

February 13, 1932

INSTITUTE FOR FISHERIES RESEARCH
REPORT NO. 127

THE HILLSDALE COUNTY LAKES

INTRODUCTION

The study of these lakes in the extreme southern part of the state has revealed a number of interesting facts. When compared with lakes in northern Michigan they are found to differ from the latter in a number of ways.

Hillsdale County has a rather large rural population. Almost all of the land is farmed. Relatively little swamp area is found here. The soil is made up chiefly of silt loams and sandy loams and appears to be well suited to agriculture.

The long moraines passing through Oakland County, Washtenaw County, and the Irish Hills pass on through Hillsdale County. The presence of large moraine areas undoubtedly accounts for the rather large number of lakes found here. The region appears to be more gently rolling than are most regions in the moraine areas.

The variety in lakes which is so marked in northern Michigan is entirely absent in Hillsdale County. Of the fifteen lakes which were examined, fourteen showed a remarkable similarity. There is considerable difference in size and depth but the kind of bottom on the shoals and in the deeper areas, the sharp dropoff, the kind of vegetation, the presence of outlets, and the relative abundance of food are quite alike in all the lakes which were examined.

According to geologists the glacial period came to a close here a long time before it did in upper Michigan. The lakes bear evidence to this fact. Drainage is fairly well developed here, practically all the lakes having outlets, and a thick organic bottom has formed below the dropoff in all cases. The lakes compare with those of northern Indiana in most respects.

A number of interesting problems arise in connection with these lakes. Food for fish in all the lakes is abundant, although minnows and other food for large fish, especially

RECEIVED
FEB 16 1932
FISH DIVISION

the basses, are generally depleted. The waters are to be classed as productive. Net sets and seine hauls indicated that fish are fairly abundant. Yet, fishermen of the region are often disappointed in their catches. Since sportsmen here are quite as well schooled in their art as are sportsmen in other parts of the state, we can hardly conclude that the reason for the poor catches lies with them. Although no definite reasons can be given for the condition which exists a certain amount of speculation on the situation can be made. It appears possible that food is so abundant that the fish do not bite very readily. Because of this abundance of food it appears that fishing can best be built up by increasing the fish population to a point where it finds more difficulty in getting sufficient food.

There are at least two possible reasons other than overfishing why fish are not more abundant:

1. Predators. Gar and dogfish are fairly abundant in most of the lakes. These predators undoubtedly have a decided affect on the fish population.
2. Spawning conditions. With very few exceptions the fish spawn on the marl making their nests on roots of the aquatic vegetation or on marl. It is possible that these beds do not serve satisfactorily, at any rate, they are not considered to be nearly as good as those placed on mixtures of sand and gravel. This is especially probable for small-mouth bass.

Considerable work has already been done to remedy situations. The conservation officer, Fay Warner, has repeatedly organized spearing parties to reduce the number of gar and dogfish. These parties have had considerable success. The Hillsdale Chapter of the Izaak Walton League has constructed some excellent rearing ponds which, according to reports in "Outdoor America" (Jan. 1931), produced 472,000 bluegill fingerlings. These large fingerlings were placed in the lakes.

The continuation of the rearing ponds, the development of rearing ponds for both species of bass, and the continued control of predators, together with improvement of spawning conditions for both game and forage fishes and better protection should have a very decided affect on the fish population and should give the anglers of the region much

better fishing. The increase of protection and improvement of spawning beds is discussed later (under recommendations).

These lakes provide fishing chiefly for local residents. Although some tourists are attracted to the county, particularly to the northeast corner, the tourist industry cannot be regarded as an important one in the region as it is in northern Michigan. A large percentage of local people take advantage of the lakes, and although they provide relatively little financial return, the lakes play a very definite part in providing the proper setting for recreational activities and are a decided blessing to the many sportsmen of the region.

The Survey

This survey was carried on by 5 men, 4 from the University of Michigan and the other provided by the Hillsdale chapter of the Izaak Walton League. The field work was done during the last half of June and the first half of July, 1931. Camp sites were on Baw Beese Lake and on Long Lake.

