

H  
167  
C3  
L83

Practical • Carp • Culture

—BY—

L. B. LOGAN,

YOUNGSTOWN, OHIO.

ALBERT R. MANN  
LIBRARY

NEW YORK STATE COLLEGES  
OF  
AGRICULTURE AND HOME ECONOMICS



AT  
CORNELL UNIVERSITY

---

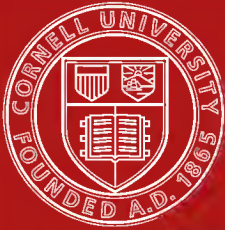
Cornell University Library  
SH 167.C3L83

Practical carp culture.



3 1924 003 225 491

mann



# Cornell University Library

The original of this book is in  
the Cornell University Library.

There are no known copyright restrictions in  
the United States on the use of the text.









THE LATE

Professor Spencer F. Baird,

United States Commissioner of Fish and Fisheries, an unsalaried office, from  
1871 to the date of his death, August 19, 1887.







HON. S. FEE,  
Fish Commissioner of Kansas.



# PRAGMICAL CARP CULTURE.



**T**HE Chrystalization of ten years experience in the United States. Gathered from more than 10,000 Successful Carp Culturists, in all parts of the country, and combined with the best teachings of the centuries of experience in Europe.

By L. B. LOGAN,  
YOUNGSTOWN, OHIO.



PRICE, IN PAPER COVER, . . . . . 65c.  
PRICE, IN CLOTH COVER, . . . . . \$1.00



# CONTENTS.

---

## CHAPTER I.

INTRODUCTION OF CARP INTO THE UNITED STATES, AND A BRIEF REVIEW OF THEIR HISTORY PRIOR TO THAT DATE.—Inland Fisheries.—20,000 Acres of Ponds and Their Product.—Capt. Robinson's Importation.—Importation of J. A. Poppe.—Importation of the U. S. Commission.—Gratuitous Distribution of Fry.—Sale of Fry. . . . . 9-11

## CHAPTER II.

DESCRIPTION OF THE CARP.—THE VARIETIES.—Gauckler, Hessel, Mulertt.—Scale Carp.—Mirror Carp.—Leather Carp.—Golden Carp.—Blue Carp.—Their Characteristics and Differences.—The Best Variety. . . . 12-16

## CHAPTER III.

THE ECONOMIC, PHILOSOPHIC, PATRIOTIC AND SANITARY REASONS FOR CARP CULTURE.—Water Farming.—Water Resources.—Drouths.—Over-Draining Land.—Freshets.—Husbanding the Waterfall.—Fish Harvests.—Increased Value of Farms.—Fishing Fever.—Panacea.—Ice Harvest. . . . . 17-19

## CHAPTER IV.

CHARACTER, LOCATION AND CONSTRUCTION OF PONDS.—Prime Factor.—Favorable Conditions.—Ravines and Gulches.—Control of Water.—Sky Ponds.—Spring Ponds.—Dams and Embankments.—Plan of Carp Pond.—Shallow and Deep Water.—Section of a Pond.—Artificial Ponds.—Draining Ponds.—The Monk.—Objections.—Flumes of Stone or Brick.—Monk Improved.—Bottom Overflow and Drain.—Defects.—Remedies.—Screen Box.—Modified Bottom Overflow and Drain.—Placing the Flumes in the Dam.—Overflows, Freshets and Storms.—Bottom Draft Overflow. . . . . 20-31

## CHAPTER V.

CLASSES OF CARP PONDS AND THEIR PURPOSES.—Live Fish Markets.—Systematic Ponds.—The Hatching Pond.—Depth of Water.—Water Level.—Plants For.—Size of Pond.—Waves, Their Effect.—Selection of Spawners.—Number of Males to Females.—Feeding the Spawners.—Size of Fry in the Fall.—Removal of Fry.—Difference of Ponds in Different Latitudes.—~~Effect of Cold.~~—The Stock Pond.—Its Depth.—When Stocked.—How Many to the Acre.—Increase of Weight.—Marketable Size.—When to Sell.—Spawn in the Stock and Market Ponds.—Pike in these Ponds.—Proportionate Size of Market, Stock and Hatching Pond.—Sale Pond.—Winter Pond.—Market Pond.—Stock Pond.—Hatching Pond.—Mixed Carp Culture.—Spawning Bed.—One Variety.—Objections.—Removal of Eggs.—Use of Boughs. . . . . 32-40

## CHAPTER VI.

TAKING THE FISH FROM THE PONDS.—IMPLEMENTS FOR HANDLING THEM.—THE SHIPMENT OF YOUNG FRY.—Drawing the water.—Remedying a Panic.—When to Begin Taking Out.—Weights and Records.—General Purpose Seine.—Bag Net.—Sinker Net.—Canvas Stretcher.—Taking Carp Alive to Market.—How to Make the Boxes.—Importance of Selling Alive.—Educate the People to It.—Shipping Carp.—Cans.—Their Size.—Treatment Before Shipment.—Best Temperature.—Proportion of Water and Fish.—Working Express Companies and Agents.—Wooden Jacket Cans.—Cans With Flaring Sides.—How to Fill.—Shipping Season.—Spring and Well Water. . . . . 41-47

## CHAPTER VII.

ENEMIES OF THE CARP.—HOW TO DESTROY THEM.—Carp Are Cannibals.—Domestic Fowls.—Water Snakes, Etc.—Shot Gun Policy.—Crawfish Traps.—Protecting Dams.—Muskrats.—Protection of Dams.—Traps.—Brimstone and Salt Petre.—Mink.—Turtles.—Birds.—Other Fish.—Black Headed Minnow. Insects, Larvæ and Bugs.—The Water Asell.—The Water Flea.—The Snail.—The Boat Fly. Its Destructiveness.—Yellow Banded Water Beetle.—Its Larva.—The Black Water Beetle.—Its Cocoon.—Its Grub.—How to Destroy Them.—The Dragon Flies.—Libellula, Aeshma, Agrion.—Their Copulation.—Mode of Depositing Their Eggs.—Their Grubs.—Their Destructiveness.—Their Enemies.—An Interesting Enemy.—Piscivorous Plants.—A Fish Eating Plant.—How to Get Rid of the Enemies.—Erratum. . . . . 48-66

## CHAPTER VIII.

THE DISEASES OF THE CARP AND ALLIED DIFFICULTIES IN POND CULTURE.—Indications of Disease.—Fungus Growth.—Remedies.—Polyp Asphyxia.—Dropsy.—Injuries.—Hospital.—Pond Difficulties in Summer.—Lack of Water Supply.—Lack of Oxygen.—Heat.—What to Do.—Absorption and Evaporation.—Winter Difficulties.—Depth of Water.—Poisonous Gasses.—Holes in the Ice.—The Help of Age.—Cornstalks or Rye Straw.—Fallacy of Bank Chimneys. . . . . 67-71

## CHAPTER IX.

THE ARTIFICIAL FEEDING OF CARP.—Natural Food.—Not Vegetarians.—A Floating Island.—Digestive Organs of Plant and Flesh Eating Animals.—Natural Food of Carp.—Nutritious Matter. Albumenoids.—Carbohydrates.—Their Uses in the Body.—The Nicklas Rule.—Difficulty of Execution.—Material at hand.—Desideratum.—Combination of Food.—First.—Second.—Third.—Preservation of Food.—Fourth,—Food for Young Fry.—Increasing the Home Supply.—Production of Natural Food.—Cheap Food.—Waste of Slaughter Houses, Breweries, Distilleries, Starch Factories.—Suspending Flesh Over the Water.—Whole Wheat.—Bread of Coarse Shorts.—Blood as a Moistener.—Platform Feeding.—Calling the Fish to Meals.—Do They Hear? . . . . . 72-77

## CHAPTER X.

ON THE HEARING OF FISH.—The Controversy.—Methods of Working the Problem.—The Organs Indicate the Faculty.—Rank Estimated by Structure.—The Human Ear.—Sound Waves.—The Drum Head.—The Eustachian Tube.—Movement of the Membrane.—The Labrynth or Inner Ear.—Nerve Motion.—Ear Stones.—Rudimentary Ear.—Ear of the Fish.—The Ear Bones.—Auditory Nerve.—Vestibule.—The Three Semicircular Canals.—The Bulbs.—The Fish Ear a True Ear.—Head Bones a Medium.—Fitted for the Water Not the Air.—Not Applicable to All Fishes.—Peculiarities of the Carp Ear.—The Air Bladder.—Illustrated. . . . . 78-87

## CHAPTER XI.

WATER PLANTS FOR CARP PONDS.—Remedial Agents—Beautiful and Essential Accessories.—Gravel and Stone Bottoms.—Measure of Life.—The Ornamental and the Useful.—Crowfoot Family.—Water Lilly Family.—Water Milfoil Family.—Evening Primrose Family.—Parsley Family.—Primrose Family.—Buckwheat Family.—Hornwort Family.—Arum Family.—Duckweed Family.—Cat-tail Family.—Pond-weed Family.—Water-Plantain Family.—Frog's-bit Family.—Iris Family.—Rush Family.—Sedge Family.—Grass Family.—Cryptogamia. . . . . 88-90



## CHAPTER XII.

FISH AS FOOD.—Fish Flesh Compared with Animal Flesh.—The Needs of the Stomach.—Analysis of Beef and Fish Tea.—Mixed Diet.—Fish Pie.—Chowder.—Improved Health.—St. Paul's Idea.—The Carp as a Food Fish.—Compared with Our Best Native Fishes.—Not Fit for Food in the Spawning Season.—Proper Weight for the Table.—Preparation for the Cook.—Cooked Like Other Fish..... 91-94

## CHAPTER XIII.

POT POURI.—Untouched Viands.—German Carp.—Hybridization.—How to Distinguish the Sex of Carp.—The Milter.—The Spawner.—Spawning.—Effect of Change of Temperature.—How to Tell When They Are Spawning.—Size and Character of Eggs.—Time to Hatch.—How to Catch Carp.—A Gamey Fish.—Bait to Use.—Difficult to Seine.—Feeding Time.—Concussion.—Its Effect.—What to Avoid.—Cutting Ice no Injury.—Waves on Ponds.—Protection Against Them..... 95-99

## MISCELLANEOUS APPENDIX.

---

INCREASE OF CARP.—PRICES.—HARDIHOOD, ETC.—From Letters of J. W. Long, J. C. Alexander, Ira H. Ewart, W. A. Day, B. F. Biggs, E. C. Wells, J. W. Thorp, L. C. Ezell, E. L. Valentine, L. J. Blankenship, J. J. Thomas, R. E. Parcher, Joseph Brunot.....	103-106
SALE OF CARP FOR TABLE USE.—From Letters of V. Stillabower, W. Bunker, W. B. Lee.....	106-107
CATCHING CARP.—From Letters of E. B. Brouster, Chas. F. Johnson, James Gay, Peter James.....	107-108
CARP IN MINERAL, SULPHUR AND SALT WATER.—From Letters of Jacob Gierisch, C. M. Clay, A. Combs.....	108-109
GREAT VITALITY OF CARP.—From Letters of R. T. W. Duke, V. Stillabower, Bull. U. S. Fish Com., E. S. Jenks.....	109-111
DO NOT HIBERNATE.—Catching Carp Through the Ice.—From Letters of C. C. Loser, Jac Knopp, S. W. Colten, W. A. Pursel.....	111-112
GROWTH OF CARP.—From Letters of Elias Cattrill, J. C. Murdock, S. D. Comfort, W. A. Day, C. C. Stanfield, S. E. Williamson, A. J. Dennis, E. H. Lemen, D. M. Darby, J. V. Hoakison, R. H. Hudson, D. N. Kern, Bull. U. S. Fish Com.....	112-116

SEASON OF SPAWNING.—TEMPERATURE OF WATER AND LENGTH OF TIME REQUIRED FOR EGGS TO HATCH IN DIFFERENT TEMPERATURES, ETC.—From Letters of W. H. Westhafer, J. H. Bournes, Jas. T. Hawkins, E. P. Underwood, D. N. Kern, B. F. Carroll, W. C. Rose, John W. White, Jas. W. Waldo, L. J. Blankenship, C. G. Bestle, John Goodwine, Jr. 116-120

SOME GENERAL PHASES OF CARP CULTURE.—A Fine Table Fish.—J. J. Strannahan.—One Way of Cooking Carp.—Turning Out the Hogs to Make Room for Carp.—Water Supplied by Wind Mill.—Bottom Puddled by Hogs.—Carp Are Cannibals.—An Easy Way to Multiply Ponds.—Fish Kept in the Cellar.—Native Fish Delay Success.—50,000 Carp Sold in 15 Days.—Trap and Automatic Feeder.—Keeping an Open Space in a Pond in Winter.—Notes From a Carp Diary..... 120-129  
 Advertisements..... 130-136

## ERRATA.

---

Page 31, under illustration should have been the name, "*Anti-choke Overflow.*"

Page 77, fourth line from top, *c-o-u-r-s-e* should have been *c-o-a-r-s-e*.

