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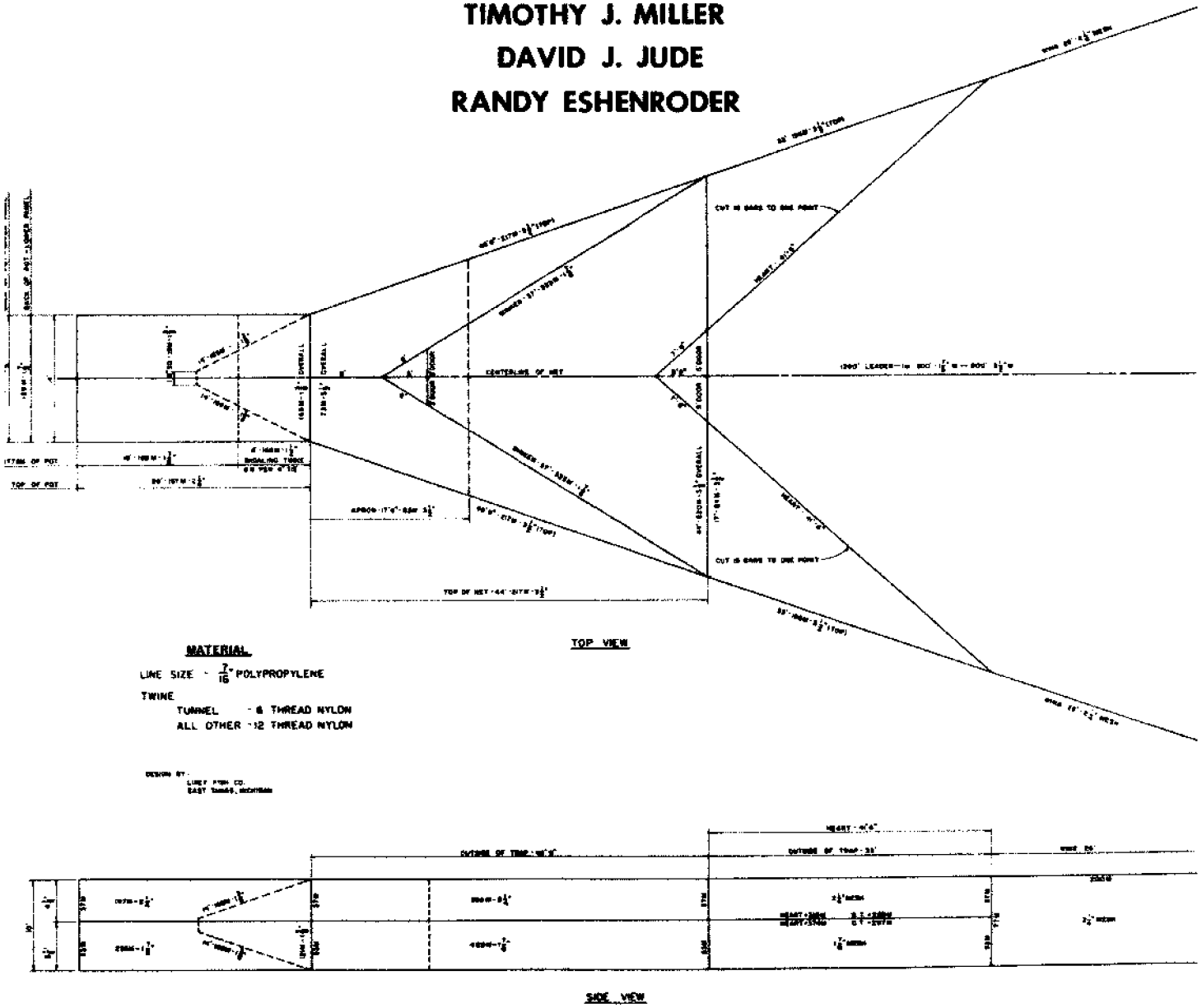

THE USE AND CONSTRUCTION OF SMALL-MESH TRAP NETS

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ABSTRACT

This report summarizes 2 years of use of small-mesh trap nets in the Great Lakes. A commercial fishing company used the nets in Saginaw Bay to exploit previously underused populations of round whitefish (*Prosopium cylindraceum)* and other shallow-water species. Small-mesh (1-3/8-in. and 1-1/2-in., stretch measure) nylon nets were successful in catching round whitefish, yellow perch and lake whitefish, among other species. These nets proved to be an inexpensive alternative to traditional large-mesh trap nets. This report outlines net design, construction and use in addition to catch statistics.