Acknowledgements. We are grateful to Mr. George Tubbs for the excellent camping site provided for our party on Baw Beese Lake and to the Hillsdale K of P Lodge for the fine camp site on Long Lake, also to Mr. E. C. Chapman and the many Waltonians and other local citizens for their interest and help in the work. We are particularly indebted to Mr. Fay Warner, local Conservation Officer, for the many services he rendered in connection with the survey.

Lakes surveyed Fifteen of the more important lakes of Hillsdale County were investigated. A report on two of these lakes, Moon and Perch, has already been made.

Because of the similarity of the thirteen lakes to be covered by this report, they will be considered collectively, except in matters in which they differ from each other.

Names and area.

The thirteen lakes and their areas are given below. Shoal area and percentage of shoal area are also give. (Shoal area is considered as all area less than two meters in depth.)

<u>Name of Lake</u>	<u>Area in Acres</u>	<u>Approximate Shoal Area (in A.)</u>	<u>% Shoal Area</u>
Baw Beese	316	101	32
Second	36	16	44
Third	35	27	77
Fourth	44	13	30
· Boot	64	12	19
Bird	114	23	20
· Bankers	74	11	15
Wilson	92	21	23
Bear	104	35	30
Long	213	41.1	19
Carpenter	33.5	10	30
Hemlock	146	27	18
Berry	22	4.5	20

Only one lake, Third Lake, has more than half of its area within the two meter line. This lake is quite shallow.

**

Maximum depth.

The maximum depth found in each lake is approximately as follows:

Baw Beese	71 feet	Bankers	46 feet
Second	62 feet	Wilson	59 feet
Third	13 $\frac{1}{2}$ feet	Bear	53 feet
Fourth	51 feet	Long	45 feet
Boot	40 feet	Carpenter	40 feet
Bird	66 feet	Hemlock	65 feet

Berry 28 feet

Inlets,
outlets, and
connections.

All thirteen lakes have regular outlets except Berry Lake. In times of high water, after spring rains, ~~this~~ lake too has a definite outlet. Inlets are also present in all cases, but, in several lakes these are only small spring feeders. The following table indicates the various connections (P indicates passable for boats).

[omit]

<u>Lake</u>	<u>Inlet</u>	<u>Outlet</u>	<u>River System</u>
Baw Beese	Second & Third Lakes (channel)	St. Joseph R.	St. Joseph
Second	Channel from Third Lake	Channel to Baw Beese L. (P)	St. Joseph
Third	Channel from Fourth Lake	Channel to Second L. (P)	St. Joseph
Fourth	Channel from Boot Lake	Channel to Third Lake	St. Joseph
Boot	1 very small spring feeder	Channel to Fourth L. (P)	St. Joseph
Bird	Several spring feeders	Bird Creek	E. branch of St. Joseph of the Maumee.
Bankers	Several small inlets	Channel to Wilson L. (P)	St. Joseph of the Maumee.
Wilson	Channel from Bankers L. and 1 small spring feeder	Outlet to Bear Lake	St. Joseph of the Maumee.
Bear	Inlet from Wilson & Pike Lakes. Several small spring feeders.	Creek to St. Joseph of the Maumee	St. Joseph of the Maumee.
Long	Inlet from Mud L. Several small feeders.	Channel to Carpenter (P)	St. Joseph R.
Carpenter	Channels from Long & Hemlock	Hog Creek	St. Joseph Ri.
Hemlock	Inlet from Round L. Several sm. feeders.	Channel to Carpenter (P)	St. Joseph R.
Berry	Several sm. feeders.	Intermittent outlet to Long Lake.	St. Joseph R.

Pollution The waters of all the lakes are favorable for fish life. No pollution, that would interfere with the fish, was found.

Use of water and adjoining land. These lakes lie in an area where farming is carried on extensively. Some patches of second growth timber are found along practically each one of the lakes.

Boats cannot be rented on all of the lakes but can be obtained somewhere on each group and, consequently, one may fish on any one of these lakes with a rented boat, without having to take the boat overland.