Page 109, letter should have been signed C. M. Clay.

Page 111, letter should have been signed E. S. Jenks.

## ILLUSTRATIONS.

---

The late Prof. Spencer F. Baird, United States Fish Com'r. Frontespiece	
The Hon. S. Fee, Fish Com'r of Kansas..... Frontespiece	
The Scale Carp.....	14
The Mirror Carp.....	15
The Leather Carp.....	16
Plan of Carp Ponds.....	23
Longitudinal Section of Pond.....	24
A German Monk.....	25
The Monk with Clamps.....	27
Bottom Overflow and Drain.....	28
Sliding Center Board.....	29
Anti-Choke Overflow.....	31
Carp Pond with Spawning Annex.....	39
Bag Net.....	42
Sinker Net.....	42
Canvas Stretcher for Handling Carp.....	43
Wooden Jacket Shipping Can.....	45
Muskkrat Trap.....	50
The Water Flea.....	54-66
The Water Asel.....	54-66
The Boat Fly.....	55
Larva of Dragon Fly.....	55
The Yellow Banded Water Beetle.....	55
The Larva of Same.....	55
The Black Water Beetle.....	56
The Dragon Fly.....	57
Fish Eating Plant, Utricularia Vulgaris (Bladderwort).....	60
Its Mode of Capturing Fish.....	62
Hind View of the Head of Carp—A.....	82
Left Ear, Seen From Outside—B.....	82
Otolith of Right Ear, Seen From Outside—C.....	82
Middle Ear of Man Viewed From the Front—G.....	83
Air Bladder of Carp with Second and Third Vertebrae—D.....	83
Inner Left Ear of Man Seen From Outside—E.....	83
Section of the Same—F.....	83
Sweet Scented Water Lilly.....	100

## INTRODUCTORY.

---

In the infancy of any industry, there is always much mis-direction of thought, effort and means. This is necessarily so, for those who teach must think, and the best of thought grows only on the tree of experience, and to gain experience requires time to grow the tree. Systems do not develop in a single season, and infallibility among systems is as rare as it is among men. In all methods judgment must be exercised as to time, place and circumstances, and upon this judgment must depend individual success or failure.

American carp culturists owe much to the pioneers of public thought on this question, through the courtesy of the public prints. This debt of gratitude is greatest to those whose thought took the form of pamphlets and books, in which list I am glad to include my warm personal friends, Hugo Mulertt, of Cincinnati, O., Hon. I. B. W. Steedman, of St. Louis, Mo., George Finley, of Pittsburg, Pa., and Valentine Stillabower, of Edinburg, Indiana. The United States Fish Commission, under whose auspices carp were introduced into this country, has through the Bulletin of the Commission, under the direction of C. W. Smiley, of Washington, D. C., contributed largely to the correct literature on the subject. Could this printed matter have reached the hands of the numbers now engaged in carp culture, it would probably have been sufficient. But with the rapid growth of interest in carp culture, and the constantly multiplying ponds and owners thereof, added to the fact that the editions of all these other works but one are exhausted, there has arisen a demand for a work that is abreast of the growing industry. This demand joined with the Syren voices of friends who were acquainted with the valuable sources from which I have been drawing information during the past five years, has lured me on to the publication of this work.

In addition to the writings of those persons already named, cheerful recognition is given to the aid derived from the writings of Hessel, Horak and Nicklas. Where the exact language of any other writer is used, due credit is given. But where their thoughts are interwoven each with the

other or all with our own thought, justice demanded that we bear the responsibility.

Mrs. Logan who has held my hobby during the weeks of my labor on this book has just returned it to me, saying, put it in the introductory. You owe her much, I owe her more. Together we stand, she and I, and launch our book on the carp ponds of America. May the pennies it costs you return to you in hundreds of dollars saved, and made by and through its instruction.

THE AUTHOR.

## CHAPTER I.

### INTRODUCTION OF CARP INTO THE UNITED STATES, AND A BRIEF REVIEW OF THEIR HISTORY PRIOR TO THAT DATE.

Carp are here, and here to stay. Whence and how they came are matters only interesting as a part of their history, which is classical and ancient. In the earlier days of their culture in America, this history was of much more importance than it is now. Then, it gave them a prestige that commended them to our good-will; now, from more than a quarter of a million of carp ponds in this country, they bring their own unimpeachable credentials. They have made for themselves, in the United States, a record even more satisfactory than that which is registered of them in Germany, and this latter excels all their other European history.

Were this work intended for those, only, who now have carp, and who are more or less familiar with what has been published on the subject, it would matter little whether, or not, anything was said on the part of the carp; but in educating those persons uninformed on the subject, history becomes fundamental.

There is no authentic account of the introduction of carp into Europe. It is only certain that it occurred many centuries ago, and that the stock was brought from Central Asia or Persia. In Bohemia, Austria and Southern, Central and Northern Germany they have long been domesticated, and are plentiful in the large rivers of Europe, from which many of fabulous size, as reported, have been taken. They are mentioned by Aristotle 350 years before Christ, and by Pliny 50 years after Christ.

The largest inland fisheries of Europe are the carp fisheries, simply because the carp, of all fish, is the most excellent pond fish known to the world. Of all Europe, Austria is credited with the earliest efforts at the production of carp, and has the renown of the largest artificial ponds on the globe. Here the culture of carp is traced back to the year 1227. In England their culture is traced to the year 1500, in France to the year 1525, and in Denmark to the year 1660.

The character of the ponds established in Europe will be best appreciated when it is understood that ponds built at Bohemia, in Austria, in the latter part of the fourteenth century, are not only still in existence, but, their banks improved with the solidification and vegetation of the centuries, they are to-day the admiration of all comers. The ponds of the Princes of Schwarzenburg, altogether, cover an area of at least 20,000 acres of ground. This would be one fifth larger than an ordinary township in the United States. All of these ponds can be drained at the pleasure of their owners, and are beyond doubt the most extensive of the kind in the world. Their product amounts to about 500,000 pounds of carp a year. Other very large ponds exist in the Provinces of Silesia and

Bradenburg, while hundreds of ponds covering a few acres each, are scattered over the entire country, and one, at least, is found on nearly every large farm. The carp produced in these ponds form the chief fish diet of the people. They are taken alive to market, are assorted according to weight and kept alive in tanks, those of about the same weight being kept in the same tank. They are sold alive; then, if the purchaser desires it, the marketman kills and dresses the fish to his order. At fairs and public gatherings, carp are sold alive, killed and cooked to order and eaten then and there by the purchasers—a luxury with which the American railroad and fair sandwich cannot compare.

This outline gives the carp a classical and an historical standing that must command for it great respect.

The history of the introduction of carp into the United States has never yet been, so far as we have seen, collectively and succinctly placed before the people; nor is it the purpose here to occupy space with details. The earliest importation was made by Captain Henry Robinson. About the year 1830 he brought carp from Holland and placed them in his ponds at Newburg, New York. From these ponds they escaped into the Hudson river, destroying every chance of practical results from his effort.

In 1872, Mr. J. A. Poppe, of Sonoma, California, made a trip to Europe, and returning to the United States from Germany, as a matter of private enterprise and speculation, brought carp home with him. He made special arrangements, and every provision for their safe and successful transportation, traveled with them and gave them his personal attention, and yet lost nearly all of them. He started with 83 carp, of all sizes, from three feet long to the size of a steel pen, and, notwithstanding his great care, but five of them arrived alive at his ponds in California. The largest died first, and the very smallest only survived. On the 5th day of August, 1872, these five tiny carp were, with much solemnity and many misgivings, planted in his pond. In the following May, the original five measured 16 inches each, and there were about three thousand of their progeny. From these, California and the adjacent states and territories received their first stock of carp. Though it looked like a speculative funeral on the day that Mr. Poppe planted his five fingerling carp, yet it was the birth of a bonanza of which the farmers of this country are now reaping the benefit. It paid Mr. Poppe handsomely, and demonstrated that carp could be successfully imported to and would thrive in America. The success of this venture probably had its effect on the national fish commission, and contributed to the formation of their purpose to bring carp to this country.

#### THE COMMISSION'S IMPORTATION.

Mr. Rudolph Hessel, a German of much experience in carp culture, and now in charge of the Government ponds at Washington, D. C., was employed by the national fish commission to bring the carp to this country and to care for them when here. He arrived from Bremen with



345 carp of different varieties and sizes, namely, 227 mirror and leather carp and 118 scale carp.

On the 26th day of May, 1877, these were planted in the Druid Hill Park ponds at Baltimore, Md., and remained there while the ponds at Washington were being prepared for them. They did not do well the first season, and the distribution of young fry did not begin until the fall of 1879. Then 6,203 were sent out to 273 applicants from 24 States. In 1880, 31,443 were distributed to 1,374 applicants from 34 States and Territories. In 1881, 113,605 were distributed in lots of 15 to 20 to each applicant. By this time many of the fish commissions of the different States and Territories that were supplied early by the national commission, had young carp of their own raising and begun to distribute them. Prominent among the States early and largely distributing young carp may be named Missouri, Illinois, Kansas, Texas, South Carolina, Kentucky, Tennessee and Iowa; New York, Pennsylvania and other States and Territories falling quickly into line. Each year since then the commissions of the several States and Territories, as well as the national commission, have had a constantly increasing number of fish to dispose of, and the applicants for them have been without number. It is very safe to estimate that these several commissions have supplied not less than 500,000 different persons with carp. Many persons applied and were supplied more than once. The second season after the first distribution by the national commission many enterprising citizens had young carp to sell, and with Yankee ingenuity and energy, pushed their interests, sold all they had at from \$5.00 to \$10.00 a hundred and had orders booked for the next hatch. The number of those persons having young carp to sell increased many fold each year, until now they are very numerous. Add to those supplied by the Government, those who supplied themselves by purchase, and the whole number will not fall short of 1,000,000 persons that have tried carp raising. Some failed in the first year's experience and some have failed since, but the number of failures is constantly decreasing, while the number of successes is as constantly increasing. This is brought about by the lessons of experience bought dearly, or obtained cheaply from others. It is quite certain that as great a per centum of the whole number have succeeded in the growing of carp as would have succeeded in the raising of poultry. The account of their success, the method of attaining it, the table qualities of the fish, etc., must form the subjects of other chapters. Suffice it to say that there is not a State or Territory in the Union without its carp ponds; that many of our rivers and streams have carp in them, that have escaped from ponds through freshets, overflows, broken dams, etc., while in an occasional emergency they have been dumped in the streams by the Government's agents, to save them from loss, while some streams in Missouri have been stocked with them by the commission. Carp weighing from 8 to 12 pounds have been taken from the Ohio, the Illinois, the Missouri and other rivers. Many of these catches have been eaten by epicures, and their flesh pronounced excellent.

