copy to: Crystal Lake Club
D. H. Thompson

July 31, 1934

Report 250

REPORT ON A FISH MANAGEMENT POLICY FOR THE NEW CRYSTAL LAKE CLUB

Location of Club Property

The New Crystal Lake Club upon which this report is based, is situated in Henderson County, Illinois some 2 1/2 miles due east, of Burlington, Iowa, and is immediately east of the Mississippi River.

History of Property

Independent drainage unit Crystal Lake and adjacent waters on the club property were formerly connected with the Mississippi River in flood season, through Stoney Lake. When the local drainage district was improved, about 1912-1914, the club lands were separated from the river by a levee high enough to hold out all flood waters. The eastern, southern and northeastern boundaries are lined by drainage ditches, so the club-property is at present an independent drainage unit.

Change in fish management problems Formerly fish came in during high water and were stranded in the lake and adjacent sloughs, providing famous fishing. Now this source of fish supply is practically eliminated and the lake is held higher than the river when the latter is low. Hence the fish management problems are now quite different from those of former years.

Present Conditions

Upper and Lower Grounds The club property is divided into an Upper Ground and a Lower Ground by a levee, as shown on the plot of the club grounds. The watershed in the Upper Ground is held higher than in the lower, especially during the duck season. The Upper Ground sloughs tend to go dry in summer, and are considered, probably correctly, as impractical to develop for fishing. The club waters considered worth developing are on the Lower Ground and consist primarily of Crystal Lake and Stoney Lake.

Stoney Lake little fished Stoney Lake is fished very little by club members because of very poor access to it. It is extremely difficult even at moderately higher water levels to get a boat through the passage connecting it with Crystal Lake. About three years ago this passage was blown out with dynamite, but filled in again because of the soft mud bottom.

Water Supply When the Mississippi River reaches the 7 foot stage at the railroad bridge in Burlington, the Club is allowed to run water in through the connection between Stoney Lake and the river until this lake reaches the level of the 7 foot stage at the railroad bridge. Stoney Lake was recently filled to the 7 foot point but due to Crystal Lake being cut off by the silting in of the ditch, it was not filled to the 7 foot height. The most constant water supply is through the 4 large artesian wells which are located on the Upper Grounds, and the one large well which is on the Lower Ground by the shore of Crystal Lake near the club house. Some water is also supplied through seepage.

Suitability of Water The water in the lakes, on the day of this investigation, July 4, 1934, gave every indication of being suitable for fish life. The moderate salt content (magnesium salts?) of the artesian water supply may be accumulating slightly through evaporation, and may be responsible for the slight whitish crust formed on the mud as the lake level falls. There seems to be no cause for concern from this angle, however.

The cold artesian water from the well near the Clubhouse does not produde any apparent thermal stratification in the adjacent deep pocket, where the depth is 9 feet at low water stage.

Vegetation

Water lily Beds — At the time of this investigation the water lily beds were flourishing in shallow water and on the sand and mud bank exposed by the falling of the water to a foot or more below the seasonal level. We understand that this low level plus excessive heat has decreased the area of lily beds this summer. (See vegetation chart.) Ordinarily they are so extensive and thick that cutting with a mire saw is practiced rather extensively to produce open water in front of the blinds for duck-shooting. As this is done in the fall, not long before the lily leaves would die down, it should not very seriously harm the cover for the fish, unless it be carried to excess. If brush shelters for young fish as suggested later under "Recommendations", are installed, a moderate reduction of lily beds should make no material difference.

Cattails — Cattail marshes line a considerable portion of the eastern shores of the northern portion and arms of Crystal Lake and along the east side and bay of Stoney Lake. At the usual summer levels these are almost entirely exposed.

Lack of Submerged Aquatics — The almost complete lack of submerged aquatic plants in Crystal Lake (lilies are floating, cattails emergent) is unfortunate, as this leaves the lake poor in underwater cover and holds down food production (especially for bluegills). The roily water (bottom visible for only a foot or so) probably accounts for this lack of weeds, and the carp and buffalo are probably responsible for the roiliness.