Resort development is more or less extensive on Baw Beese, Long, and Bird Lakes. It is moderately extensive on Bankers, Hemlock, Wilson, Bear, and Carpenter Lakes. Berry Lake, Second Lake, and Third Lake have one cottage each, while Fourth and Boot Lakes have no resort developments, except for a dock and boat livery or two on the latter.

Ice is cut from a few of the lakes. Baw Beese Lake furnishes the water supply for the city of Hillsdale.

Temperature and Chemical Condition The lakes resemble each other considerably in alkalinity, hardness, and carbon-dioxide, and to some extent in oxygen and temperature. All are well suited, chemically, for warm water fish.

The following table indicates some of the conditions as found in each lake. All these lakes with the exception of Third show a definite thermal stratification: that is, the lower levels remain cold and stagnant through the summer.

<u>Lake</u>	<u>Air Temp.</u>	<u>Top Temp.</u>	<u>Bottom Temp.</u>
Baw Beese	89	76	49
Second	81	80	48
Third	101	83	64
Fourth	90	80	47

<u>Lake</u>	<u>Air Temp.</u>	<u>Top Temp.</u>	<u>Bottom Temp.</u>
Boot	90	78	50
Bird	80	76	46
Bankers	88	77	46
Wilson	84	80	46
Bear	88	75	50
Long	94	76	52
Carpenter	73	75	47
Hemlock	81	78	46
Berry	93	76	54

Bottom temperatures in all but Third Lake, are more or less similar. They range from 46 degrees to 54 degrees Farenheit (Third Lake 64 degrees). Surface temperatures vary with air temperature and depend on previous weather conditions. These may also be regarded as quite similar in all cases.

<u>Lake</u>	<u>Oxygen</u>	<u>Carbon dioxide</u>	<u>Hardness</u>	<u>Alkalinity</u>
Baw Beese	Satisfactory	None in upper half	Moderate	Moderate
Second	"	None in upper third	"	"
Third	"	None in upper half	"	"
Fourth	"	"	"	"
Boot	"	"	"	"
Bird	"	"	"	"
Bankers	"	"	"	"
Wilson	"	"	"	"
Bear	"	Some at surface but none at 12 feet	"	"
Long	"	None in upper half	"	"
Carpenter	"	"	"	"
Hemlock	High	"	"	"
Berry	Satisfactory	"	"	"

Oxygen is satisfactory in the warm upper layer of all lakes. Carbon-dioxide is also satisfactory in all cases. A small amount was found at the surface in Bear Lake but this should not interfere seriously with fish life. All lakes were found to be moderately hard and none were acid, even at the bottom. The basic fertility in all cases may also be regarded as moderately high.

Bottom

An examination of the maps of the lakes will show a remarkable similarity in all thirteen of them. In every case the shoal area is chiefly marl while the bottom below the dropoff is of pulpy peat. A small amount of fibrous peat is present on the shoal area of all lakes and a small amount of sandy shoal is present in all but Boot Lake and Fourth Lake. In a few cases a small amount of clay was found and, in a number of cases, a little gravel was present. Spawning beds of some sort were found on all lakes except Berry.

Vegetation

The similarity exhibited in other respects is shown also in the kinds and distribution of vegetation. The shoal contains a moderate amount while the slope contains a thick stand of weeds. In all cases some vegetation, particularly algae, is also found below the slope. Rushes, pond lilies, and musk-grass are most abundant on the shoal, while musk-grass and various pond weeds (Potamogetons) are most plentiful on the slope.

Although the vegetation on the shoal is, in most cases, only moderately abundant, the lakes all have sufficient (but not too much) vegetation.

Natural
Food.

The amount of food in all lakes is moderately high. Aquatic insects are fairly abundant. Although these ~~was~~ not studied, the plankton (free swimming) and bottom food organisms ~~may~~ be assumed to be plentiful. Forage fishes are only moderately common in all lakes, less abundant than would be expected. A list of the forage fishes is found under the next item, together with the names of the lakes in which each was found.

One may safely say that the food now present could support a larger fish population than is in these lakes. ~~This~~ may be one of the chief reasons why fish, though fairly plentiful, are usually difficult to catch in large numbers.