## CHAPTER II.

### DESCRIPTION OF THE CARP.—THE VARIETIES.

Among the many descriptions of the carp family, we consider the following the best, and fully sufficient for their general identification. Gauckler, a German authority, says: "The carp is high on the back, compressed laterally and covered with scales. The back is more or less arched. The head is pyramidal, the mouth is very small, having two pairs of barbels, of which one pair is attached to the upper lip, and the others, which are longer, are at the corners of the mouth. The general color of the carp is golden brown, rather bright in the case of those which live in running water, and darker with those which have lived always in ponds. Often blueish reflections manifest themselves in the dorsal region, and an orange tint colors its sides. The belly is a yellowish white."

Dr. Rudolph Hessel, Superintendent of the Department of Carp Culture in the United States Fish Commission, at Washington, District of Columbia, says: "The carp *Cyprinus Carpio* of the family *Cyprinidæ*, has a toothless mouth, thick lips, and four barbels on the upper jaw. In place of the usual teeth of the mouth, there are a number of stout teeth on the pharyngeal bones, which are arranged in three rows. It has one single dorsal which is longer than the anal. Both of these fins have at their origin, on the anterior edge, a strong ray which is serrated in a downward direction. The caudal is a semi-circular shape, and the natatory bladder is divided into two sections with connecting air passages. The scales have an entire edge, and the body is compressed on the sides. The general color of the back and sides is a dark olive brown, the abdomen often of a whitish or orange tint. The coloring depends, as with all fishes, partly upon the age and season, partly upon the water."

Hugo Mulertt, of Cincinnati, O., writing for AMERICAN CARP CULTURE, says: THE SCALE OR NOBLE CARP. *Cyprinus carpio*, *Edelkarpfen*, *Le Carpe*. The body is stout and elongated, sides compressed, head naked, small and supplied with well developed lips, the upper of which carries two pairs of barbels, one larger than the other. The mouth is toothless, though the fish is provided with masticating organs which are situated far back in the throat. The color of the fish is generally dark olive brown on the back and sides, though it will vary, according to circumstances; the abdomen may be either yellowish, white or orange tinted. The entire body is covered with *silvery* scales of a *uniform* size. The dorsal fin is situated on the middle of the back, extending nearly to the tail and consists of three spinous, the third one of which is serrated, and fifteen to eighteen soft rays. These characteristics as far as the small

naked head, the barbels, and the dorsal fin are concerned, are leading for all the varieties.

**THE MIRROR OR KING CARP.** *C. rex cyprinorum*, *Spiegelkarpfen*, *Carpe a cuir*. This variety has a higher body than the preceding and is but *partly* covered with scales, which are of *different* size and shape, some of them three or four times the size of the scales on the noble carp. This variation has given rise to the false impression, that carps shed their scales, the fact apparently seeming to prove the idea. The color of the scales is deep *black* in the center, and edged with silvery white, giving each scale the appearance of a miniature mirror, hence the name. The skin, where it is not protected with scales, is of a creamy yellow on the back inclining to olive brown, and yellowish on the belly.

**THE NAKED OR LEATHER CARP.** *C. nudus*, *Lederkarpfen*. As the name indicates, this variety is very nearly or entirely *naked*, its skin as soft as that of a catfish. Its shape is the same as the mirror carp, differing only in color, which is brownish gray and the belly white.

**THE GOLDEN CARP.** *C. aureus*, *Goldkarpfen*, *Carpe d'or*. This variety is very popular in France and cultivated to a considerable extent. It must not be confounded with our common gold fish, as it is no wise identical. Its flesh is salmon colored, (that of other varieties being white) and of an exceedingly fine flavor, which together with the rich *golden* color of its scales is due to the locality and the food upon which it subsists. In all other respects, this variety resembles the noble carp, as does

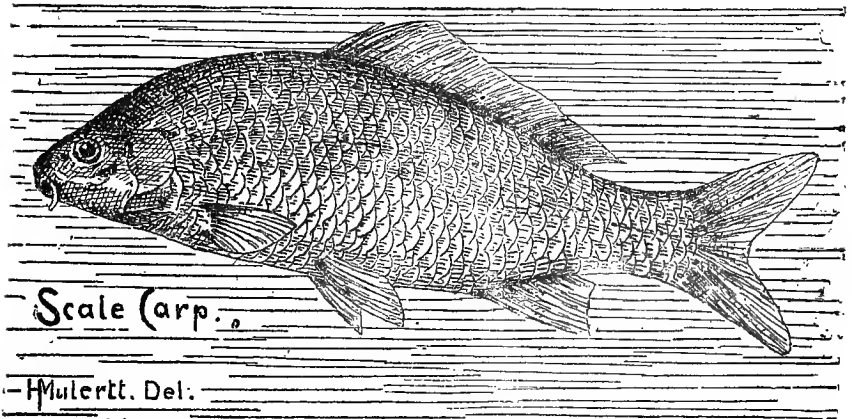
**THE BLUE CARP.** *C. coeruleus*, *Blauerkarpfen*, *Carpe bleu*, which is highly esteemed, especially so in and around the city of Leipzig, Saxony. When cooked it still retains the *blue* color of its scales, though this is ingeniously imitated by placing some other variety in vinegar for a while, the scales thus turning blue. In such cases the fish is known as "*Karpfen blau*" instead of "*Blauer Karpfen*," the name of the genuine fish. The large pond situated in the city park of Leipzig, in the rear of the opera house, and known as the "*Swan Pond*" (*Schwanen Teich*), is stocked exclusively with blue carp.

To these descriptions we wish to add that the mouth is of moderate size and is formed for bottom feeding, with the upper jaw covering the lower one. That the lateral line is continuous; that the dorsal fin is very long, and the anal fin is very short, the body as a whole resembling that of the buffalo fish.

The varieties of carp are no doubt the result of domestication, cultivation and hybridization. Whether the original stock introduced from the fresh waters of Central Asia were of the mirror, leather or scale variety, or all of these varieties, is not known. These are now the three principal

varieties where ever the carp are cultivated, and as this is to be a practical book it is with these only that we will deal.

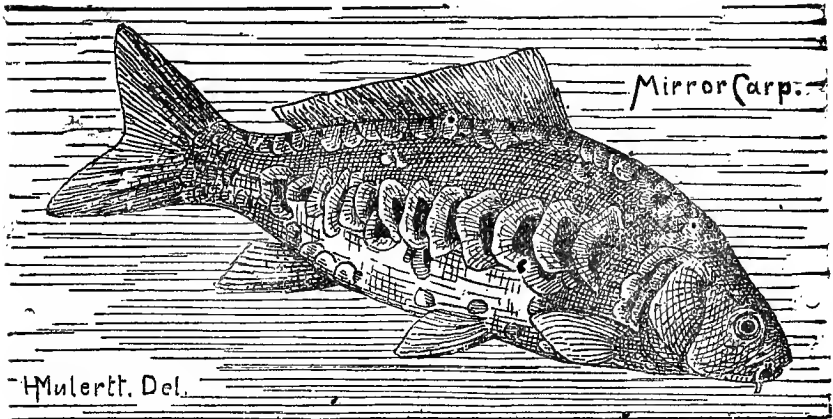
In the scale variety the entire body is clad with scales, which are about the same size as the scales of our ordinary native fish. It is considered by many to be the best of the varieties. It is slimmer, longer and more graceful than either of the other varieties, and very much more prolific; while it is generally conceded that it does not grow as fast as either of the other varieties, yet it certainly grows fast enough to satisfy most people. Hon. I. B. W. Steedman, in 1884, then Chairman of the Missouri Fish Commission, in his work on carp culture in that State, says that the scale carp in the State ponds at St. Louis reached a weight of eight pounds in two years. Those who want more growth than that will be hard to satisfy.



The second year after the distribution of carp by the Government, some individuals, who were breeding carp for stocking purposes, were so unfortunate as to have gold fish in the pond with their scale carp, and as the gold fish is of the carp family, a hybridization took place, producing an inferior progeny, which were placed on the market and sold. This misfortune gave other individuals, with an egotistical turn of mind, an opportunity to grind their axes, which they forthwith proceeded to do, at the cost of the scale variety of carp. They did not have the courage to attack the individuals and hold them responsible for their misdeeds, but assailed the fish, on the principle that the case would then be all their own as the fish could not answer back. Their purpose was to exterminate the scale carp, destroy the business of those who had pure-blooded carp, and boom an *accident* of their own—a so-called scaleless carp, which, like hairless dogs and wooden legs, will not produce their like. How far short of the mark they have fallen is demonstrated by the constant favor given to this variety, as much certainly as to either of the others in every State and Territory of the Union. Rudolph Hessel supposes the scale carp to

be the original species improved. We give this variety this much attention, not because of its superiority to the other varieties, but to help right an attempted injustice.

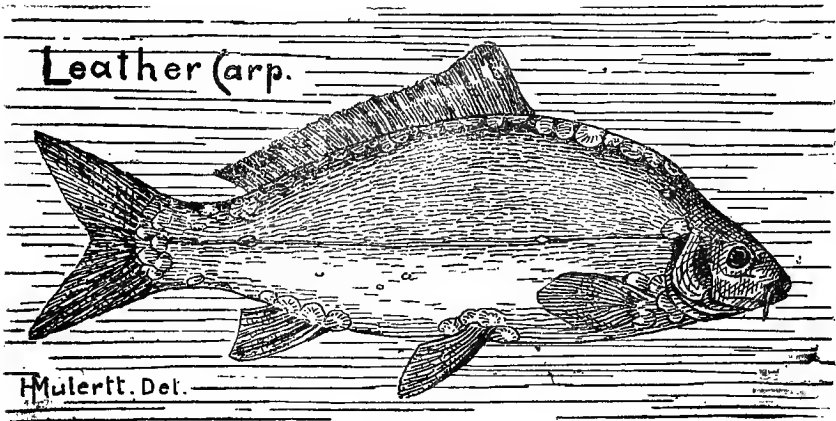
The mirror carp, as the cut shows, is but partly covered with scales, which are sheeny and bright and beautiful, reflecting the light in gorgeous tints and colors, and from this peculiarity of the scales it obtained its fanciful and thoroughly descriptive name. These scales are irregular both in size and shape, and are scattered along the back and the sides of the belly from gills to tail, and along either side on the lateral line from gills to tail is a broken row of irregular sized scales, while about the gills and tail a few scales are also scattered. The rest of the body is naked of scales. The row of irregular scales on the lateral line from gills to tail is the practical matter of difference between the mirror and the leather variety.



The difference in appearance between the mirror and leather carp, as before observed, is in the absence of rows of the scales on the lateral line on the sides, otherwise they are much the same in form, in shape and in covering. The scales on the leather carp frequently vary in number and in location, like the spots on a pig, they may be found anywhere on the body. Sometimes more of them, and sometimes less of them; sometimes in one place, sometimes in another, but usually along the back and about the tail and fins.