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INTRODUCTION

Two events have triggered an interest in the development of small-mesh trap nets. First, in 1974 the Michigan Department of Natural Resources (MDNR) banned the use of commercial gill nets. This action created an interest in alternative fishing gear which would be compatible with MDNR management goals. Second, the MDNR documented large stocks of round whitefish in the Tawas Bay region of Lake Huron. Because of offshore inaccessability and poorly developed fishing techniques, these stocks were relatively unexploited by either commercial fishers using standard large-mesh nets, or anglers. As a result, the MDNR, Michigan Sea Grant and Lixey Fisheries initiated a cooperative research effort in East Tawas, Michigan. The use of trap nets was desirable because they capture fish alive and allow non-target species (trout, salmon and undersize commercial species) to be released in keeping with MDNR management goals. Also, should rough seas prevent lifting of a net, even for 10-14 days, the catch would not be lost. Round whitefish is a very perishable species which must be taken alive and immediately iced if it is to be acceptable on the fresh-fish market. Flesh of round whitefish not taken in this manner soon becomes very soft and can be marketed only after being smoked.

The small-mesh trap nets which were used for this study were patterned after traditional large-mesh trap nets used for harvesting lake whitefish. However, in constructing the three nets fished during 1977, the large mesh of lake whitefish nets (usually around 8 in., stretch measure) was replaced with small mesh (2-1/4 in., stretch measure). Subsequent changes in the mesh sizes were made for the 1978 season to improve net efficiency and to correct problems identified during 1977.

In developing the small-mesh trap net, we had three major goals. First, we wanted to determine the largest possible mesh size that could be used in net construction without compromising net efficiency. We also wanted to determine the minimum height needed for the net. These considerations were important due to the expense of constructing small-mesh netting. Second, we had to avoid excessive gilling of fish in the net. Third, we wanted to design the pot so that alewives could escape during a lift.

BACKGROUND

Results of the 1977 season showed that both the 10 ft. and 15 ft. high nets were effective in capturing target species. We also established that either 2-1/4 in. or 3-1/2 in. mesh netting could be used in the leader, and that a net constructed with a single tunnel appeared to fish as well as a net with two tunnels. However, we quickly discovered that 2-1/4-in. mesh netting used in the hearts, tunnels and pots was too large. Large numbers of round whitefish and yellow perch were found to gill in these areas of the nets. The problem was most serious in the hearts and tunnels. While fish that were gilled in the pot could be removed by hand, the hearts and tunnels were not accessible. This necessitated trying to shake the gilled fish out of the net and allowing the remaining fish to decompose. When the hearts and tunnels contained large numbers of gilled fish, we found that the rate of catch decreased markedly. These findings resulted in changes

in net design for the 1978 season aimed at reducing the number of gilled fish to acceptable levels. To this end, a fourth net was constructed which made it possible to set the nets in pairs. Thus, comparisons between various net designs could be made. Setting the nets in pairs also aided in determining the largest mesh sizes that could be used in net construction.

Changes in net design for the 1978 season involved rebuilding the hearts (1-1/2-in. mesh twine) and tunnels (1-1/2-in. or 1-3/8-in mesh twine) and adding shoaling twine (1-7/8-in. or 1-1/2-in. mesh twine) to the lower portion of the pot walls. We also compared the relative efficiency of 2-1/4-in. and 3-1/2-in. mesh leaders. Individual specifications of the nets fished during 1977 and 1978 and the depths at which they were set are given in Tables 1 and 2, respectively.

RESULTS

Catch data for the 1978 season (Tables 3 and 4) failed to demonstrate any significant difference in efficiency between nets with 2-1/4-in. and 3-1/2-in. mesh leads. Nor was there any significant increase in catch for a 15 ft. high net compared with a 10 ft. high net.