Species of
Fish

Some netting and seining were done on each of the lakes to determine the kind of fish present and to get some idea of the abundance of each species. Only a limited amount of ~~this~~ this work was done on each lake and the table below does not necessarily indicate all the species present in the lakes. It does show most of the kinds of fish and gives some idea of the relative abundance of the more common ones. Intensive seining and netting tend to deplete the population and, therefore, this work was done only to a very limited extent.

White fish have been reported in Long and Hemlock Lakes and cisco in Bankers Lake. A report on Baw Beese Lake made in 1886 shows that cisco were also present there at that time. Although a number of deep net sets were made, neither of the two species could be found in any of the lakes by our Party.

The table gives the kind of fish and the number of fish of each species taken, as well as the names of the lakes in which each species was found. The table includes only the species of fish actually taken by the Party. The fish ~~are~~ reported to be present but not found by the Party are not included in the list. Moon Lake and

Species	Moore	Parce	Earl Reese	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth	Eleventh	Twelfth	Thirteenth	Fourteenth	Fifteenth	Total
Red Pickerel		1	1											2	1		1	12
Bass Pike	2		2	3	2	1												12
Perch	4	108	20	1	1	10	30	11	147	185	10	102	17	43	2			667
Large-mouth Bass	20	21	30			1	3	10	7	42	40	45	14	41	7			416
Warrent's Bass	1		1	1	2	1	1	1			5	1		1				15
Green sunfish			1		1		4					12	10	20	9			107
Blue Gill	17	29	73	12	14	2	27	42	5	57	29	32	2	9	20			392
Long-eared sunfish								1		100	10							111
Pumpkinseed sunfish	6	6	1	1	3			4	1	3								25
Rock Bass			4	1					3	4	10	7	1	7				37
Black Striped			1		3	2	1	2	1		1	3		6				20
Coarse Fish																		
Sucker								6				3	1	1	1			12
(White Club sucker)							9	3	1			6	1					20
Walleye																		9
Black Bullhead			5	7				2										14
Brown Bullhead					5	3		1	1			3	1	1				16
Yellow Bullhead	1	1	3	14	19	3	1	112	2	6	4	309		4				507
Obnoxious Fish																		
Short-nosed Gar			2			2						6		1				13
Long-nosed Gar			10	1					1	9	3	1	1		1			27
Dogfish	1		23	4	7	2	1					2						40
Forage Fish																		
Pirate Perch														1				1
Stone Roller			2									24	5	3				34
Pow-nosed shiner						1	10											11
Steel-colored minnow			1															1
Black-nosed shiner	19		22						1			1	22	23				68
Black-chin shiner	6	122	14	27	14	36	13	4	1			11		9	1			200
Mimic Shiner							1			3		1	1	99				105
Straw-colored shiner									1									1
Common shiner			3				2	1										6
Golden shiner					10		9	1				34	4		10			68

Species	Moon	Perch	Raw Feese	Second	Third	Fourth	Foot	Bird	Bear	Wilson	Bankers	Long	Carpenter	Hemlock	Ferry	Total
Blunt-nosed minnow		57	340	7				101	115	38	20	39	27	174		1021
Tadpole cat							2	10		4		2				18
Mid minnow				1	1	1	3	4		1						11
Menona Killifish			102		9				2	10				25		152
Black-banded Top minnow								1								1
Black-check top minnow					1		3					1				5
Log perch									104	42	9	48	23	6	7	239
Johnny Darter		3	8						3			41	6	23		84
Iowa Darter		6	1			1	1	8	15	15	1	94	9	8	3	151
Rainbow Darter			1											4		5
Least Darter			3			1	4	1		4	1			3		17
Brook Silversides			91						2		1	18	2			114
Horned Dace		1										21	1			22

(Handwritten mark)

Perch Lake, Somerset Twp., are included in this table.

Only two species of fish, Perch and Bluegills, were found in all of the thirteen lakes. Perch, yellow bullheads, large-mouth bass, and bluegills appear to be the most common of the larger fishes. Blunt-nosed minnows are far more common than any of the other forage fishes.