These last two varieties, the mirror and leather carp, grow more rapidly, but do not multiply so fast as the scale variety; but none the less are probably more plentiful and numerous than the scale variety. The cause of this lies in two facts: First, because of the greater number of these imported by the U. S. Commission. The natural consequence being that the Fish Commissions of the several States sent out more of these

varieties than of the scale variety. Second, because even the scale variety in its progeny tends toward the leather and mirror varieties, and adds largely to their ranks. It is also true that the mirror and leather varieties in their progeny frequently contribute to the scale-clad tribe, but not in as great proportion as the scale variety contributes to them.



The cuts used here were made expressly for use in this work, by Hugo Mulertt, of Cincinnati, O., who made the drawings from live carp raised in Ohio, and persons at all familiar with carp will recognize how perfectly true they are to life.

The question most frequently asked by persons about to stock a pond is "which variety is best?" This is a question that no culturist in this country, unless governed by prejudice or a selfish motive, is prepared to decide. No German authority that we know of has ever attempted to decide it. The varieties stand out like the favorite breeds of poultry. Men are partial to old friends (the kind they have) because unfamiliar with the varieties of those he knows only by reputation. We have thousands of letters coming from every State and Territory in the Union, from honest men, and true, and men of fine discernment, and each is perfectly satisfied with that variety which he produces, and has no criticism for the varieties that others produce. Our own conviction is, that all pure-blooded varieties are excellent, and that even with the eye of your judgment closed, you can not make a mistake in your selection.

The golden carp and blue carp are two varieties but little known in this country. We are not aware that any golden carp were ever brought to America. The United States Fish Commission did, however, in January, 1883, import some blue carp, only four, however, were alive on the 9th of February of the same year, and they were badly diseased; hearing nothing further of them, it is quite probable that they died.

## CHAPTER III.

### THE ECONOMIC, PHILOSOPHIC, PATRIOTIC AND SANITARY REASONS FOR CARP CULTURE.

For years our American farmers in the pursuit of systematic economic farming have vied with each other in applying labor, experience, intelligence and capital to make their lands most productive with the least outlay. Their attractive homes and the comforts that surround them bespeak their successful efforts. Still there is a branch of economic and successful farming to which they have not applied themselves. One which is of more importance in its relation to the value of farms and the other branches of agriculture than appears possible on a superficial view. And this branch is

#### “WATER FARMING.”

There are not many farms without either sheets of water, natural ponds or pond sites, of which we will treat in due time. Money has been spent freely in ditching, tiling and underdraining to make such spots blossom as the rose. Where these efforts have succeeded, unaccompanied by ague and malaria, the ground has been dearly purchased, the remainder of the farm has been injured and the beauty of the landscape has been marred. The cost of ditching, tiling, underdraining and redeeming will be a big price for the land. The farm has been injured by being robbed of its water reservoir, and the face of the landscape has a black eye instead of the silver sheen of water. How much better to mold the swail, morass, or bog into a thing of beauty, give it banks and limits, if so it will contribute equally well to our revenues while adding greatly to our comforts and pleasures.

The water resources of every farm should be taken under as complete and perfect control as it is possible to get them, aside from the purpose of water farming. The following editorial article, taken from the October number of the National Journal of Carp Culture, 1887, covers the thought we wish to present:

“The present long, continued and very widespread drouth, accounts of which have come to us from several States relating the exhausted condition of small streams, springs, ponds, and even wells that never went dry before and that now are as dry as the middle of the highway, has at length reached Ohio. Beginning in the southwestern part of the State and traveling north and east drying up ponds and streams and exhausting wells until in many places water for household purposes is being hauled several miles. Those who had ponds, whether natural or artificial,



whether used for fish culture or not, have realized what a blessing an extra supply of water is and how well even unfarmed water pays for the space it occupies. . The attention of agriculturalists and agricultural journals in this country has been so long directed to the cutting of water courses, the underdraining of land, and the precipitating of the rainfall into the streams and rivers that they have finally succeeded in overdoing what they set out to accomplish, until, as our friend, Hugo Mulertt, in accounting for the great floods in the Ohio river that did-so much damage at Cincinnati and other points within the past three years, describes the rainfall as being received in tile drains, rushed into the valleys or depressions of the earth, then off through larger sewers or open water courses to the creeks and streams and thus to the river almost within the hour that it fell, robbing the soil, flooding the river lands, carrying destruction on its breast, and leaving a drouth and its dread consequence to follow in its wake. We do not underestimate the value and advantage of a proper system of underdrainage. But we would place our agricultural friends upon their guard against rushing the rainfalls beyond their reach in time of need. Husband the waterfalls in ponds, making them as deep as the character of the land will permit. One-third of the area covered by the water should be from two to eight feet deep, the remainder of the area spreading out to a few inches at the margin. Then with a good well and a windmill supply your cattle trough and with an overflow conduct the waste water to your pond. Your well will be the better for the drain upon it and your pond will just about maintain its level during ordinary seasons, and its full body of water will be preserved as a resource against time of drouth. Farm this body of water by cultivating fish in it and you will have the regular harvest of fish besides the harvest of water in the time of drouth. If you have ponds that have dried out make them deeper and turn the water of your well into them. If you have no ponds build them at once and your labors and expenditures will be a continual source of joy and profit to you."

In the waters planted with carp, the fish harvest comes twice a year. When the birds begin their songs and all nature arouses from the lethargy of winter; when the barns and cellars are well nigh empty, and the exchequer running low, the two and three-year-old carp become a source of revenue. Again in the fall when the freshets of spring, the drouths of summer, the north winds, and the sun's scorching rays have made their impression felt on the resources of the farm, and the farmer is depressed with care, and weighed down with anxieties; the carp, unaffected by these extremes, will come to the rescue and balance the accounts. Then, whilst the farmer, with a vast amount of care and tireless effort, provides six, and even seven months food for the warm-blood animals, and doles it out to them day by day; the carp, very accommodatingly, fasts, and yet comes out in spring ready for the market. We feel justified then, in claiming for the carp a very high position among the best of domestic animals.

We believe that with general water farming, in this country, the utilization of springs and husbanding of rainfalls in ponds and reservoirs,

that the rainfall will be more evenly distributed; that the evaporation from the ponds in the heated season will moisten and purify the air, destroy disease germs and contribute to better health; that the immense and devastating freshets of our great rivers will be things of the past; that the nearness of water and the evaporations from it will affect beneficially all crops, and that our farmers in their provisions against drouth, like vaccination for smallpox, if overtaken by drouth, will suffer less from it.

A good pond of water, under proper control, adds to the beauty and commercial value of any farm, in other ways than those already mentioned. No article of diet is more healthful than that of fish, with a pond well stocked with fish on a farm, it is no trick to have fish any day, and every day for that matter at any of the meals of the day. A luxury provided by Providence in exchange for salt pork which is the staple meat of the farmer; not of choice but from necessity; fresh meat not being available, and if available, greatly adding to the cost of living.

A fish pond adds to the home attractions of the farm and makes it a pleasanter place for the sons and daughters of the home, a place to bathe, to boat, to skate, and above all, a place to fish. Where is the boy or man that does not like to angle for the finny tribe? If you have him, send him to Barnum, he has a place among his world's curiosities for all such. How many farmers hitch up their teams and take their families, or their boys and drive half the night to reach a fishing ground by daylight, then labor all day, rain or shine, and come home in the middle of the next night with a string of small suckers, or other valueless fish; the team is used up, the whole party is exhausted and can't half work for the next three days. Disgust prevails for the time and a general swearing off follows; but Lord bless you it's only until the next fishing fever is on. Like all other fevers to which the human family is subject, it has its periodicity of attack, and is recurring as the ebb and flow of the tide. The panacea for all these ills is the carp pond on the farm. You know where the fishing ground is; you have not to hunt for it, and when found, ascertain that others have been there before you and taken all that were worthy of capture.

The ice harvest of many ponds will pay better than any crop that could be grown on the ground occupied by the pond. This is in localities where the ice can be disposed of; where it cannot be disposed of, if harvested and used in the dairy department of the farm it will pay a good dividend, and in the heated season it is always a luxury in the house.

Other reasons might be assigned, but these are sufficient to demonstrate the importance of water farming, and the pleasure and profit to be derived from it.



## CHAPTER IV.

### CHARACTER, LOCATION AND CONSTRUCTION OF PONDS.

In the construction of ponds water is the prime factor, because necessarily the first consideration of the builder. The water supply determined upon, the soil, its water-holding and vegetation-producing capacity, the size and location of the pond or ponds to be constructed, must next be considered. These are the forethoughts of pond making; the after thoughts are plentiful enough, as every pond builder knows.

If the conditions of soil and water are favorable the labor is greatly simplified. If unfavorable then skill and patience and perseverance will be required to overcome the unfavorable conditions. But these latter are matter of special thought, and since no general provision would apply to them, they must simply be laid aside until each condition and situation is known and can be studied and provided for by itself.

In a dry time it looks a simple thing to build a dam across a dry stream, or at the open end of a gulch or ravine, and so form a pond. If the gulch, ravine or stream is of any length, or drains any considerable territory of the rainfalls, an ordinary dam and overflow will be of no consequence. We know of some beautiful ponds constructed in just such places. It requires skill, money and labor. A very correct idea of the dam necessary in such a location will be obtained by viewing some of the mill dams built in rivers and streams. The requirements are excavations on sides and bottom down to a firm, waterproof base, then heavy, substantial, symmetrical structures from base to summit. The latter being level from side to side the entire length of the dam, spreading the overflowing water into as thin a sheet as possible. The carp pond dam on other and smaller streams should differ from the mill dam in being wider on the top, and a few inches above the desired water level a six-inch stratum of coarse gravel, extending from side to side and end to end of the dam, should be placed. This will act as a strainer for any ordinary freshet, and prevent the escape of the fish. The advantage of such a pond is that more otherwise useless and unsightly ground can generally be covered, frequently to the extent of making a pleasure resort and a place for picnicing and boating.

For general pond purposes, the water, both in supply and escape, should be under the more perfect control of the culturist than is possible in the ponds mentioned. The way to secure such control is to dam the gulch or stream higher up in its course, and from the backwater, by means of open ditches or pipes, conduct the water in just the quantities wanted to the ponds, which may then be located at your pleasure on either side

the bed of the water course, and beyond the reach of its overflow. It is usually practical, then, to build a series of ponds either on the same or different levels. If on different levels, the ponds both overflow and drain into each other to the lowest one; in time of need this will be found a great economizing of water. If on the same level, or nearly so, each pond must have its own supply pipe and drain directly into the bed of the water course. Supply and drain pipes to each pond, whether on the same or different levels, are both desirable and advantageous to the culturist. It gives him absolute control of each pond independent of any of the others.

#### SKY PONDS.

These ponds form quite a class of the successful carp ponds of America. They are dependent nearly, or entirely on the rainfall and the water shed from adjacent lands. Here husbanding of the water is everything. It is accomplished chiefly by making the pond bottom and embankments of soil impermeable to water, so that the only loss is by evaporation. Without such bottoms and banks this class of ponds must fail. They fill slowly, unless in very wet weather. Where they receive the water shed of considerable territory they should be protected against sudden inundation in heavy rainfalls by side ditches with sluice-gates leading to the pond, so that when these gates are closed the shed-water is carried off beyond the dam and made powerless for evil to the pond and its inhabitants. The water supply of these ponds may be greatly reinforced by a windmill supplying a cattle trough from the well, and the overflow of the trough conducted to the pond.