The use of 1-3/8-in. and 1-1/2-in. mesh twine to reduce gilling in the hearts, tunnels and pots gave mixed results. While these mesh sizes significantly reduced the incidence of gilling of yellow perch and round whitefish, alewives continued to gill. However, gilling of alewives did not seem to decrease the efficiency of the nets to any great degree. Alewives were easily removed and any that remained in the net decomposed rapidly. The 1-7/8-in. mesh netting used for shoaling twine proved more efficient. This mesh size did not gill as many alewives; however, it was not as effective in reducing the number of yellow perch and round whitefish that were gilled. Weighing all factors, we concluded that the 1-7/8-in. mesh twine was the most desirable for construction of the hearts and winkers, and for use as shoaling twine. The 1-3/8-in. appeared to be best suited for the tunnels while 1-1/2-in. mesh twine was used in the pot bottom under the brailing area. Specifications of the final small-mesh trap net design are given in Fig. 1. The commercial fishers with whom we worked felt that including 1-7/8-in. mesh netting in the last 300 ft. of leader improved net efficiency. We do not have any information to support or reject this idea, but feel that 3-1/2-in. mesh netting would work as well in this area of the net. Inclusion of the 1-7/8-in. mesh netting will slightly increase construction costs.

CATCH STATISTICS

Catch results for the 1977 and 1978 seasons (Tables 3-9) showed that small-mesh trap nets were effective in capturing not only round whitefish, but also lake whitefish and yellow perch. In addition, 14 other non-target species (Table 10) were also taken. While non-target species were taken in low numbers, these data did demonstrate the potential for small-mesh trap nets to harvest some of these species, if the net is fished in the proper location. Species that showed particular promise were suckers *(Catostomus* spp.) and channel catfish *(Ictalurus punctatus).*

The total catch of round whitefish, lake whitefish and yellow perch for 1977 was 8,507, 1,514 and 1,395 lbs., respectively. This compares with the total catch of 20,435, 395 and 4,236 lbs. of round whitefish, lake whitefish and yellow perch, respectively taken during 1978. Examination of catch-per-unit-effort (CPE) (pounds/day) for round whitefish for 1977 and 1978 (Tables 3-9) shows the catch of round whitefish to be greatest during spring and early summer. Round whitefish catches usually declined during summer months, even offshore. During 1977, round whitefish catches increased again in the fall. However, during 1978, the decline in catch continued through the fall months. CPE for round whitefish was, almost without exception, greater at the deeper stations. From our experience, we found 40 ft. to be about the shallowest depth practical to fish trap nets, with a depth of around 60 ft. being preferable. During 1978, even for yellow perch, CPE was greatest from the deeper nets. During 1977, the CPE for yellow perch was about equal at all depths. Whitefish catch varied greatly between 1977 and 1978, but, in general, greater CPE could be anticipated at deeper sets.

CONSTRUCTION COSTS

Cost of construction of the trap net described in this paper (Fig. 1) is estimated at about $4,500/net (1978 dollars), including labor and materials. Commercial fishers who build their own nets can expect to pay around $2,700 for materials and invest about 124 hrs. in construction time. Construction time will vary, of course, depending upon the ability of the individual building the net. Hours quoted here are likely the minimum needed for an experienced net builder.

GREAT LAKES FISHING REGULATIONS

Fishing regulations governing the use of trap nets in the Great Lakes vary considerably from state to state. Differences in regulations involve fishing seasons, minimum and maximum depths for fishing trap nets, legal mesh sizes, legal species and corresponding size restrictions and restrictions on areas open to fishing. Other regulations concern the maximum distance from home port at which the licensee may fish, the minimum distance from shore at which a net may be set and the direction in which a net may face. Anyone wishing to fish small-mesh trap nets should first become familiar with state regulations.

OTHER CONSIDERATIONS

While small-mesh trap nets offer much promise for the commercial fishery, they are not without drawbacks. The initial investment in equipment might well be prohibitive to anyone wishing to enter this fishery for the first time. Adoption of small-mesh trap nets would be most feasible for commercial fishing operations with vessels which are already equipped for trap nets or which could accommodate trap nets with minimal modifications. The cost for a gillnetter to convert to trap nets may well prove prohibitive. Vessel requirements include not only a fish tug designed to accommodate lifting a trap net, but also a scow. It is used to transport the net to and from the fishing location at the beginning and end of the season. Because it requires about half a day to set or pull a commercial trap net, frequent relocation of a trap net is not practical. In our experience, we found that trap nets were usually fished in a single location for the entire season. This necessitates fishing a number of nets at various depths and locations to assure contact with the fish stocks throughout the season.