Algae — In the morning of our visit we found a fairly heavy growth of planktonic green algae (each plant microscopic in size) where it had concentrated along shore near the boat house. By night on this hot day, this was

replaced by an oily brown mass which has caused considerable worry recently (late May and early June of this year) and has interfered some with swimming, though not causing any noteworthy odor nuisance. (Slight odors of stagnation this spring, and summer are probably referable correctly to the drying up of "Black Jack" basin.) This oily brown material, partly streaked through the water and partly floating, seems to be the decaying remnants of the minute plant life which makes the greenish water. It is said that this summer was the first time the algae have been noticed. This is explainable as due to the low water stage and the heat, and to the partial depletion last year and this spring of the gizzard shad, which feeds on just such growths.

Fish Present

"Pickerel" Like many lakes intensively fished Crystal Lake has gone through changes in game fish populations. In general fishing "ain't what she used to be". The northern pike or "pickerel" which furnished the trophies on the club walls seem now to be exterminated—which is hardly to be regretted, as other fish will produce much more total poundage and are less destructively predaceous. It was reported that no northern pike have been caught in the last four years at least.

"Walleyes" The pike-perch or "walleye", though formerly abundant, have been very scarce for some years. The seining of two half years show the species to be still extant, and possibly on the increase again.

Large-mouth Bass Large-mouth bass are the natural game fish for this lake. Trophies on the club walls attest the fine sizes which have been taken—a 7 pounder in 1899, a 6 1/4 pounder in 1909, etc. One of four pounds was recently taken. We understand bass fishing has been fairly good again this year after a number of poor years. Since the food is not scarce the decline in the bass is attributable to overfishing and the scarcity of spawning beds.

Small-mouth Bass Small-mouth bass are poorly suited to this lake, though a very limited number could exist around the artesian well inlet, and might even spawn on some of the gravel piles later recommended for this firm shore area.

Crappies — Crappies are fairly common, the white crappie over the more or less muddy shoals, and the black crappie in the deep hole off the sandy shore.

Bluegills — Bluegills (locally "sunfish") are abundant, probably the result of heavy stocking in the very recent years. The size runs small, generally just under the legal limit.

Yellow Bass — The little yellow bass (locally "striped bass") is abundant enough, perhaps too much so.

Coarse Fish Present

Carp — Carp abound in the lake being seen in considerable numbers splashing and feeding around shore. The record of coarse fish seemd by one man (John Van Blaracan) alone, with a 200 yard 1" seine (now shrunk to about 150 yards and 3/4" mesh) in only a fair state of repair and without baiting and largely by day, indicates a heavy ênncentration of carp. (See chart on following page.) The roiliness of the water confirms this conclusion, ad does also the small size and rather emaciated and sometimes diseased appearance of the carp (which by the way limits the sale). Carp up to only 10 lbs. in weight are reported as caught, but they are long enough to weight 14 lbs. The carp seen were "scrawny" with prominent though hard heads (denoting age, slow growth and lack of proper food). As John puts it, they are "like eels with scales on". John estimates the average dressed weight to be 1 1/2 lbs.

Buffalo — These fish, though not very abundant, reach a large size (15 lbs.) and are in good condition. Of the buffalo seined nearly all were large-mouth buffalo, two were small-mouth buffalo and one a black buffalo. One river carp (Carpiodes cyprinus), a related form, was also seined.

Bullheads — These are said to be fairly abundant, though only one, a black bullhead was caught.

Record of Coarse Fish Removed Recently

Year & date	Carp lbs.	Buffalo & carp lbs.	Buffalo no.	Dogfish no.	Turtles no.	Shad lbs.
1933						
Aug. 2	225	-	-	-	-	-
Aug. 15	150	-	-	-	-	-
Sept. 3?	100	-	-	21	-	-
Sept. 4?	75	-	-	11	-	-
Sept. 4-7	125	-	-	12	3	-
	200	-	-	13	4	-
	200	-	-	25	-	-
Sept. 24	-	300	-	-	-	-
Oct. 16	50	-	5	-	-	-
17	225	-	-	7	-	-
Nov. 2	-	300	-	-	-	-
Nov. 3	-	-	-	-	-	8000
Nov. 7-8	-	675	-	-	-	-
Nov. 8-9	-	475	-	-	-	-
Estimated total	1350	1750	5	89	7	8000
1934						
Jan. 27	145	-	-	-	-	1100
Feb. 16	800	-	-	-	-	-
Mar. 4	275	-	-	-	-	-
Mar. 27	-	750	-	-	-	-
Mar. 31	-	125	-	-	-	-
Apr. 2	500	-	-	7	-	600
Apr. 6	125	-	-	-	-	-
Apr. 12	500	-	-	-	-	-
Apr. 16	250	-	-	-	-	-
Apr. 18	400	-	-	-	-	-
Apr. 23	-	200	-	-	-	-
Apr. 24	125	-	-	-	-	-
June	100*	-	-	-	-	-
June	450	Some	-	-	-	-
Estimated total	3420	1325	Some	7	-	1700