Below or to one side of the main pond of such an establishment should always be a pond or two of considerable depth, but the surface need not be great. Then in the drawing and fishing of the main pond you will not be caught with dry weather or a freeze-up in winter, with your stock on hand and no place to safely quarter them. The lower or side ponds need be but little below the level of the main pond. If empty at the drawing off of the main pond they can be filled with the first water taken from the high-water level by means of pipes or sluices constructed for that purpose. These smaller ponds will be of great advantage, too, as breeding and hatching ponds, or as reservoirs for stock and market fish.

#### SPRING PONDS.

The size of these ponds should be in proportion to the amount of water flowing from the springs, bearing in mind that the evaporation and absorption every hour is equal to about 250 gallons to the acre. The rainfall and water shed off the immediate vicinity will contribute to the water supply. If the height of the springs will permit it, the water coming from them during the warm months should be broken, aerated and warmed by falling on wire netting and passing over rocks before reaching the pond. In cold months remove the obstructions and let the inflow be

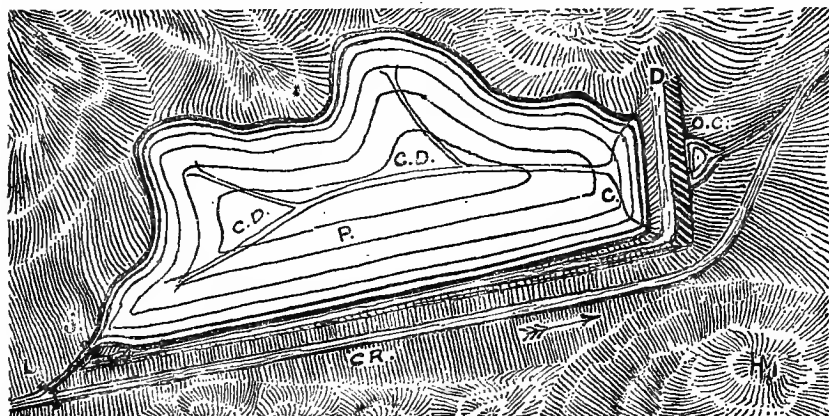
direct. The advantages of these ponds are constancy of water supply summer and winter and high temperature of water in winter, usually keeping some surface of the pond in the immediate vicinity of the springs clear of ice, affording oxygen to the fish and permitting the escape of any poisonous gases generated by decomposing vegetable matter in the bottom of the pond. The disadvantages are lower temperature of water in summer time and very small supply of food carried by the water to the pond.

The best water for carp ponds is that furnished by running streams. It is aerated, heated, and carries food for the fish. The best sites for ponds are along the courses of such streams or by the feeders of mills, below the basins of canals, etc. The sites for ponds will naturally suggest themselves whenever they meet the eye. Nor is it within the province of this chapter either to indicate them all or to furnish plans for the construction of the various embankments and dams necessary to the varied character of the sites. Some locations need but a dam, others need banks on two or even three sides. The principle of construction, however, is the same.

#### DAMS AND EMBANKMENTS.

The difficulty of repairing a dam makes it necessary to build it well in the start-out. Stake out the line of the embankments, determine their height and allow ten per cent for shrinkage; make the base three times the height. Then, in the center of the base, cut a ditch three to five feet wide down through the surface-soil to a sub-stratum of the earth that will hold water; extend this ditch out under the shoulders of the dam. Throw the material taken from the ditch to the outer side. This ditch must then be filled with loam (a small per cent. of sand, a large per cent. of clay) or good plastic clay. The filling should be done in layers of six to twelve inches each, each layer carefully spread and thoroughly tamped. It will pack better if wet, even to the point of puddling. When the ditch is full, the dam spreads out to its limits, and is continued on up in layers just as in the ditch. If the banks are to be built from material taken from the bottom of the pond, which is the most economical plan, and if the material is fit, put the surface soil on the outer side of the dam, and the next inferior soil on the inside, placing the very best of your dam-making material in the center of the embankment, continuing it on up over the lines of the ditch to the top of the dam, carefully tamping and packing every stratum as it is laid on; removing all stones, sticks, sods and other debris. The dam should be as wide on the top as its height above the ditch. The slope of the sides will then be at an angle of 45 degrees. The rich surface soil on the outer side leaves it in good shape to sod or seed with blue grass. This will add to its beauty, and prevent furrowing or washing with the rains. Dams improve with age. To protect them against depredations by muskrats, build them only about 12 or 15 inches

above what you design for high-water mark. There is then no room for the dwelling of the rodent above the water level.



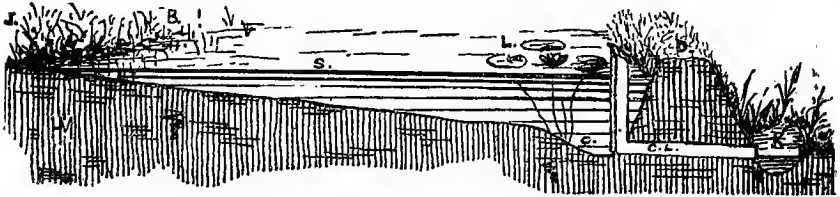
PLAN OF A CARP POND.

The diagram shows a small valley surrounded by little hills. A creek runs across this valley, and the farmer concludes to make a carp pond on this spot. The first step in the doing of this is to alter or correct the bed of the creek. It is led to the right along the foot of the hill (*cr*). Next the dam (*d*) is located and built, at the same time the ditches (*c d*), the collector (*c*) and the outer collector (*o c*) are formed, the material thus obtained being used on the dam. The dam (*d*) runs first across the valley, then forming a right angle it runs alongside of the creek to protect the pond against the wild water of the latter. *L* is a lock in the creek which can be opened or closed at will. From here the pond is supplied with water. A second lock in the supply channel, which leads to *J*, is supplied with some arrangement, a wooden box with slatted sides, a box of gravel, or a wire netting, to keep out wild fish.

The form of the bottom of a pond must depend on its size and shape and the purpose for which it is to be used. If there is but one pond, which is to be the home of the carp winter and summer, the pond must be arranged to that end, and must have both shallow and deep water. The carp thrive best in warm water; the reason is twofold. They are adapted to the higher temperature, and the higher temperature produces more food for them in the form of insects, larvæ and worms. They will stand a temperature of ninety degrees before dying. In long-continued hot spells, in shallow water subject to the direct rays of the sun, it is not uncommon for the temperature to range from eighty five to ninety degrees. The carp then need a cooler, deeper place to retreat to. In winter the shallow water is too cold, and they seek the deeper water for warmth. Many carp culturists have lost their fish during the winter season, and

while, no doubt, poisonous gases had much to do with it, it is just as certain that lack of deep water also had much to do with it.

To obtain both shallow and deep water, on about one-half of the area of the pond around its edges the water should be from nothing to eighteen inches deep; on about one-fourth of the area of the pond, from eighteen inches to three feet deep, and on the other one-fourth, from three feet to eight or ten, or even twelve feet deep, the greatest depth being at the point where the drain-pipe and collector are situated, as shown in the accompanying illustration:



LONGITUDINAL SECTION OF A POND.

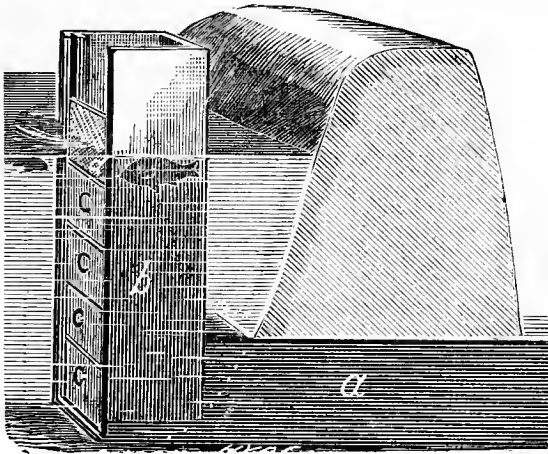
*J* is the inlet or point where the water enters the pond; *B* is the spawning ground for the fish, and is shallow and full of water plants; *S* is the surface of the water; *L* is pond lilies to give shade to the fish in hot weather; *C* is the collector, or deepest point in the pond, and is situated at the entrance of the drain-pipe. *OL* is the outlet passing under the dam from the lowest point in the pond bottom; *K* is a collector situated outside of the dam to trap any fish that may possibly escape through *OL*; *D* is a cross section of the dam. The bottom should be of a uniform grade, sloping from all points to the collector. A ditch, four feet wide and two feet deep, leading half the length of the pond and down to the collector, will, when drawing off the pond, greatly facilitate the bringing of the fish to the collector. Side ditches, tapping any low spots in the bottom, should be run into this leader. It serves a further purpose in getting below the gas-producing stratum of the bottom, and in just that degree preserves the fish in winter from its influence, as the gas rises to the ice and saturates the water from the ice downward.

All artificial ponds should be so constructed that they can be drained. It is quite indispensable to successful pond culture. In Germany, with the experience of centuries in carp culture, their system of draining ponds is so complete that they rotate carp culture and agriculture as we do crops, and one helps the other. The bottoms of ponds, in which fish have been raised a few years, make rich fields, and cultivating the ground a few years again makes it produce more food for the fish. Whatever the advantage arising from the power to drain ponds for this purpose, it is certainly much more essential in enabling you to gather your harvest of fish.

Of all the plans, systems and methods of draining ponds in vogue, both in Germany and America, the most popular and the simplest method



is that of the "Monk," mentioned first in this country by Hugo Mulertt, of Cincinnati, Ohio, afterwards by Rudolph Hessel, Superintendent of Government ponds at Washington, D. C., and put into practical operation by Dr. H. H. Cary, Superintendent of the Fisheries of Georgia, through whose kindness I have the pleasure of presenting the illustration.



A GERMAN MONK.

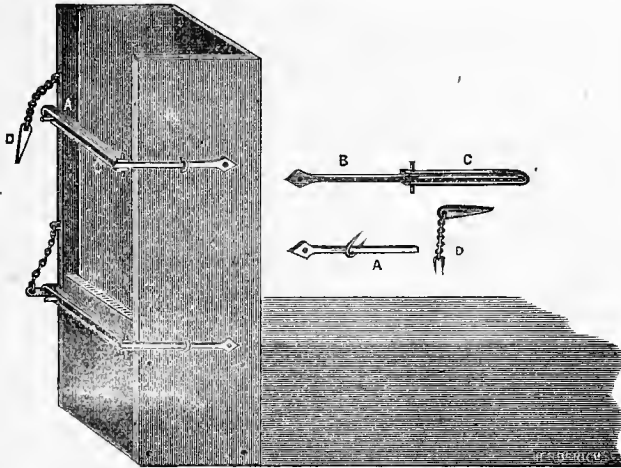
The wood-cut above represents this simple apparatus that has become so popular; *a* is a wooden box running crosswise through the dam, six inches below the lowest point in the collector, so that it will insure the complete emptying of the pond, made of heart-pine plank, being twelve inches wide and two thick, securely nailed together. The upright part, *b*, is of the same material and size, and joins it at right angles, and of sufficient length to extend some distance above the water line. This is made secure to the horizontal portion, and it will be of great advantage to give the whole a dressing of coal tar. The side of the upright next to the pond is left open, and narrow strips are nailed to the uprights on the inside to constitute grooves for the gate pieces, *c c c c.*; *d* is a strainer of wire, secured in a frame of the same size as the gate pieces, *c*. When it is desired to empty the pond, remove the highest gate piece, *c*, and substitute the strainer, *d*. When the water line is lowered to the next gate piece, remove it and substitute the strainer for it, as in the first instance, and so on until the water is drawn down nearly to the collector, then the mud can be removed from the collector, the fish dispersing while this is being done. The water can then be drawn off until the fish are drawn into the collector, when they can be readily removed with the dip-net, when the last gate piece can be taken out and the collector completely emptied. The only defect is in making the gates tight. If the water supply is abundant, this is of no consequence, as the leakage would not allow the small fish to pass out, and still might constitute a part of the overflow.

but, if the water supply is limited, this might lower the pond at a time, when you could not afford to lose any water. Fortunately, this defect can be easily remedied. Prepare a plank of the size of the opening of the box, *a*, (let it be green lumber, so that it will not swell, to prevent its being withdrawn), pass this down along the side of the upright, *b*, so it will include the opening in *a*, then *b* can be filled with sawdust for a foot or two, and a little dirt, if necessary, which will entirely stop the leakage.

