Original: Fish Division
cc: Mr. Ralph Marks 7-7-42
Mr. Frank Hoard 7-7-42
Mr. Dexter Reynolds 7-7-42

Education-Game
Dr. Shetter

INSTITUTE FOR FISHERIES RESEARCH
DIVISION OF FISHERIES
MICHIGAN DEPARTMENT OF CONSERVATION
COOPERATING WITH THE
UNIVERSITY OF MICHIGAN

ALBERT S. HAZZARD, PH.D.
DIRECTOR

ADDRESS
UNIVERSITY MUSEUMS ANNEX
ANN ARBOR, MICHIGAN

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REPORT NO. 792

REPORT ON THE OPERATION OF THE CRYSTAL LAKE OUTLET WEIR, AND OBSERVATIONS ON THE POSSIBLE LAKE SPAWNING OF THE SMELT IN CRYSTAL LAKE, BENZIE COUNTY, WITH GENERAL NOTES ON THE SMELT SITUATION IN CRYSTAL LAKE

by

David S. Shetter and Dexter Reynolds

In July, 1941, the writer and Dr. Hazzard, accompanied by Frank Hoard, District Supervisor for the Field Administration Division inspected the outlet and also contacted "Cap" Morrill of Beulah with reference to a complaint by Morrill that large numbers of game fish and their young were being lost to Crystal Lake because they were swept over the outlet dam which is located on the southeast shore of Crystal Lake in Section 20 of T. 26 N., R. 15 W. We suggested various simple devices that Morrill might install to obtain a sample of the species of fish reported to be lost and he said at that time (July, 1941) he would try to install such a device and obtain samples of the fish lost to the lake. Because of the press of business matters, Morrill never carried out his promise.

When Dexter Reynolds was assigned to the care and operation of the Platte River Weir not far from Crystal Lake in the late fall of 1941, we instructed him to build and operate a simple fish trap at the most convenient site as close as possible to the outlet dam. Accordingly,

Reynolds installed a single blocking arm made from hardware cloth of approximately 1/4" mesh stapled to a frame 10 feet long and 2 feet wide, made from 1" x 4" lumber. This blocking arm led the fish to a small box trap approximately three feet long, two feet deep and about 1½ feet wide, which was provided with a lid which was kept locked. The first installation of the trap and blocking arm was completed on December 30, 1941. The weir was located first between the outlet dam and the road bridge, but was later placed below the railroad culvert (January 26, 1942) after Reynolds observed that there was a tendency for the structure to be frozen in completely during severe cold weather.

Reynolds was instructed to visit the Crystal Lake outlet weir as often as was feasible under the existing tire situation, and to combine trips to the outlet weir with other field activities in the immediate vicinity. After installation on December 30, 1941, the site was visited and checked by Reynolds on 22 different occasions as follows:

January 11, January 18, January 24, January 26 (rebuilt and reset at new location below railroad culvert), January 30; February 3, February 6 (collected samples of lake emerald shiners from trap (Notropis atherinoides), February 10, February 14, February 19, February 22; March 16 (weir was smashed by party or parties unknown between this date and next visit on March 22, and Reynolds repaired and replaced the weir on March 23, but on his next visit on April 1, he again was forced to rebuild the weir as it had been broken between March 23 and April 1); April 4 (17 smelt taken in trap), April 6 (one section of blocking arm was removed to permit passage of floe ice coming down from Crystal Lake), April 9, April 23, April 28 (weir broken up and smashed between this date and May 3, date of last visit).

Evidently few fish moved out of Crystal Lake during January and February, as the only mention made of any fish taken by the trap was concerning the collection of lake shiners taken on February 6 (specimens on file in the Institute fish collection). The only other fish recorded as caught by the weir were 17 smelt taken on the night of April 4. These were smelt which apparently were seeking spawning grounds.