It is not feasible to use trap nets in all areas of the Great Lakes. They require areas with firm and regular bottoms that are free of debris. They cannot be fished in areas with swift currents, drifting debris or excessive algal fouling. Also, trap nets cannot be lifted during periods of even moderate wave action (anything greater than about 4 ft.). Therefore, trap nets must be fished in areas that are not subject to frequent rough seas by virtue of geography or climate. Trap nets fished in inshore waters may also conflict with the sport trolling fishery. Fished under proper conditions, however, the small-mesh trap net offers a versatile commercial gear capable of harvesting a variety of species while allowing for live release of non-target species.

TABLE 1

Mesh sizes (stretch measure) and net dimensions of three small-mesh trap nets set during May-October 1977 in 32, 42 and 57 ft. of water in Lake Huron off Au Sable Point, East Tawas, Michigan.

Net Description	Net Specifications	
	32-and 42-ft. sets	57-ft. sets
Net Height	10 ft.	15 ft.
Lead		
length	990 ft.	1350 ft.
mesh size	3-1/2 in.	2-1/4 in.
Wing		
mesh size	3-1/2 in.	2-1/4 in.
Heart		
length	24 ft.	44 ft.
mesh size	2-1/4 in.	2-1/4 in.
Tunnel(s)		
no. of tunnels	2	1
size of tunnel opening(s)	24 x 24 in. 18 x 18 in.	24 x 24 in.
mesh size	2-1/4 in.	2-1/4 in.
distance tunnel openings are offset from bottom of net	4 ft.	6 ft.
Pot		
no. of pots	2	1
total length	40 ft.	32 ft.
width	10 ft.	20 ft.
height	10 ft.	15 ft.
mesh size	2-1/4 in.	2-1/4 in.
Total Length of Net	1034 ft.	1412 ft.

TABLE 2

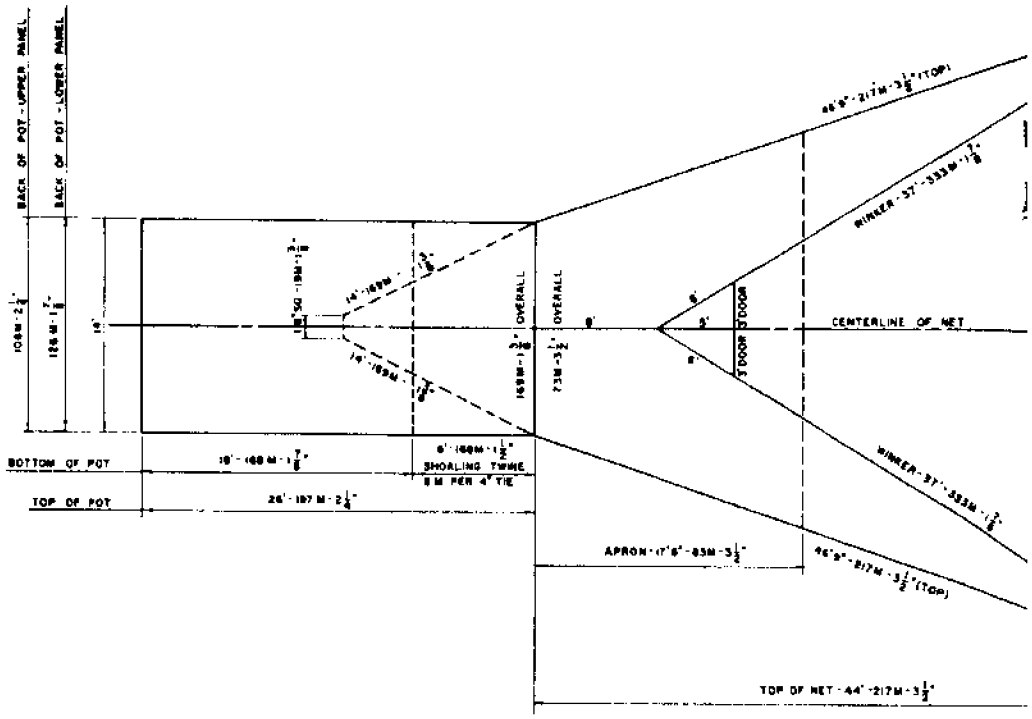
Mesh sizes (stretch measure) and net dimensions of four small-mesh trap nets set during May-October 1978 in 42, 44, 63 and 65 ft. of water in Lake Huron off Tawas Point, East Tawas, Michigan.