Obnoxious fishes were found in all of the thirteen lakes (Moon Lake and Perch Lake not included) except Bird Lake. A local resident reports that carp were formerly present in Bird Lake in fairly large numbers but that, in recent years, only a few adult carp have been taken. It is possible that the relatively large number of bass in this lake have helped to hold down the species.

As has been stated, the list as here presented does not necessarily include each species present in each lake. If a species is scarce in a lake it may well have escaped our nets and seines.

Spawning
grounds.

Spawning beds were found in each of the thirteen lakes. In almost all cases these were on marl, the nests being made of plant roots or of shells. These beds were commonly found in sparse patches of bulrush.

Some excellent gravel nests were found along the east side of Carpenter Lake. This is the only lake in which gravel beds were found. Spawning conditions will be discussed more fully in the recommendations.

Designation.

Pike are present in some of these lakes but are not numerous in any one of them. Bass and bluegills are far more common in every case. We found no reason why any of these lakes should be designated as pike lakes.

Predators

Predators are present in each of the lakes. Some fish eating birds were seen on all thirteen lakes. Kingfishers, bittern, great blue herons, and little green herons were found in the county. None of these were extremely abundant.

Snapping turtles are quite common. Often when nets were lifted many of the fish were partly or almost entirely eaten. On several occasions snappers were seen eating these fish in the nets. We cannot say to what extent snappers kill live fish but their willingness to include fish in their diet has been shown in more than one instance.

Predatory species of fish are present in each of the thirteen lakes. No gar or dogfish were found in Bird Lake. Some mud-pickereel were taken here. These seldom, if ever, reach legal size. In each of the three chains of lakes either dogfish, gar, or both were taken, and found to be fairly common.

It is to be remembered, too, that where little protection is afforded the young fish, the adult game fish may have predatory tendencies. Forage fish and young of game fish include a large item in the diet of the grass pike and the mud-pickereel. Bass likewise eat many young fish, and especially where food is scarce they exhibit decided cannibalistic tendencies.

Cover

The vegetation provides a considerable cover but in these lakes, where predators are abundant, much more protection for the young fish should be provided. Vegetation is thickest on the slope. Many young fish are found on the shoal area between the dropoff and the shore. Here vegetation is fairly common but include chiefly rushes and muskgrass. In most cases the beds of rushes are not dense and

the muskgrass does not grow tall. Weed beds on the shore do not offer nearly enough protection and better cover is desirable. (See recommendations).

Fertility

Since the lakes have been formed, much organic and mineral matter has accumulated here through the decay of vegetation and through seepage and drainage from the surrounding land. The basic fertility in all these lakes may be considered high. They are quite productive compared to many other lakes in the state.

Recommendations

Since the various improvements which are recommended will undoubtedly be thoroughly discussed with those who are concerned in improvement work by someone familiar with improvement work and since someone acquainted with this work will very likely be present to aid the men when these improvements are begun, the suggested improvements will be listed here only in the barest of detail. The nature of each improvement, its merits, and our reasons for recommending it will not be considered here for reasons mentioned above.

The table below lists the improvements which we feel should be made. Because of the great similarity in the lakes, these suggestions will also be found to vary little for these thirteen lakes.

Stocking Suggestions (Annual).

<u>Name of L.</u>	<u>Acres</u>	<u>Large-mouth Fingerlings</u>	<u>Small-mouth fingerlings*</u>	<u>Bluegill fingerlings</u>	<u>Perch fingerlings</u>
Baw Beese	316	3000	2000	10000	1500
Second	36	500	0	1000	500
Third	35	1500	0	3500	500
Fourth	44	500	500	1500	500
Boot	64	1000	500	2000	500
Bird	114	1500	1000	4500	1000
Bankers	74	1000	500	3000	1000
Wilson	92	1000	500	3500	1000
Bear	104	1500	500	5000	1000
Long	213	2500	1000	8000	1500
Carpenter	33.5	1000	500	2000	500
Hemlock	146	2000	500	6000	1000
Berry	22	500	0	1000	0
Totals		17,500	7500	51,000	10,500

*Small-mouth bass recommended to be planted only in case gravel spawning beds are provided.