Pertinent to the situation at the Crystal Lake outlet are the following remarks, extracted from a letter to Shetter by Dexter Reynolds written on May 8, 1942. Reynolds writes:

> "The Cold Creek run of smelt was a fizzle as indicated in a past letter. There were about 400 dippers the first night with very little success. During the entire run only three successful dips were enjoyed and any dipper getting more than 50 smelt felt lucky. The first blush of enthusiasm soon wore off and the crowds dwindled steadily to the twenty or thirty previously mentioned. One night's dip was a complete washout as a strong northwest wind piled ice along the east shore and blocked the creek mouth.-------
>
> "---- It was a different matter at the outlet. Cap Morrill checked it four nights and I know from having talked with various participants that the picture was different. The run (of smelt--D.S.S.) was tremendous. Anywhere from 20-50 dippers were in attendance every evening. A gunnysackful was generally accepted as a good take. I previously mentioned this minnow dealer having trapped 600 pounds in his boxes (located just south of M-115 on the outlet--D.S.S.). There were many people who did not go to the Beulah run. All this transpired without my knowing too much about it. The run (of rainbow trout on the Platte River--D.S.S.) was on here (and Reynolds had to tag and transfer the rainbows--D.S.S.) and some of the local boys threw me off the track with their estimates. I recorded no temperatures other than on the smelt shelter investigations.
>
> "The men interested in conserving fishing in Crystal Lake are hot for a screen across the outlet. I can't tell you what went over last week as somebody has again smashed the trap up. I really believe that it is useless to try and check this form of vandalism. When I obtained the easement from Mrs. Pember she informed me that the screens which she put in were given the same treatment.-----"

Investigations on the Possible Spawning of Smelt in Crystal Lake Proper

Metzelaar and Langlois (Investigations on the smelt of Crystal Lake, Benzie County, Michigan. Unnumbered Institute Report, May 7, 1930) mentioned testimony (pages 9, 10) of J. Long of Beulah, and Mark Crow, Conservation Officer, concerning lake spawning of the smelt, but were unable to obtain definite evidence of such spawning. When Reynolds was stationed in Benzie County he was also assigned to study this problem.

The author and Dr. Hazzard suggested that he use the method of smelt egg collection in lake habitats outlined by the above-mentioned report (page 18) which consists of placing the outer ends of cedar boughs on likely spawning grounds.

Reynolds followed our suggestions, and constructed 21 egg-catching devices made from cedar boughs. The egg-catching devices, or "smelt shelters", were roughly star-shaped and varied in diameter from 28 to 34 inches and about 8 inches in depth. The butt ends of the branches were tied together and the devices either were weighted with a gunnysack full of sand, or were staked to the lake bottom. These "smelt shelters" were placed in the localities indicated on the accompanying map on February 24 and 25, 1942, when there was still an ice cover of 8 to 24 inches at all points. All shelter localities were sufficiently distant from creek mouths so that any smelt eggs found on them could be said to have originated from lake-spawning smelt.

A brief description of the location of each "shelter" and the territory in which it is placed is given in Table 1. These devices were placed in water varying in depth from two to six feet deep over sand, gravel, stones and varying combinations of these bottom types.

Reynolds made five circuits of inspection to check the devices for the presence of eggs and to take water temperatures. The observations made are summarized in Table 2. According to Reynolds' notes, one smelt egg was found on shelter no. 9 near Robinson Creek on April 30, 1942. None were found at any time on any of the others. Reynolds' last observations were made on April 30. It was unfortunate that both the peak of smelt spawning activity on Crystal Lake and the rainbow spawning run on the Platte River occurred almost simultaneously. This condition prevented Reynolds from devoting more time to observations on Crystal Lake.

Reynolds' observations written on April 30, 1942, are quoted here because of their relationship to the question of whether or not the smelt spawn in the lake, and also because of their relationship to the outlet problem. He writes:

"Crystal Lake Smelt Spawning Shelters

The investigation conducted around Crystal Lake as to whether or not the smelt spawned in the lake proper did not reveal any eggs laid on the cedar bough shelters placed at various points in the lake. With one exception--where one egg was found on a shelter at the mouth of Robinson Creek.

"It must be remembered that the shelters were placed during the time when the lake was covered with ice. It was found that many were not well located when the ice cleared away in the breakup. It was suggested that they be visited bi-weekly after the ice broke up but the Platte River weir had a big spawning run during the same time and this program was not followed.

"It was noticed on one visit to the shelters that the stony bottom around the mouth of Glen Rhoda Creek had many places apparently fanned off by the smelt. It is my suggestion to concentrate a number of shelters at this locality if further investigation is deemed desirable.