*Boat leaked

Sheepshead — These fish (locally "perch" as the true perch, yellow perch or ringed perch is all but absent—Frederick Leopold reports having seen only 1 or 2) is present in rather small numbers.

Channel Catfish — Channel catfish are reported to be caught occasionally up to 15 lbs. in weight, though are not common enough to warrant removal. The variety offered in catching such fish occasionally must add to the interest in fishing.

Obnoxious Fish and Turtles

Gars and Dogfish — Gars fortunately are now scarce, and should be kept so. Only one was seined, and removed a short-nose gar (John reports all to be of this species). Formerly, the open connection with the Mississippi River gave the gars and dogfish of that river ready access to the club waters, and is the reason for the former abundance of both these fish. Dogfish at present are fairly common.

Snapping Turtles — Snapping turtles are rather common and should be removed as later explained under "Recommendations".

Forage Fish

Except for the gizzard shad, forage fish are very scarce. No trace was found of a large planting of golden shiners made from a nearby slough in 1932 (though these might well have escaped our attention). Only a few minnows were taken in rather extensive seining. These were partly escaped bait, partly remnants of a former population, or strays coming in from the river through the screen. They consisted of the following species: Western redfin shiner (Notropis lutrensis lutrensis), Steel-colored shiner, (Notropis whipplii spilopterus), Big-mouth shiner (Notropis dorsalis dorsalis), Emerald shiner (Notropis atherinoides), Silver chub (Hybopsis storerianus), Bullhead minnow (Hypergyrus velor), and Blunt-nose minnow (Hyborhynchus notatus). All told, only a few dozen shiners or minnows

of all kinds were taken. The brook-silversides are fairly common, supplementing the forage fish supply to a meagre extent.

Gizzard Shad Gizzard shad abound, though they are not notably more abundant than in a number of lakes where most excellent fishing is had, due to the abundance of this unexcelled forage fish. The taking of as much as three skiff loads in one haul when the shad were schooling in one area just before a freeze-up or just after the ice melts does not indicate an excessive abundance. There may have been a harmful excess, though this is very unlikely. The gizzard shad feeds on microscopic algae (in itself a benefit), transforming this basic food supply directly, into flesh for game fish to eat. This is the most direct and effecient food chain known. It is of course the young of the gizzard shad which furnish the food for the game fish and were it not for the shad, they game fish would have little upon which to feed.

Management Recommendations for Crystal and Stoney lakes

Install screen between river and Stoney Lake Since the Club is and should make efforts to regulate the fish population of its lakes, a screen of 1/2 " mesh or a rolling screen (self-cleaning type made in the form of a cylinder which revolves in a current by the aid of paddles) of 1/4" mesh should be installed in the ditch connecting Stoney Lake with the Mississippi River. Either type of screen should be so built as to prevent fish from leaving the club waters or prevent obnoxious fish from entering.

Stoney Lake should be accessible to fishing As Stoney Lake is at present fished but very little by club members, because of very poor access, it should be made readily accessible to fishing, as it is too large to be left lying idle from a fish standpoint. It is always good policy to spread fishing intensity by such means. It is considered advisable to make a connecting channel between Stoney and Crystal lakes and wide enough to allow a boat to pass through. This channel could be built by the aid of piling, though if this were considered too expensive, a canal or channel could be run through finer soil between the two inlets just

south of those now connected. If this is done Stoney and Crystal lakes would be left in open communication, which would not harm Crystal Lake, as at least a seeding of any undesirable fish which may be expected to occur in Stoney Lake are at present in Crystal Lake. If as suspected, Stoney Lake is mostly very shoal and only about 5 feet deep at the deepest, this connection might help save the fish from winter killing by allowing them access to the rather deep water (9 feet at low stage) of Crystal Lake near the railroad embankment.