Stocking with white fish has not been recommended. None were taken by the Party. Lakes in each of the three chains are reported to have, or to have had, either whitefish or cisco. As soon as there is evidence that either species still exists in any of the lakes, stocking with whitefish will be recommended for these lakes in which the cisco or whitefish are found.

Third Lake is exceptionally well suited to serve as a nursery water. Because of these favorable conditions a rather large number is recommended for the lake.

Large-mouth bass, small-mouth bass and perch should be planted at various places along the shore. Bluegills should be planted chiefly in bays and more or less protected areas.

There are reasons to believe that where fish are overstocked a decided tendency toward dwarfing occurs. In making these recommendations this has been kept in mind.

It appears advisable to have a pond or two used in rearing bass, both species if possible, otherwise large-mouth bass. Both species have been recommended for most lakes since some anglers prefer one species and some the other species. The habits and habitats of the two species differ in some ways, and where conditions are favorable, the planting of both species appears desirable.

Improvement Suggestions

<u>Name of Lake</u>	<u>Gravel for Spawning Beds in Cu. yds.</u>	<u>Brush Shelters*</u>	<u>Slabs for Minnow Spawning</u>	<u>Dam in Outlet Needed</u>	<u>Predator Control Desirable</u>
Baw Beese	200	50	500		x
Second	30	10	100		x
Third	25	5	100		x
Fourth	30	10	100		x
Boot	35	15	150		x
Bird	80	20	200	x	
Bankers	70	20	200		x
Wilson	70	20	200		x
Bear	70	20	200	x	x
Long	150	30	400		x
Carpenter	35	15	100	x	x
Hemlock	80	20	200		x
Berry	0	5	0		x
Totals	775	240	2,450	3	11

*The number given is for shelters of about 15'x40'. If smaller shelters are used a proportionally larger number should be used.

Gravel Spawning Bed

The gravel should be placed where the bottom is firm. It should be put in areas about 5'x5'. A layer about an inch thick appears most desirable. It should be placed in water from 2 to 6 feet deep.

Brush Shelters

A number of different kinds of suitable shelters can be constructed. These furnish both food and protection for the young fish. The shelters should be placed on the shoal area deep enough so as not to interfere with boating or with the general appearance of the lake. The diagram show one type of large brush shelter. Smaller heaps would undoubtedly be more easily made from the material available here, and would very likely be more desirable in this area.

Slabs for Minnow Spawning.

Details are given on the enclosed diagram. These are particularly important since the shores generally have few objects under which the minnows can spawn.

Dams in Outlets

These dams are not intended to raise the water but are used to keep lake fish from entering the streams and visa versa. A barrier of brush construction or of any construction that will have a screen-like affect and will keep fish in the lakes and in the outlets separated will be satisfactory.

Predator Control

In most lakes continued efforts should be made to reduce the number of gar or dogfish present. This can best be accomplished by spearing or by setting surface nets.

The Institute will gladly give further information and aid in carrying out the improvements which are here recommended, whenever such information or aid is desired.

