0	0	3.1	0.3	0.9	0.4	2.4	19.7	25.7
12.0-12.9	13.4	3.9	1.1	7.0	0.9	3.9	7.0	10.5	7.1	18.9
13.0-13.9	29.2	17.9	13.4	18.1	8.0	17.0	21.8	23.8	16.8	11.8
14.0-14.9	37.4	49.8	47.4	43.5	37.4	40.7	34.6	28.3	22.8	24.4
15.0-15.9	12.1	19.2	31.1	22.8	34.7	31.3	18.1	.7	8.1	15.2
16.0-16.9	0.9	3.5	3.3	1.9	12.3	3.9	3.0	1.0	2.8	2.3
17.0-17.9	0.5	0.2	0.2	0.5	4.3	0.5	0.2	0.1	0.3	0.2
18.0-18.9	0	0	0	0.5	1.5	0	0	0	0	0.2
19.0-19.9	0.2	0	0.4	0	0	0	0.2	0	0	0
Number Sampled	438	458	454	416	326	412	504	684	578	472

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