If for some reason the channel connecting the two lakes is not built, a boat house to accommodate a suitable number of boats with a walk across the lowland between the two lakes should be erected so as to make it possible to fish Stoney Lake.

Winter killing of fish — Mr. Frederick Leopold recalls one winter killing of fish which occured about 15 years ago, before the large artesian wells were driven. The four wells on the Upper Grounds and the one on the Lower Ground near the Club must aid in preventing such an occurrance at present by aerating the water in winter, by bringing in fresh water, and by keeping the lake open near the Clubhouse. To make doubly sure that no winter killing of fish takes place, the water level, fed by artesian wells and seepage of the Upper Ground should be conserved until a time when the clear ice becomes covered deeply with white snow; then opened up to feed Crystal Lake—and also Stoney Lake if connected,—thus bringing in water largely artesian fed and raising the level of the lower lake or lakes so as to break the ice around the shore.

Water pump needed — It is proposed to install a pump at the northeast corner of the property to pump water from a drainage ditch into the Upper Ground. This would help relieve the strain and controversy over the Clubs' holding their water so high as to fill the ditch by seepage, adding to the pumping expense of the drainage district. This would also undoubtedly be advantageous to the Upper Ground, allowing the filling of areas made dry by such dry spells as the one now being experienced. It is recommended that a large capacity, low lift

pump be used, and that it be made portable. This would facilitate handling of the nursery units, would allow the pump to be moved cheaply to safe storage over the winter and during years of high water level, and would make a pump available for use in winter if the fish should begin to winter kill and a head of water in the Upper Ground ~~breaking~~ to break the ice was not available.

This method of preventing winter killing would consist in pumping the water out onto the ice, to allow it to drop back on through holes cut, previously, a considerable distance away. This of course would be done to advantage only when the temperature is not far below freezing.

Cattails for spawning fish — At the present summer water levels, the cattail marshes are almost entirely above the water level. As the root systems of the cattails offer excellent spawning conditions for large-mouth bass, crappies and bluegills, and because of the restricted spawning facilities in the lakes, it would be highly advantageous if the lake level could be held high enough through late May and as far as possible through June, to cover at least the outer portion of the beds with a foot or more of water.

Submerged aquatic s needed — A fair amount of submerged aquatic plants would be extremely beneficial to these waters, providing food (in the form of aquatic insects, etc.) and shelter for the game fish, especially bluegills and the young of the large-mouth bass. Besides this, it would offer additional food to the waterfowl. However, until the carp are better controlled, it is impracticable to begin any weed planting program, as they, together with the waterfowl, are sufficient to prohibit any successful establishment of weed beds at present. With the carp brought under control, Crystal Lake may better live up to its name (which suggests that it was once much clearer) and permit the successful planting of submerged aquatic plants.

The most desirable submerged aquatics for lakes of their type appear to be the pondweeds (Potomogetons) especially of the broad-leaved type; water ~~leave~~ weed (Elodea); water milfoil (Myriophyllum) and coontail (Ceratophyllum). These should be planted

by digging a small trench in the lake bottom in from one to three feet of water, placing and firmly anchoring the roots in the trench and re-filling. They should be planted in as protected a place, from wind action, fish and waterfowl, as possible so as to give them every advantage. If practical they should be enclosed with cheap chicken wire to prevent the large fish from entering. As the plantation becomes established it will spread outside the chicken wire enclosures. Water smartweed (Polygonum) may successfully be planted along the shore and in a few inches of water, provided the larger fish are kept from rooting out the plants, waterfowl are kept from it until it has become established, and coarse grasses are held in check. Wild rice (an emergent aquatic) does not grow in warm, quiet or stagnant waters and therefore is found but seldom in such waters as Crystal and Stoney lakes. Wild rice is therefore not recommended.

Increase spawning grounds — As mentioned under "Vegetation" it is very desirable to provide better spawning conditions for large-mouth bass, crappies and blue-gills by attempting to hold the lake level high enough in the spawning season (May-June) to cover the outer part of the cattail beds. Also attempts should be made to transplant some root systems of cattails to deeper water so that after becoming established they too would furnish favorable spawning beds.