The objections to this method are: First, the wood will decay. Second, for very large ponds the drawing would require too much time. Both these objections together with all possibility of leakage, may be overcome by building the flumes, *a* and *b* both of brick, covering the top of *a* with flagging stones, or any others long enough to reach from wall to wall, and leaving *b* entirely open in front. *b* should then be built closer in to the dam than shown in the cut; far enough in so that the open front at the bottom is a little within the line of the dam. Against the open face of *b* lay two-inch plank, sawed of a length to just cover the outside edges. In front of *b*, and two feet away, sink two posts; fill in the space between the posts and *b*, with good clay or loam, tamping it well as it is put in. Make a sufficient detour in your dam to include these posts and it will protect the sides of *b* and give you an absolute water-proof draw-off that will last without repairs for ages. The draw-off can be built any size to suit. The top of *b* can be covered with a lid, or, if the top is below the level of the dam, it can be covered with boards and a little earth thrown on them will conceal it entirely. A door should be fitted to the outer end of *a* and kept locked when not in use. In drawing off the pond take the earth from between the posts and *b*, remove one plank at a time, and as the water runs down remove more earth and other plank, and so on to the last. A frame the size of your pieces of plank made of two-by-two-inch stuff and covered with a wire run the short way of the frame between six-penny nails driven so closely together as to only permit the wire to pass between them. The heads of the nails on either side should be covered with sheet iron which comes even with the surface of the inside of the frame. This frame slipped into the place of each piece of plank as it is removed, will prevent the escape of the fish and will not clog as will a mesh or screen.

An improvement on this method where lumber is used in its construction was published in the NATIONAL JOURNAL OF CARP CULTURE, October, 1886, by S. F. Ulery, of Garrison, Iowa, which consists of clamps as shown in the illustration (next page) herewith. These clamps are made in four pieces out of  $\frac{3}{8} \times \frac{3}{4}$  inch iron. To make a clamp for a box 12 inches across from outside to outside, cut a piece of iron 10 inches long as described by letter A in cut, flatten one end and punch a hole to receive a  $\frac{3}{8}$  inch bolt so that the  $\frac{3}{8}$  inch edge of the iron can be bolted against the box which will give it sufficient strength; B is made the same as A except that a  $\frac{1}{4}$  inch hole is made in the opposite end the flat way of the iron; C is made  $27\frac{3}{4}$  inches long, with a  $\frac{1}{4}$  inch hole in each end the flat way of the iron. Bend the iron in the center, and bolt the two ends on to the end

of B in the shape of a hinge, now close C to within  $\frac{3}{8}$  of an inch, so it will pass over the end of A. D is a key in the shape of a wedge to tighten the clamp. Bolt A on the outside of the box so that it will project  $1\frac{1}{2}$  inches in front of outlet, drive a staple over it in the center. Bolt B directly opposite to A on the outside of box and staple same as A, place the clamp C over the end of A and drive in the key. Fasten the key to the box with a chain. This clamp will not rust so but what it can be easily adjusted above or in the water. Use three clamps on a ten foot box.



THE MONK WITH CLAMPS.

It is necessary only to use slats on the inside of the box as the clamps keep the sections firmly to their places from the outside and the sections can be put in or taken out anywhere up or down the box.

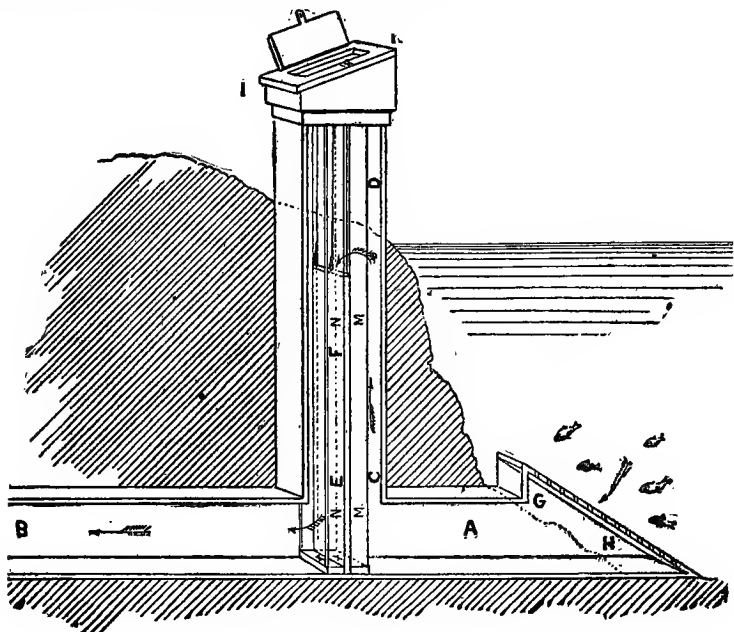
#### A BOTTOM OVERFLOW AND DRAIN.

In ponds where the water is cold and the supply constant, and a consequent continual overflow, it is very desirable that the water passing out of the pond should be the coldest water it contains. This is always found at the bottom of the deepest part of the pond. A very practical and popular method of accomplishing this is presented in the accompanying illustration. It was introduced into this country by George Eckardt, formerly Superintendent of the Missouri Fish Commission. We take the description given of it by I. G. W. Steedman, A. M., M. D., ex-Chairman of the Commission of that State, in his work on "Carp and Carp Culture in Missouri."

"The illustration represents a combined overflow and draining apparatus, the sketch having been drawn from those now in use in three of our Forest Park spawning ponds.

A B is a wooden box running crosswise to (at right angles with) the dam, the box G H, where the water enters, being placed in the lowest

point in the kettle, so as to insure thorough emptying of the pond. The perforations in this box G H should not exceed a half inch in diameter, and should be numerous in proportion to the volume of the water entering the pond and passing the overflow; if necessary, perforations may be made in the side as well as in the front. The total capacity of these perforations should be considerably greater than the capacity of the horizontal box, as in emptying the pond, the holes necessarily become more or less choked by mud, fish, water-plants, etc.



BOTTOM OVERFLOW AND DRAIN.

In the upright box C D K I, is framed a perpendicular slide or gate, E. F, which fits tightly on the bottom of the horizontal box A B, the end of gate being held in position by strips nailed on the bottom; similar strips, N N, are nailed on the vertical sides of upright box; between which the gate is lifted up or forced down by means of an iron hook or ring in top of gate at the point where the curved arrow shows water passing over. The course of the water when overflowing is shown by the arrows.

The pond is emptied by simply lifting the gate E F, when the water passes directly through the horizontal box A B.

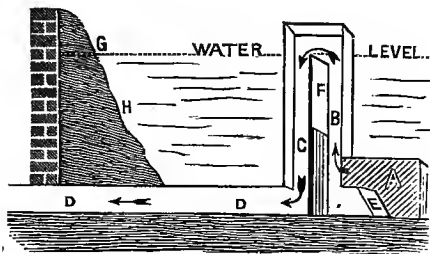
On the top of the upright box at I K is shown a lid which may be locked down, to keep idlers and thieves from raising the gate and emptying the pond.

The water level in the pond can be changed at will by simply placing

strips of board on top the gate, at the curved arrow, as desired.

The most serious defect in the whole apparatus consists in making the gate E F water-tight. If the water supply is scant, a small leak may lower your pond at a season when additional water can not be obtained. A liberal supply of saw-dust thrown into the box may materially assist in closing the leaks. It is best to make this combined overflow and draining apparatus of two inch boards, and in addition to what is shown in the drawing, drive upright boards deep into the clay beside the horizontal box A B, and nail them fast to the box, so that no amount of heavy strain in lifting and lowering the gate can displace the apparatus and cause a leak. We recommend that all this wood work be thoroughly painted with coal tar before it is placed in the dam. For that portion above the water level it is *indispensable*."

It will be found much more satisfactory to extend A far enough into the pond to build a box-frame 4x4 feet wide and 2 feet high over the end G H. The sides, ends and top of this box should be made of slats one inch thick and one inch wide on one side by three-fourth of an inch on the other side. These should be nailed on the frame with the narrow side in and the wide side out, and one-fourth of an inch apart. These openings will then be one-fourth inch on the outside of the box and one-half inch on the inside of the box. Any debris starting through the crack will go clear through and the strainer will not clog up as will augur holes. Being a level surface it is easily cleaned. The slats may be made from a plained inch board. This box strainer should be anchored to well-sunk stakes at its corners. This plan of straining is the result of many years experience in pond culture, by George Finley, an eminent pisciculturist, of Pittsburg, Pa., who commends it most highly, as do all others who have used it.



SLIDING CENTER BOARD.

G.—Water Level.

H.—Embankment or dam.

D. D.—A tube passing under the dam.

A.—Strainer box over inlet E. of tube, to prevent the escape of fish.

B. C.—Perpendicular tube at right angles to D. D., with F., a partition dividing it across in the center. The water entering at A. follows the arrows and passes through D. D. to outside of dam.

F. is a sliding center board, to be raised or lowered at will.

A modification of the method in use in the Forest Park ponds and

showing a strainer box, such as described above, was suggested to us by E. C. Griffiths, of Honey Brook, Pa. We had it engraved for the benefit of the readers of "American Carp Culture," and because of the strainer box and sliding center-board reproduce it here. In suggesting it Mr. Griffith said:

"The greatest trouble in ponds is to make an outlet that will not choke with drift and at the same time prevent the fish from escaping. Frost also tries the best constructed appliances. In the plan of drawing I send you, *all* these obstacles are overcome. Three years ago I designed and introduced it into my pond and it has worked in the most satisfactory manner. Other parties have also made their outlets after this plan and say it works better than anything of the kind they ever tried.

Drawing the water from the bottom, the temperature is several degrees cooler than the surface in the summer, and in the winter it maintains a temperature of spring water, therefore seldom forms ice inside the pipes. Another advantage I claim is if at any time the water is wanted to be partly lowered, it can be done without disturbing the under drain. The water level can also be changed at will, simply by raising the sliding center partition."