Net Description	Net Specifications		
	42-and 44-ft. sets	63-ft. sets	65-ft. sets
Net Height	10 ft.	10 ft.	15 ft.
Lead			
length	990 ft.	1350 ft.	1350 ft.
mesh size	3-1/2 in.	3-1/2 in. for first 1020 ft. 1-1/2 in. for final 330 ft. to pot	2-1/4 in.
Wing			
mesh size	3-1/2 in.	3-1/2 in.	2-1/2 in.
Heart			
length	24 ft.	24 ft.	44 ft.
mesh size	1-1/2 in.	1-1/2 in.	1-1/2 in.
Tunnel(s)			
no. of tunnels	2	1	1
size of tunnel opening(s)	18 x 20 in.	16 x 16 in.	24 x 24 in.
mesh size	1-1/2 in.	1-3/8 in.	1-3/8 in.
distance tunnel openings are offset from bottom	4 ft.	5 ft.	6 ft.
Pot			
no. of pots	2	1	1
total length	40 ft.	26 ft.	32 ft.
width	10 ft.	14 ft.	20 ft.
height	10 ft.	10 ft.	15 ft.
mesh size	2-1/4 in.	2-1/4 in.	2-1/4 in.
Shoaling Twine			
height on pot walls	5 ft.	5 ft.	7 ft.
mesh size	1-7/8 in.	1-7/8 in.	1-1/2 in.
Total Length of Net	1054 ft.	1400 ft.	1426 ft.

TABLE 3

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1978 from a small-mesh trap net set at 63 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
June	3	3400	103	100	3	2	<1
July	4	1256	41	18	1	191	6
August	9	1055	33	0	0	586	18
September	7	377	13	0	0	453	15
October	5	117	4	0	0	164	5
Total	28	6205	---	118	---	1396	---
Mean	6	1241	40	24	1	279	9



TOP V

MATERIAL

LINE SIZE - $\frac{7}{16}$" POLYPROPYLENE

TWINE:

TUNNEL - 6 THREAD NYLON

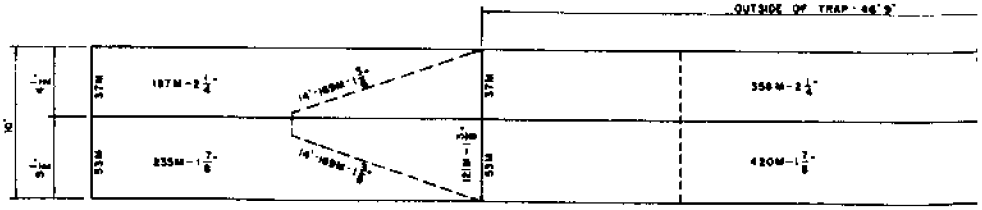
ALL OTHER - 12 THREAD NYLON

DESIGN BY

LIKEY FISH CO.