To further provide spawning facilities, especially for large-mouth bass, and to make possible some spawning of small-mouth bass, about 200 low piles of gravel, of about a bushel each, should be installed on the firmer portions of the bottom inside the channel and around the southern part of the lake, where the bottom is hard enough to keep the gravel from sinking out of sight. This can best be done by placing the gravel on the ice, so that it will drop down on the bottom with the thawing of the ice. If the railroad can be induced to drop a few carloads of gravel off its embankment, cutting the southern end of the lake as has been suggested, more spawning then would doubtless result. As a later program, gravel spawning boxes should be added elsewhere around the lake where the bottom is softer. These are made of rough lumber and are 3' long × 3 ' wide × 6" deep, are filled level with gravel

and placed at various intervals over the soft bottom.

Fish shelters — Brush shelters of the sort diagrammed in the accompanying leaflet are very much to be desired. These should be of two sorts:

(1) Adult and subadult fish attracting shelters. These should be large (at least 15 feet square) fairly high and rather open (though firmly constructed) structures, to go in water 5 to 10 feet deep, and to be marked by piles, or floats. These should not exceed 10 in number (for Crystal Lake). One should be placed on either side of the artesian inflow, 2 or 3 in the channel north of the proper seining ground, and the others well spaced in the southern half of the lake and around the deep basin off the Clubhouse.

(2) Young fish shelters. These should be made low (about 2 feet high) and should be placed at frequent intervals (about 100 yards) around the lake, in water 2 to 6 feet deep at mean lake level. Fairly compact brush should be used, but it should not be jammed tight. All shelters should be firmly anchored. Brush from the slower growing trees, such as oak, is usually more suitable and will last longer than brush from such fast growing trees as the cottonwood. However, the brush most readily available and the most economical should be used.

Recommendations for Game Fish

"Walleyes" — The population of gizzard shad is still high enough to take care of a goodly number of "walleyes" (pike-perches) which it is hoped may "return". Some stocking would be advisable, provided the fish are available. If the club's fisherman seines walleyes in the river he might be engaged to bring these over to the lake, in numbers up to a few hundred a year.

Large-mouth Bass — As stated previously, the large-mouth bass is the game fish for this lake. Bass should be reared to advanced fingerling size and planted, if fry are obtainable, or the fingerlings or rescued bass should be planted if these can be had. Heavy stocking is called for to restore the balance between game fish and coarse fish. The years of removal of the game fish has

naturally lead to an increase in the coarse fish which have received little control until recently. (It has been like the pests of rabbits produced by poisoning the coyotes).

Small-mouth Bass — A few hundred fingerling small-mouths every few years would probably be adequate stocking, in view of the generally unfavorable conditions for this species. No extensive establishment of small-mouth bass may be anticipated. The most to be had is a bit of variety to the fishing by stocking the waters with this fish.

Crappies — An adequate supply of the black crappie seems present, though a few might be added from time to time. Fairly extensive stocking with white crappies is recommended, especially as this worthy panfish feeds extensively on young gizzard shad.

Bluegills — The size of the bluegills is small, just under the legal limit, denoting a dwarfing due most likely to a scarcity of food supply and overcrowding. Under these circumstances the taking of bluegills down to 5" or even less (provided it can legally be done) would be sound management policy. The dwarfing is apparently not due to the brood stock as the ancestors of these fish were said to have attained a larger size a few years ago when the bluegills population was much less. The one small "hatchery" or rearing pond behind the Clubhouse is considered adequate ~~"hatchery" or rearing pond~~ for stocking purposes, when supplemented by adult and half-grown bluegills to be seined from the ponds on either side of the highway fill. The fall fingerlings from the rearing pond should be planted about the brush shelters to be planted around the lake.

Further calls on the state or federal Bureau for bluegills (rescued or reared fish) would seem unnecessary. Likely rescued crappies and large-mouth bass, if possible, should be obtained, or else some small-mouth bass fry or early fingerlings might be obtained from the government hatchery at Fairport, Iowa.

One danger in getting rescued bluegills lies in the possibility of establishing

in the clubs waters certain dwarfed species of sunfish which often are mixed with the bluegills or are even substituted for them by the rescue crews. At present Crystal Lake is comparatively free from these undesirable species as we found no orange-spotted sunfish, a notable runt, and took only two green sunfish. Reports of rock bass in this lake likely refer to the warmouth bass, which is hardly to be classed as undesirable.