In placing of overflows and under drains in dams and embankments, we cannot insist too strenuously upon the necessity of great care in the work to prevent leakage and to insure the complete emptying of the pond. They must of course be put in place as the dam is being built, and immediately after the ditch underlying the dam is filled. This will be before much material has been taken from the pond bottom. If the material to fill the ditch is taken from the pond bottom it should be taken from the point where your collector is to be situated, (if the material there is good for the purpose). This will lower that point so that you can better judge the right level for your underdrain, which should be about four inches below the bottom of the collector. When ready to lay your tubing, prepare a very level, thoroughly tamped bed for it. When in its place drive stakes with a flat surface next the tube, two feet apart. Nail these to both the bottom and top piece of tube. Good stakes should also be driven at the collector end of the tube and nailed in the same way. Brace the upright end of the drain pipe, then begin filling around the tube, using pulverised earth, well wet, tamped from end to end on each side, carefully working every particle of earth that you can in under the tube; the stakes will prevent its lifting, and you can pack it very thoroughly. Continue the filling and tamping on up the sides and over the top in the same way. The soil, if wet to the point of puddling, will pack so much the better.

In large ponds it may be found necessary to place more than one of these outlets to facilitate the emptying of the pond. But this is a matter which every culturist will be able to pass the best judgment on himself and we leave it with him.

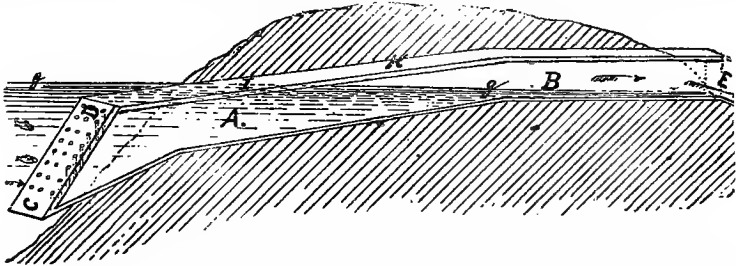
#### OVERFLOWS.

In ponds subject to freshets or sudden inundations of water, a provision should be made, if possible, to have an overflow at the upper end of the

pond, or as far away from the dam and embankment as possible. This should consist of a space wide in proportion to the size of the pond, amount of water passing and frequency of inundation. This space should be covered with grass or a stratum of coarse gravel, so that it will not wash or cut out. The overflowing water should be conducted in a channel at a safe distance from the embankments of the pond to below the dam, where it will take care of itself. Where the water passes out of the pond, a strainer made of slats, as described for the drain box, should extend clear across the space; the slats being placed a half an inch apart.

Where for any reason the overflow of the pond cannot be regulated from the upper end, or where such an arrangement is designed only for special protection against freshets, and the desire is to keep the water ordinarily below that level, the following device introduced by Mr. George Eckardt into the Forest Park ponds, of Missouri, will be found serviceable. I. G. W. Steedman, explaining it in his work before quoted, says:

"No pond is safe against storms and floods, unless it has a properly constructed overflow of sufficient capacity to carry off all surplus water, and at the same time not permit the escape of the fish. Overflows which receive the water from the surface of the pond will clog and choke from the drift leaves and other trash always brought down by heavy rains.



The illustration shows a wooden overflow, so constructed as to prevent surface drift from choking the perforations in the box C D. The arrows show the water entering the box C D below the water level and near the bottom of the pond, passing over the dam at B E; at the end of this chute a sheeting of boards or stone should be constructed to prevent a wash and undermining of the dam by the overflow.

Of course the size of the box C D, A B, I K, and the number of perforations at C D must properly be proportioned to the volume of water to be expected in extreme floods, always allowing for more or less choking at C D. This overflow should be built of two-inch stuff, and thoroughly coated with coal tar before being put down. If properly constructed it is automatic and needs no watching. We have one in Forest Park that works admirably. This sketch is made from it.

Before the introduction of this simple overflow, it was necessary to have men stationed with brooms day and night during heavy rains to keep the wire gratings swept clean of drift, to prevent disastrous overflows. Now, we have no trouble in ponds thus equipped.

It is all important that the size and capacity of the overflow be properly proportioned to the maximum floods which may occur."

We advise that C D be made of slats, as described for the mouth of the drain flume.

## CHAPTER V.

### CLASSES OF CARP PONDS AND THEIR PURPOSES.

There are but few persons that engage in carp culture as a mere matter of pastime or pleasure, and to whom the ulterior motive of profit does not present itself. The culture, happily, combines in an eminent degree these much desired ends, *pleasure* and *profit*. Even while we write, the incentive to systematic and extensive culture grows stronger day by day. Following the lead of Germany, arrangements are now being made to place live carp for table use on the market in this country. A stock company has been chartered in Illinois to so supply the Chicago market. This is a matter of no surprise to us, because we expected just such things. The young industry is moving rapidly forward, and in a few more years will occupy its legitimate place as one of the leading and most profitable branches of agriculture. Chicago has but taken the lead. Whenever the stock on hand warrants it, other cities will follow with live fish markets. The people once educated to the difference between a fish that dies of suffocation, as do all the dead fish offered for sale in our markets, and the flesh of which is therefore not fit to eat, and a fish taken alive from the water and killed immediately and dressed for the table; then carp, as the one fish, that can be supplied alive in sufficient quantities for the market, will command a price that will make their culture exceedingly profitable. The political complexion of our national legislature will not affect this industry. The difficulty of importing live fish places it beyond the need of a tariff protection.

The line between extensive and systematic carp culture and simple carp culture will lie between those who push it as a business enterprise and those who engage in it as a home pleasure that will add a luxury to their table. For the former a number of ponds are necessary, a single pond will answer for the latter. The conditions not being the same the ponds must be differently constructed. In describing those suited to each purpose we will begin with a series of ponds intended for the systematic pursuit of carp culture.

### SYSTEMATIC CARP PONDS.

In France, England and Germany they have different classifications and names for these ponds. In this country they should be styled according to the ends they serve.

1. The hatching pond.
2. The stock pond.
3. The market pond.

The size of these ponds should be in keeping one with the other; the



hatching pond much the smallest, the stock pond next in size and the market pond largest of all.

**THE HATCHING POND.** Its average depth should not exceed eighteen inches, less will do. Considerable of its area, about the margin, the water should be from nothing to six inches deep, and over this area the flat, long, soft leaved manna grass, known to botanists as *Glyceria fluitans*, which grows readily and rapidly and is common in the United States, should be planted. German authors credit the carp with a weakness for depositing their eggs on this particular plant. If these authors have assigned any reason for the preference of this plant by the carp, we have not yet seen it. There is a cause for everything, and we believe the cause for this is that these plants grow close together, almost covering the bottom of the pond their strap like leaves coming straight up to the top of the water and then floating. At the time of spawning the female pursued by the male rushes through the thick mass of leaves, the resistance to her passage compresses her body and requires greater exertion on her part to force the passage, both of which give her aid in ejecting the eggs, which are caught by the leaves as she passes, and as the male follows the same causes contribute to the more liberal ejection of the milt. A greater per cent. of eggs are thus kept from sinking, and are fertilized by the male than would be possible with almost any other water plant.

The bottom of the hatching pond must be constructed on the same general plan laid down in chapter IV.; that is, it must have collector, collector ditches, etc., the main ditch being wide, long and deep enough to afford a resting place for the fish in either exceeding hot or cold weather, as the young fry pass their first summer and winter in this pond. The collectors in all ponds should be cleaned every year. In hatching ponds, owing to the small size of the fish when they are taken from the pond, that the collector should be clean is indispensable. A bed of gravel in the collector, or a rough board floor nailed to mudsills thoroughly anchored to stakes driven deep and firm, will greatly facilitate the cleaning, as well as the taking out of the fish. The pond must be provided with outlet drains and overflows, and must be protected with side ditches from freshets or inundations. A fundamental requirement of successful carp culture is an unchanging water level. If this is specifically true anywhere in the domain of carp culture it is in the hatching pond, and particularly during the period of spawning and hatching. A change in the water level after the eggs are deposited and before they are hatched is sure to do damage. If the water level is raised it either washes the eggs from their hold on the vegetation of the pond, in which case they sink and are lost, or it covers them with such a depth of water as to change the temperature and chill them, which will delay if it does not prevent their hatching. To lower the water level is still more disastrous, as it leaves the best lodged eggs, those nearest the surface of the water, high and dry and subject to the direct action of the sun's rays, which speedily dries out and spoils them. For weeks after hatching a change of the water level would be disastrous to the young fish, in its effect on their feeding ground and on the vegetation of the pond. The

hatching pond is a paradise quite for the enemies of the carp, (see chapter on enemies of carp) and must be jealously guarded against them. In this connection we desire to say that it is not wise to have hatching ponds cover much more than an acre of territory each. If greater space is necessary it will be wiser and better to build other hatching ponds. First, because the larger the body of water the more attractions it presents for the large army of water fowls that prey on the young carp. Again, the larger the body of water the greater the opportunity for damage by waves formed on the pond by wind, that frequently wash the eggs from their lodgment, carry them on to the shore and on retiring leave them there to dry up. The newly hatched fry will even be carried out in this way by the waves.

In the selection of spawners great care must be exercised to secure the healthiest and largest of their age, and truest to their variety. Fish affected by fungus growth, polyp or any other disease should never be used for spawners, and the best thing to do with them is to kill them, or put them in a small pond by themselves.

The general rule in Europe for the stocking of hatching ponds is two males to three females to each acre contained in the pond. This number is, however, frequently doubled. Some of the culturists of Germany and a great many of the culturists in America make quite a change in the proportion of the sexes, and put two males to each female and with very satisfactory results. We are not well enough established in carp culture in America to talk experimentally of it by the acre, and acre hatching ponds in America are yet scarce, as are also the men who make a special business of carp raising. Either rule will operate satisfactorily. With one more female than male it is certain that some eggs will either not be deposited or go unfertilized. With two males to one female there is greater activity and better possibilities of fertilizing the eggs. The females are very prolific, and will deposit about 100,000 eggs for every pound of weight. Those that are not fertilized, and many of those that are fertilized never come to life, and many of those that come to life die very young or are destroyed by enemies. So that at the drawing of the pond in the fall or spring the average to each spawner will not exceed from 1000 to 1500. It requires water rich in natural fish food to supply the wants of 5000 young fry the first summer to each acre. If, however, artificial feeding is resorted to when the spawners first begin their work of reproduction and continued carefully until they are through spawning and the spawners are then removed, and the young fish are carefully and regularly fed, and the water supply is good, then much better results will be attained, and the number of spawners to each acre even may be greatly increased and the number of young correspondingly increased. The one difficulty to be guarded against is too much stock for the water and food; when the former occurs the fish come to the surface with open mouths in search of oxygen; when they have not food enough they stop growing and the bones begin to harden, and if left long in this way they never overcome it and are always very small for their age. With plenty of food and water the young fry of April and May hatch should measure in November from five to nine inches long. If the water is overstocked

and they are not fed they will only measure from two to three inches. In smaller hatching ponds all the relations above hold good. The bottom must be constructed on the same plan, plenty of shallow water about the margins with deeper water to retreat too. The question of how many good, healthful, growing fish can be raised in a limited area of water if the margins are in good shape for spawning grounds and the temperature is all right, resolves itself into a question of oxygen and food.

The removal of the fry from the hatching pond, either for shipping purposes or for transfer to the stock pond, must be done with the utmost care. The water must be drawn off through the slatted or grated outlet very slowly, that no fish may remain in the mud, for if the pond is to be again used for spawning purposes the larger fish remaining will consume the food intended for the new hatch. The slightest injury to the young fish in the breaking of the skin or knocking off of scales may result in disease and death.