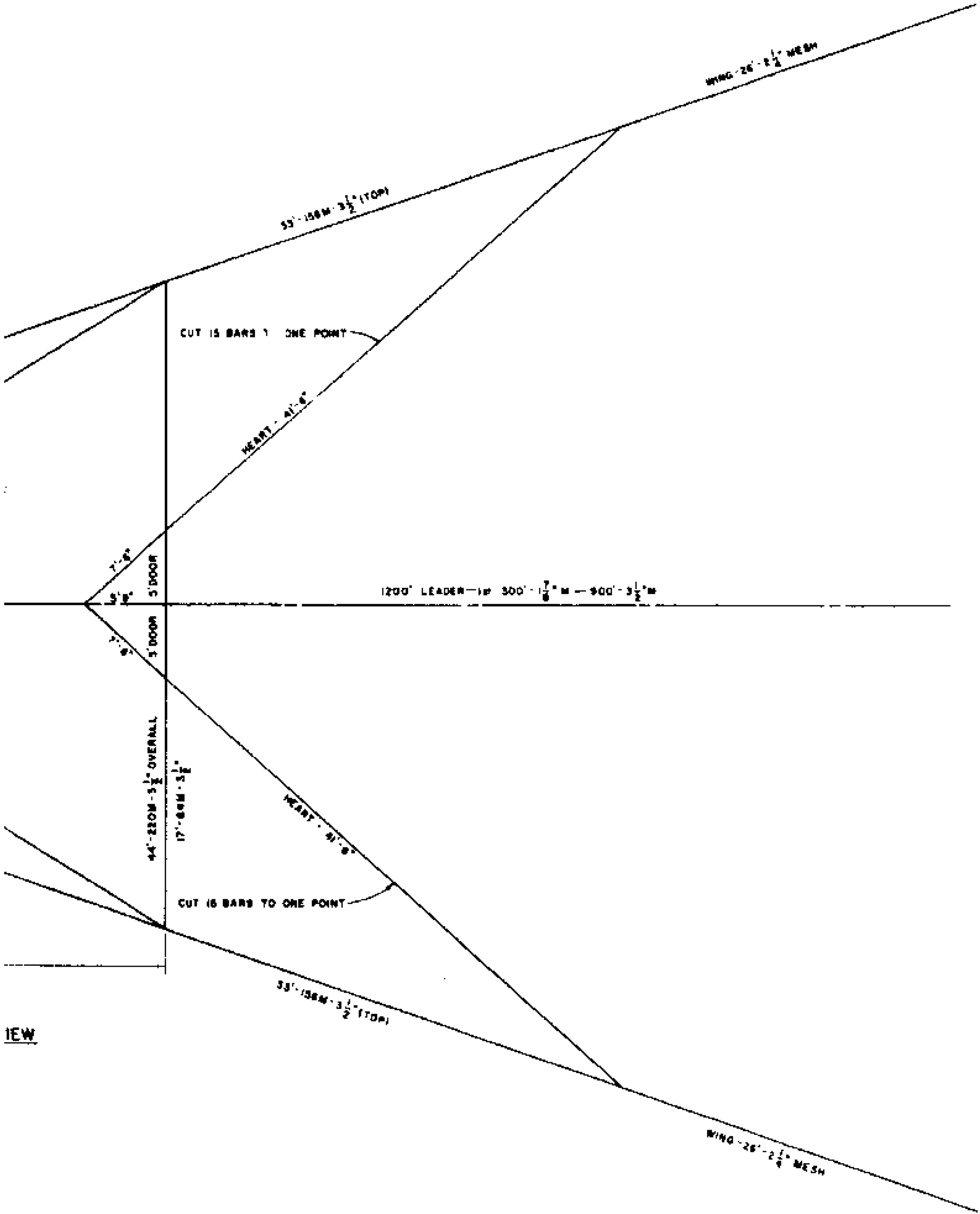
EAST TAWAS, MICHIGAN

SCALE: 1" = 8'



SIDE

Figure 1. Construction specif
Full-sized blueprints (24 in. by 36 in.) o
from Michigan Sea Grant, 2200 B



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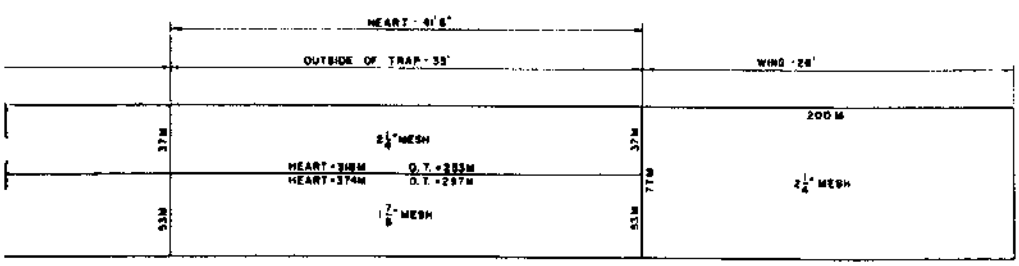

VIEW

ications for a small-mesh trap net.
f this net design can be purchased for $2.00
onisteel Blvd., Ann Arbor, MI 48109

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ASSOCIATES, INC.
405 RIVER STREET ALPENA, MICH. 49707