Yellow Bass As this species is abundant, flyfishing for it should be encouraged.

No other species are recommended for stocking. The main recommendation is to build up the large-mouth bass and white crappie populations.

Recommendations for Coarse Fish

Carp It is strongly recommended that the removal of carp be continued but with certain modifications. To prevent any danger of injuring plant growths which may start reestablishing themselves, to keep fishing closer under observation, and to increase its efficiency, we recommend that seining be done at night over a single cleared seining ground, just north of the bathing beach in front of the boat house. This area should be cleared of all obstructions which might catch and tear the seine, and should be previously baited with fermented barley for one to five nights before seining. To ferment the barley, all that is necessary is to let it stand in a tub of water until fermentation has begun. Well soaked, unfermented barley is almost equally as good. The seining ground should be baited with from one peck to over a bushel of barley every night during the seining season irrespective of whether it is to be seined that night or not, so that the carp form the habit of feeding there. On those nights when seining is to be done, the net is to be placed quietly around the baited area, after the fish have begun to feed, after which it is to be pulled. A similar seining ground should be established in Stoney Lake, when this is reconnected with Crystal Lake.

Carp seining should be done throughout the open season in the spring, then suspended until July 1.

The carp seined through the summer could supply the bass rearing pond with food and fertilizer.

As soon as the small meshed seine in use needs replacement, a seine of 2 1/2" square mesh should be bought, and 300 yards long. This larger mesh would catch more carp because it would fill much more easily and cover the ground faster. This would also prevent the gilling of large numbers of yellow bass (striped bass) and small crappies. The few larger fish gilled could be removed quickly.

Buffalo — Buffalo should also be removed, as the sale of the buffalo helps to make seining financially possible.

Bullheads — Bullheads probably would rank as coarse fish in these waters, to be removed when caught on hook or by the seine.

Sheepshead — As this species is present in rather small numbers, and as they furnish some sport and are not seriously predaceous their removal is not urged. However, if they tend to become dominant, removal of the access would be in order.

Recommendations of obnoxious fish and turtles

Gars and Dogfish — These should by all means be removed from the club waters when caught on hook or by the seine.

Snapping Turtles — These should be removed, especially as there is some market for them. It would be well to operate a few turtle traps (build according to plans previously sent), whenever the carp seining is restricted to the one seining ground.

Recommendations for Forage Fish

Gizzard Shad — As stated elsewhere, the gizzard shad is the principal and the only important food for adult game and pan fish in this lake, and indications are that they will, and should, remain so. There is little fear of shad becoming too numerous, especially after the large-mouth bass and crappie numbers have been increased. Therefore further removal of the shad is not recommended.

Recommendations on use of adjacent waters

(other than Crystal & Stoney lakes)

Upper Ground — As stated elsewhere, it is doubtful if it is practicable, at least for the near future, to use the Upper Ground waters for fish purposes.

Bluegill Hatchery — The bluegill "Hatchery", the small pond behind the Clubhouse, seems adequate for bluegill rearing as indicated in the recommendation for that species.

North and South "Rearing Ponds" — If properly handled the North and South "Rearing Ponds", (which are first being used this year) can amply supply all the large-mouth bass and a large percentage of the crappie fingerlings needed for stocking the clubs waters. The recommendations for this ponds are as follows:

The North and South ponds should be entirely separated from each other by a dike or embankment and should at all times be independent of each other. It is estimated, that when made into two separate units each will cover more than one acre.

Whatever diking is needed to separate the ponds from the surrounding marsh and ditch, should be done, so that the water level can be controlled as much as possible.

The bottom of the ponds should be scraped and levelled to remove all depressions, and each pond bottom should slope gradually towards one corner, (whichever corner is most convenient) to facilitate the draining of the ponds and removal of fish.

When containing fish the water in the ponds should range in depth from 3 feet at the shallow end to 6 feet at the deepest part.

If used only for rearing purposes, no gravel is necessary, but if brood bass or crappies for spawning purposes are placed in them the bottom edges along the ponds for some ten feet out (especially in the shallower ends), should be covered with moderately fine gravel.