"There is no doubt that many thousands of these fish are irrecoverably lost at the outlet. They are caught in the current and swept over the check dam and again through a culvert just south of the first retaining wall. This situation has

not been of recent development but has apparently gone on for years. Due to the desire of local tradespeople in Beulah to garner all that could be had from the well-advertised run in Cold Creek this situation was more or less kept quiet until this year. General fishing was poor during the winter months and now the crux has developed that the smelt need protection during the spawning season. The trap at the outlet is not big enough to hold the smelt and one wing was removed for safety's sake.

"There is no doubt in my mind that the smelt do spawn in the lake. There is some wrinkle not yet found that can produce conclusive evidence. I would suggest:

1. To study the school habits of the smelt at Windemere and Glen Rhoda Creeks. Also along the shoreline adjacent to Oleson's Bay and what is known as the "Girls' Camp".
2. To place shelters in these restricted areas. The shelters should not be placed until more is known of the smelt habits such as any tendency to congregate, to favor certain depths, to favor certain types of lake bottom or any such features as might be picked up by observation."

D. B. Reynolds, Jr.
4/30/42

Recommendations

1. Because of the time and expense involved in the constant repair of the Crystal Lake outlet weir after continued breakage by unknown vandals, we suggest that Dexter Reynolds be relieved of the responsibility of the maintenance and checking of this weir, and that any studies concerning the Crystal Lake outlet be abandoned for the present.

Any such structures placed here in the future should be erected and financed by the local sportsman's organization or Chamber of Commerce, under supervision of the Fish Division.

A possible solution to the satisfaction of all concerned would be the erection of a fish ladder over the outlet dam. This would be quite feasible as there is only a four-foot head of water where the lake flows into the outlet stream. If a fish ladder were placed here, the fish would be free to make the choice of where they would go, and no one could argue

that they were being "lost" to Crystal Lake if they did not desire to return there. According to Morrill and other officials of the town of Beulah, money for such worthy projects could be obtained by popular subscription.

2. We would recommend that Reynolds try to obtain more complete evidence of lake spawning of smelt next winter (1943), particularly in the vicinities he believes them most likely to spawn.

3. If it seems desirable to the Department to protect the spawning run of smelt in Cold Creek proper, the method suggested by Metzelaar and Langlois (pages 36-37), that of establishing a spawning sanctuary in the extreme lower waters of Cold Creek and allowing no dipping until the smelt had spawned for three days in this general area, appears worthy of consideration. Such protection might also be given spawning smelt in the outlet if the fish ladder is built.

Literature Cited

Metzelaar, Jan, and T. H. Langlois, 1930.

Investigations on the smelt of Crystal Lake, Benzie County.

Unnumbered Institute Report.

INSTITUTE FOR FISHERIES RESEARCH

By David S. Shetter
and
Dexter Reynolds

Report approved by: A. S. Hazzard

Report typed by: R. Bauch

Table 1

Description of "smelt shelter" locations,
Crystal Lake, Benzie County, 1942

N.B.	Shelter	Location
	# 1	Windemere Creek--2 chains east from telephone pole. Two chains, 2 paces south.
	# 2	Windemere Creek--2 chains west of creek to telephone pole. 135' south.
	#14	Cold Creek--North to two Betula alba, north of street. 2 chains west.
	#15	Cold Creek--North of two white birch to clump of 3 popple. West 2 chains.
	#16	Cold Creek--North of three popple to 5" cedar (lone). West 1½ chains.
	#17	Cold Creek--South of creek to lone elm on north side of hotel. West 2 chains.
	#18	Cold Creek--South of creek to lone elm. South to two balsam (lone). West 1½ chains.
	#19	Cold Creek--South of road to white phone pole. West 2 chains.
	#20	Cold Creek--South to brick building about 30' from shore near spring, plainly visible.
	# 3	Cap Morrill's--Four miles west and north of Beulah on North Shore Road. South 1½ chains from dock.
√*	# 4	Glen Rhoda Creek--Due south from creek's mouth by 2 chains.
√*	# 5	Glen Rhoda Creek--East of creek to first phone pole. SSW 220'.
	# 6	Point Winetka--East by 2 chains from north fence corner of private property.
	# 7	Schauf Creek--East of creek to stationary bench. North 100'.
	# 8	Schauf Creek--West of creek to 4" cedar. North 2½ chains.
	# 9	Robinson Creek--East of creek to second Lombardy popple. North 2 chains, 4 paces.
	#10	Robinson Creek--Directly north of creek 135'.
√*	#11	Crystal Outlet--NNE from cedar on point 1½ chains.
	#12	Crystal Outlet--West 60' from #11.
	#13	Crystal Outlet--West shore of outlet to frame. North 72-75'.