TABLE 4

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1978 from a small-mesh trap net set at 65 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
June	3	3299	114	198	7	<1	<1
July	4	2131	65	7	<1	176	5
August	9	1137	34	0	0	486	15
September	5	415	14	0	0	261	9
October	4	103	3	0	0	139	4
Total	25	7085	---	205	----	1062	----
Mean	5	1417	45	41	1	212	7

TABLE 5

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1977 from a small-mesh trap net set at 32 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
May	3	215	15	10	1	0	0
June	6	579	19	56	2	50	2
July	5	268	9	0	0	30	1
August	5	349	11	17	1	255	8
September	5	388	13	14	< 1	154	5
October	4	399	23	0	0	61	4
Total	28	2198	---	97	---	550	---
Mean	5	366	14	16	1	92	4

TABLE 6

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1977 from a small-mesh trap net set at 42 ft. in Lake Huron in the vicinity of East Tawas, Michigan. Number of net lifts is also given.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
May	3	344	25	16	1	15	1
June	6	786	26	239	8	21	1
July	6	396	13	0	0	57	2
August	5	434	14	0	0	162	5
September	5	367	12	5	<1	169	6
October	4	434	26	0	0	85	5
Total	29	2761	----	260	---	509	----
Mean	5	460	18	43	2	85	3

TABLE 7

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1977 from a small-mesh trap net set at 57 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish lbs. of Fish Netted	Round Whitefish CPE (lbs./ day)	Lake Whitefish lbs. of Fish Netted	Lake Whitefish CPE (lbs./ day)	Yellow Perch lbs. of Fish Netted	Yellow Perch CPE (lbs./ day)
June	1	180	20	619	69	0	0
July	7	1768	57	471	15	10	< 1
August	5	627	20	48	2	169	5
Setpember	4	434	14	19	1	99	3
October	4	539	32	0	0	58	3
Total	21	3548	----	1157	----	336	----
Mean	4	710	30	231	10	67	3

TABLE 8

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1978 from a small-mesh trap net set at 42 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
May	6	872	32	0	0	1	<1
June	6	1577	45	27	1	2	<1
July	5	432	15	0	0	306	11
August	8	885	27	0	0	321	10
September	6	446	17	0	0	189	7
October	4	238	8	0	0	185	6
Total	35	4450	----	27	---	1004	-----
Mean	6	742	25	4	<1	167	6

TABLE 9

Landed weights (lbs.) and catch-per-unit-effort (CPE) (lbs./day) for round whitefish, lake whitefish and yellow perch taken during 1978 from a small-mesh trap net set at 44 ft. in Lake Huron in the vicinity of East Tawas, Michigan.

Month	Number of net Lifts	Round Whitefish		Lake Whitefish		Yellow Perch	
		lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)	lbs. of Fish Netted	CPE (lbs./ day)
May	6	606	22	0	0	10	<1
June	4	821	23	45	1	2	<1
July	3	360	13	0	0	199	7
August	8	505	15	0	0	338	10
September	4	272	10	0	0	92	3
October	4	131	4	0	0	133	4
Total	29	2695	---	45	---	774	---
Mean	5	449	15	8	<1	129	4

TABLE 10

Numbers of non-target fish species caught in small-mesh trap nets during 1977 and 1978. Nets were set in Lake Huron in the vicinity of East Tawas, Michigan.

Species	Number of fish	
	1977	1978
Lake whitefish *(Coregonus clupeaformis)* (under-sized)	25	814
Lake trout *(Salvelinus namaycush)*	41	146
White sucker *(Catostomus commersoni)*	44	64
Longnose sucker *(C. catostomus)*	73	17
Carp *(Cyprinus carpio)*	3	10
Channel catfish *(Ictalurus punctatus)*	2	123
Burbot *(Lota lota)*	0	2
Sea lamprey *(Petromyzon marinus)*	0	2**
Gizzard shad *(Dorosoma cepedianum)*	0	1
Alewife *(Alosa pseudoharengus)*	*	*
Coho salmon *(Oncorhynchus kisutch)*	3	0
Chinook salmon *(O. tshawytscha)*	1	0
Brown trout *(Salmo trutta)*	2	0
Rock bass *(Ambloplites rupestris)*	1	0
Shorthead redhorse *(Moxostoma macrolepidotum)*	1	0

* Alewives were frequently seen in the nets but were seldom landed because they escaped from the net.

** Sea lamprey taken were attached to other fish.