One pond should be used for large-mouth bass propagation, the other for white crappies. If it is found later that the large-mouth propagation is much more success-

ful, or if more fingerlings of this species are needed, then later both ponds should be given over to large-mouth propagation.

The draining of the ponds can best be done by pumping the water from the ponds into the neighboring ditch. A pen stock of wood or concrete, with a removable screen on one side, can be built at the deepest end of each pond. The hose from the pump can then be placed in it, preventing an excess amount of debris or fish being sucked into the pump.

If the ponds are to be used for spawning purposes as well as for rearing, the brood stock should be placed in them no later than April 15. After the bass and crappie have spawned and the young are rising from the nests, all or as many of the adults should be removed as thought practicl. The adults will eat many of the young if left with them, even though places of refuge are present for the young. The brood stock of both bass and crappies should be plentifully supplied with forage fishes, or if the brood stock are tamed enough to eat it, with ground up carp. The smaller yearling gizzard shad make an excellent forage fish for this purpose.

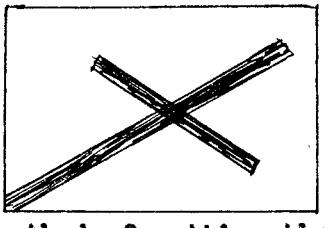
As the young of both species to be propagated feed almost entirely upon small crustacea during the first fewweeks of their life, it is necessary to supply them with this food in sufficient quantities. This can best be done by fertilizing the edges of the rearing ponds. Superphosphate is at present considered the best fertilizer. It is thrown into the water along the edge of the pond a week previous to the hatching of the first young and continued at regular intervals until the last young are three weeks old. Care should be taken not to fertilize too heavily; twenty five to fifty pounds at any given time is sufficient for a normal rearing pond of this size. Sheep manure can also be successfully used and even ground carp will serve the purpose though the latter is by far the least suitable. No fear need be felt concerning whether or not the proper crustacea are present as they they are always present, apparently, in such ponds as these.

When the first young bass and crappie are two weeks old, the feeding of ground carp should being. At first for the very young fish the carp should be finely ground

(a regular meat grinder, either of the hand of electric operated type is to be used). With ~~In~~ the smaller carp the whole fish is ground up, while the head and larger bones of the larger carp are removed before grinding. As the fingerling bass and crappie increase in size, the carp can be ground coarser.

The feeding of the carp to the fish should take place at regular intervals during the day, as many times as the man or men in charge have time for this work. As some fish do not learn to come for food and remain out in the center where they cannot be fed, a wooden platform to feed from, such as diagrammed below, can be installed:

Pond



Wooden platform built on stilts with a wooden floor on which one can walk, to throw ground carp food to all parts of the pond.

Another method of getting the feeder nearer the fish is to bisect the pond with a dike, thereby making two units instead of one. In that case another pen stock should be built to accommodate the newly made unit.

A moderate amount of submerged aquatics is very desirable in the ponds, especially for the bass as it offers hiding places. If an excess of vegetation is present it should be removed by dragging a rope of chain across and under the water, or else with rakes.

If the above method is followed it can reasonably be expected to remove a good number of advanced fingerlings in October of each year.

If for some reason, the above recommendations cannot be carried out, the ponds can still be used for propagation purposes by first placing the brood bass in the pond, supplying forage fish or ground carp to the brood stock, and let the young forage on whatever happens to be in the ponds. However, if this latter method is used the yearly crop will be very small.

The cattail pond across the levee from the rearing ponds was reduced, when examined, to the channels along the levees. Here are found (to the surprise of the

Stewart) a large population of 2 to 5 inch bluegills, and other fishes. This should be kept unfished, and used as a seminatural reservoir for stocking the main lake. Hundreds of subadult bluegills may be removed each fall. The carp and bullhead, present in moderate numbers, should be destroyed. The crappies and golden shiners seined here should go into the main lake with the bluegills. The green sunfish and orange-spotted sunfish should be destroyed as they are runt species. The warmouth bass should be added to the lake. To make positive of the identifications of the various sunfishes, see the illustrations in "The Fishes of Illinois". This book should be purchased for club use (price $4.00; address, State Natural History Survey, Urbana, Illinois).

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NEW CRYSTAL LAKE CLUB