To accompany Report No. 127 - Hillsdale County Lakes

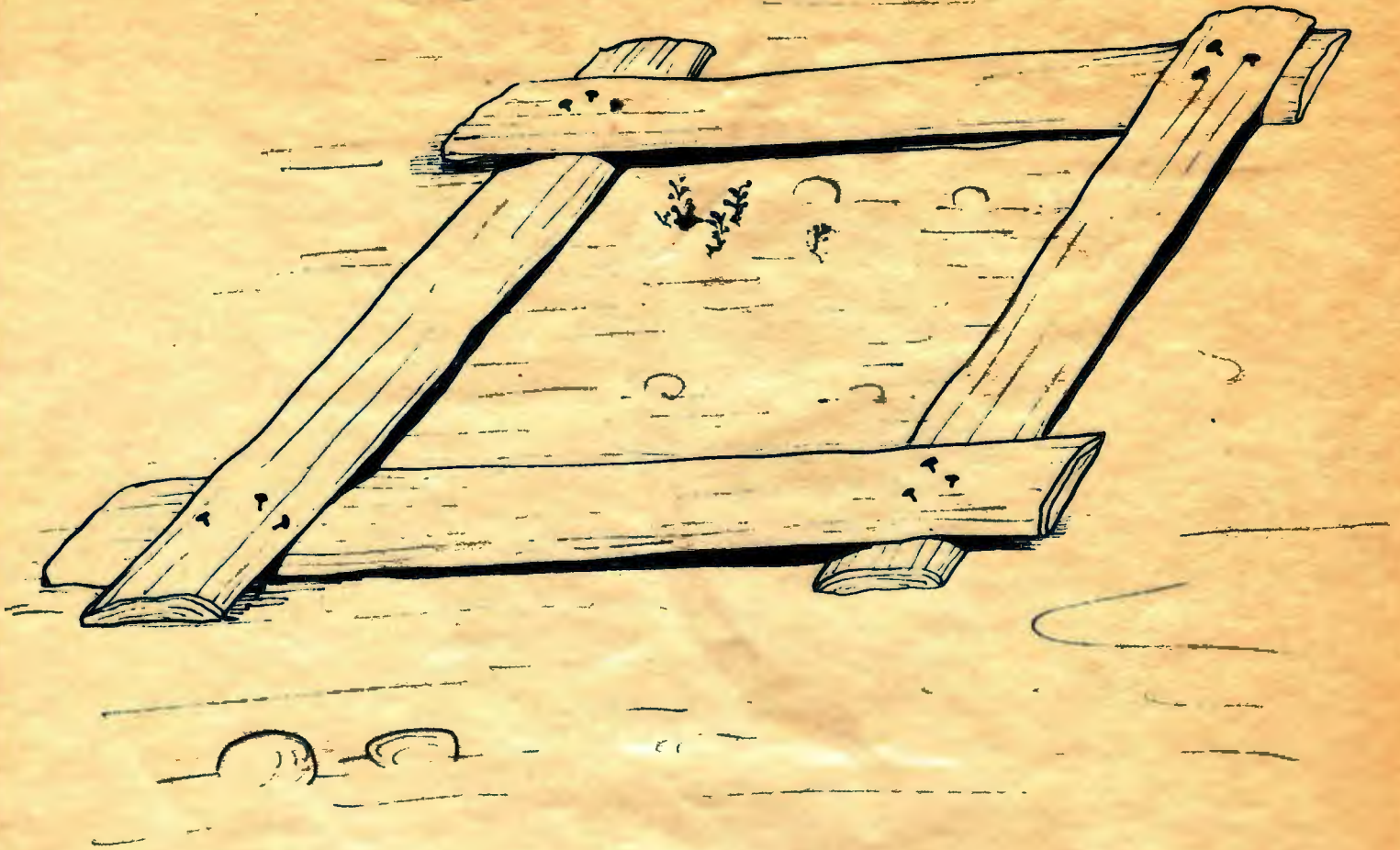


Figure 1

Slab device for increasing the spawning of blunt-nosed minnows, and for providing shelter especially for bass fingerlings.

To be installed in the shoal waters in depths of 1 to 1 1/2 feet.

The minnows spawn on the under surface of flat objects. The slabs are ideal for this purpose. Being put together as illustrated, the slabs will not tend to be buried quickly.

Small fish, especially small-mouth black bass fingerlings, use such crevices for shelter; so the device serves the double purpose of increasing food and providing shelter.

In some places weed beds will no doubt obtain a foothold within such shelters.

The size and shape of the slab constructions will depend on size of material available.

(6/11/27)

To accompany Report No: 127 - Hillsdale County Lakes

INSTITUTE FOR FORESTRY RESEARCH
UNIVERSITY OF MICHIGAN



Figure 2

Showing method of construction of large rectangular type of brush shelter. This shows how log frame is made in position, and how brush is attached - either whole bushes, snags or fagots of small brush.