√* From notes on habits, these should produce.

Table 2

Results of examination of smelt egg collecting devices, Crystal Lake, Benzie County, 1942.
(See Table 1 and map for locations)

Shelter number	Depth (in feet)	Character of bottom	Examination 3/20/42			Examination 3/27/42			Examination 3/30/42			Examination 4/9/42			Examination 4/30/42	
			Water temp.	Ice	Smelt eggs	Water temp.	Ice	Smelt eggs	Water temp.	Ice	Smelt eggs	Water temp.	Ice	Smelt eggs	Ice	Smelt eggs
1	3	Sand and gravel	34°	Rotten	None	33°	Rotten	None	33.5°	Open	None	40.5°	Open	None	None	None
2	3½	Sand and gravel	34° (Windemere Cr.-44°)	"	"	33°	Open (Windemere Cr.-42°)	"	33° (Windemere Cr.-40°)	"	"	40.5° (Windemere Cr.-43°)	"	"	"	"
3	5	Gravel and sand	33°	Rotten	None	33.5°	Rotten	None	33°	Open--Floes	None	40.5°	Floes	None	"	"
4	6	Sand with few pebbles	33°	"	"	33°	Floes	"	33°	Open	"	40°	"	"	"	"
5	4½	Sandy	33.5° (Glen Rhoda Cr.-43°)	"	"	33° (Glen Rhoda Cr.-41°)	"	"	33° (Glen Rhoda Cr.-40.5°)	Open	"	40° (Glen Rhoda Cr.-45°)	"	"	"	"
6	4	Sandy	33°	Rotten	None	33°	Rotten	None	33°	Rotten	None	40.5°	Floes	None	"	"
7	4	Sandy	33°	"	"	33°	Rotten--Floes	"	33°	"	"	40.5°	"	"	"	"
8	3½	Sandy	33° (Schauf Cr.-40°)	"	"	33° (Schauf Cr.-39°)	" "	"	33° (Schauf Cr.-37.5°)	"	"	40.5° (Schauf Cr.-43°)	"	"	"	"
9	1½	Sandy	34°	Rotten	None	33°	Big floes	None	33°	Floes	None	40°	Floes	None	"	1
10	3	Sandy	33° (Robinson Cr.-38°)	"	"	Couldn't reach--covered by heavy floe ice. (Robinson Cr.-38°)			33.5° (Robinson Cr.-38°)	"	"	40°	Open (Robinson Cr.-43°)	"	"	None
11	3	Stony with sand and gravel	33°	Rotten	None	33°	Floes	None	33°	Rotten	None	Smashed by shore ice			"	"
12	3	Gravelly	33°	"	"	33°	"	"	33°	"	"	Removed by dippers (?)			"	"
13	2½	Sandy	33° (Outlet Stream-35°)	"	"	33° (Outlet Stream-35.5°)	"	"	33° (Outlet Stream-35°)	"	"	40°	Floes (Outlet Stream-40°)	None	"	"
14	To be placed later near Cold Creek											Destroyed by vandals				
15	3½	Sand and gravel	33° (Cold Creek-35.5°)-(1 smelt seen)	Rotten	None	34°	None	None	34°	None	None	40°	Open	None	"	"
16	4	Sand and gravel	35.5°	Rotten	None	33°	Rotten	None	33°	Floes	"	40°	"	"	"	"
17	4½	Sandy (near bathing beach)	33°	"	"	33°	"	"	33°	"	"	40°	"	"	"	"
18	2½	Stony	33°	"	"	33°	"	"	33°	"	"	40°	"	"	"	"
19	2½	Stony	33.5°	"	"	33.5°	"	"	33°	"	"	40°	"	"	"	"
20	2	Stony	33.5°	"	"	33°	"	"	33°	"	"	40°	"	"	"	"
21	2	Stony	33°	"	"	33°	"	"	33.5°	"	"	40°	"	"	"	"