In our Northern, Northeastern and Northwestern States the hatching ponds should be shallower, with the greatest depth of water not to exceed two feet and be used for the purpose only of hatching and rearing the young the first summer. The pond should be drawn off in the fall and the fry transferred to the stock pond. The reason for this is that with water enough to successfully winter the fry in the hatching ponds in these latitudes it would be difficult to get the water warm enough for the carp to spawn. It would at least delay the time of spawning until late in June or July, and the young would have but a short season for growth. The earlier the spawning is done the better the opportunity for the fry to get a good growth the first summer, which is a very important factor in their development the second summer. With the exception of these colder sections of our country, the general rule will obtain for hatching ponds; that is a large proportion of the area of the pond the water is to be shallow, from one foot deep to nothing, and plenty of vegetation in this part of the pond, which should equal about three-fifths of the whole area, one-half of the remainder should be from one to two feet deep and the other one-fifth from two to four feet deep, and it will be safest and best to winter the young fish in these ponds.

**THE STOCK POND.**—Its construction is the same in every particular as that of the hatching pond, only that it is deeper and larger. The average depth of the hatching pond is about fifteen inches. The average depth of the stock pond should be from twenty to twenty-four inches. The shallow and deep water may be divided in the same proportions as in the hatching ponds, three-fifths of the whole area being from four to eighteen inches deep, one-fifth from eighteen to thirty-six inches and the remaining one-fifth from thirty-six to sixty inches, which will give an average depth of about twenty-three inches.

The stocking of these ponds generally takes place in the spring as soon as the ice is gone and the fish begin their search for food. Owing to the great climatic differences in portions of the United States it is difficult to set a definite time for this operation. Between Texas and Wisconsin or Minnesota there could readily be a difference of six weeks or

more. But usually it is done in the latter part of March and first part of April.

The number of fish to be planted to the acre in these ponds, if not artificially fed, will depend largely upon the size of the fish. The plant can better be determined by weight than by numbers. The rule that has obtained in Europe is to plant from 800 to 1000 fish that would weigh less than one-half pound each, to the acre. It must be remembered, however, that in Europe the fry the first summer could have only about four months growth, while in many of our Southern States the carp gets seven or eight months growth the first season, and in some of those States even more. In Texas, for instance, they grow nearly if not quite the entire year through. While these favored sections produce larger fish, nature maintains the balance by supplying a greater abundance of food. Owing to these climatic differences of our country, and the contrast in growth of carp in these extremes as evidenced in the reports of our correspondents for the past four years, we conclude it much safer to establish a rule of weight to the acre in planting both stock and market ponds. The rule then would be to plant your stock ponds with about 600 pounds of carp to the acre. The fish remain in the pond until the following spring unless large enough to market in the fall.

THE MARKET POND is the main or largest pond of the culturist, and is constructed as described in chapter IV, and will require about 700 pounds of carp to the acre to stock it. The size these fish will attain by fall will depend on their size when planted. They usually increase about one hundred and fifty per centum the third season.

In a large portion of the United States it will not be good economy to keep carp the third year, and it will be found profitable to use the market pond in connection with the stock pond for second summer carp. In a large section of our country the carp have conditions exactly suited to rapid growth, and grow from seven to ten and even eleven months in the year, and attain a size at eighteen months old much greater than that attained in Europe at thirty months of age. It is the size and not the age of the carp that makes it marketable. When carp weigh three pounds and upwards each they are fit for market. Much time and thought and labor has been and is now given to reach market one year earlier with warm blooded stock, the sole purpose being to realize their money value earlier; the same philosophy is applicable to carp. When they are ready for market do not keep them another year, but realize on them. In attaining this the second year the market pond will accomplish a good purpose; in transferring the one summer carp from the hatching pond select the largest ones and place them in the market pond, and the smaller ones in the stock pond. If you have the full quota per acre for the market pond a little food supplied regularly will greatly add to the prospects of a marketable crop in the fall.

In this system of ponds the hatching pond is the only one in which it is designed to raise any young carp, the others are feeding, growing and fattening ponds. But in this country carp frequently spawn the second summer, and if the quota of the pond is already full, and the spawn is allowed

to live, with the great number of spawners in the pond, they will be very numerous and will consume largely the food intended for the larger fish, greatly retarding their growth. To overcome this it will be found advantageous to adopt the European rule of introducing male pike into the pond; a bout 6 pike for every 100 carp. The pike should be much smaller than the carp as it grows very much faster than the carp; about 300 per cent. a year. The pike will serve a threefold purpose: 1. The carp fear the pike and will keep a safe distance from them; this will cause the carp to move about the pond and prevent them feeding at one place. 2. It will in a measure prevent the carp from spawning, and when spawning does occur the pike will devour the young fry; besides the pike become general scavengers of the pond and will destroy other fish and their spawn that by some means, and despite the care of the culturist, are constantly getting into ponds. They will also devour watersnakes, tritons, etc. For all these reasons they are very worthy a place in the ponds, and are a necessity in market ponds that are fully stocked. In ponds not adapted to pike, bass or other game fish of small size may be introduced in their stead. In this system of ponds, where artificial feeding is not resorted to, the stock pond should be four times as large as the hatching pond, and the market pond twice as large as the stock pond.

#### SALE POND.

Those three ponds will be found all that is necessary in a system where artificial feeding is not resorted to. Where such feeding is practiced, two other ponds may be found of advantage, as the purpose of feeding is to keep great numbers of carp where the natural food would supply but comparatively a few. These great numbers, on a small area, keep the bottom constantly plowed up with their snouts, in search of food, so that the entire body of water in the pond is continually clouded with muddy discolorations, and this bottom character of the water will necessarily affect unpleasantly the flesh of the fish; this is of consequence only in the market pond. To overcome this a small pond, with bottom and sides paved with brick or stone, the waste stones carted from the fields of the farm will do, making the slope of the sides and the surface of the sides and bottom as uniform and smooth as practical, that a seine will operate to the very best advantage. This pond should be oblong in shape, and the width so that in dragging the seine, parties can walk on either side of the pond, and the seine should reach from bank to bank. Its size must be governed by the number of fish to be kept in it and the flow of fresh water that reaches it. Water from the other ponds should not be used in this pond, though the water passing from this pond may be used in the others. Its depth may be from 6 to 10 feet. The depth will not interfere with successful seining, as the pond is small, only large fish in it, and the character of sides and bottom permits the water to be lowered very rapidly to facilitate seining. While in this pond the fish should be regularly fed. A few weeks here will put them in excellent trim for the table.

#### WINTER POND.

Where the hatching pond is small, used for the purpose of hatching

only, and too shallow to successfully winter the young fry, that, owing to care and artificial feeding are in great numbers, the stock pond not being ready for them until spring, a place to winter them in is necessary. The winter pond is used for this sole purpose. It should be clear of mud, and from 8 to 10 feet deep, and plentifully supplied with running water, if possible. The hatching pond is drawn and the young placed in the winter pond in November, and as they do not eat during the winter, no feeding is necessary. Such a pond plentifully supplied with water may be stocked at the proportion of about 50,000 fry to the acre.

#### THE MARKET POND.

The market pond should be drawn in the fall and the carp converted into money. They will lose from 2 to 5 per centum of weight during the winter. In many places in the United States they have been held over until the lenten season and then sold at advance prices, which more than made up for the loss in weight. Where the carp cannot all be disposed of at once, the sale pond will be found an invaluable annex.

#### THE STOCK POND.

The stock pond should be drawn in the spring, the spawners selected for the spawning pond and the remainder placed in the market pond.

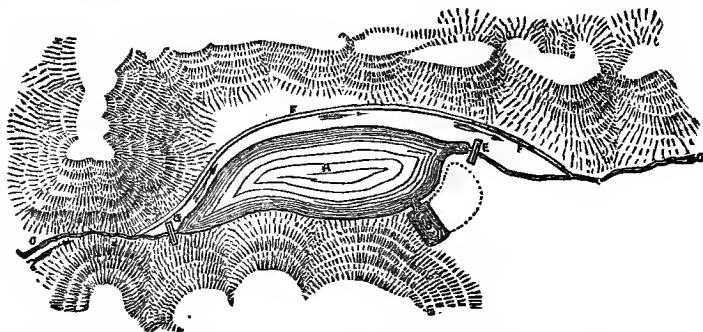
#### THE HATCHING POND.

The hatching pond, or if the young were transferred to a winter pond in the fall, then the winter pond is drawn as soon after the stock pond has been emptied and filled again as possible. The hatching pond is then again filled and the spawners placed in it.

#### MIXED CARP CULTURE.

A method of systematic carp culture in a series of proportioned ponds as detailed in the preceding pages would be entirely too extensive and costly a luxury for beginners as most farmers must be, and who utilize some waste spot to raise carp for a home luxury, any profit arising from the sale of fish, for any purpose, being only incidental. In these instances a single pond must answer all the purposes, and must therefore have the requirements of all of the other ponds. If a natural pond is used for this purpose it should be drained first, and the inhabitants of it destroyed. The bottom should then be arranged as described in Chapter IV. Ditches, collectors, drains, etc., that the water of the pond may at all times be under control, and its level maintained. In such ponds the water is frequently too deep for successful spawning and hatching. It will then be necessary to construct a hatching place. To do this, select some flat spot at, or near the edge of the pond of such dimensions as the opportunity affords, say 30 feet wide by 80 feet long. Excavate it so that when filled from the pond the water will run from nothing at the margin to 18 inches deep in the center. Make a cut then in the bank from 6 to 10 feet wide, and deep enough so that in the drawing off of the pond the hatching annex will be completely emptied. This annex should be thickly planted with water vegetation; manna grass,

before mentioned, water plantain, water cress, etc., taking the best water plants of the section in which the pond is located. The plants best adapted for spawning purposes being those of upright close growth beneath the surface, and whose leaves float on the surface of the water. The spawning carp will find this hatching bed and when they have deposited their eggs close the neck with a seine or slatted grating, shutting the large fish out from the bed for a few weeks, allowing the eggs a chance to hatch unmolested and the young an opportunity to develop somewhat and learn to hunt their own food.



The diagram designed by Rudolph Hessel represents such an annex or hatching bed. *A* is the pond, *B* the annex or hatching pond, leaving nothing wanted to complete a system of ponds but the stock pond.

In artificially constructed ponds for mixed carp culture, though to be commended, such an annex is not a necessity. Shallow water about the margins with the proper vegetable growth will afford spawning beds for the carp. If, however, there is not plenty of food for the larger carp many of the eggs and young fry will be devoured by them. Usually, however, enough will escape, owing to the number of spawners and the great number of eggs and young to satisfy the culturist.

By mixed carp culture is meant the raising of carp of all ages and sizes in the same pond; not the raising of all varieties in the same pond. We cannot impress too deeply on the minds of carp culturists the necessity of keeping the varieties separated. In the start out do not plant a mixed variety of carp in the same pond, and if in their progeny they run to other varieties than themselves, weed out such strangers, if large enough eat them, if not turn them loose in some stream. If you have or want more than one of the varieties, prepare separate ponds for them. The closer they are kept to themselves, not allowed to mingle even when small, the better and sharper defined will the characteristics of the varieties show.

The objections to mixed carp culture are that you can never tell how many carp there are in a pond until you draw it off, and that all do not get their proportion of food owing to difference in size and age. But with many it is the starting point in the culture, and soon becoming interested they get into it more largely and have a system of ponds adapted to their

opportunities and necessities. No pike or game fish should be allowed either in a hatching or mixed culture pond.

Another method of securing a crop of young fish practiced by small culturists in Europe and America, and finding favor and being practiced by some of the fish commissions of the States, is to place along the margin of the pond boughs of trees at the spawning season. The carp spawn among the boughs, the eggs are adhesive and attach themselves to the leaves. These boughs are examined every day, at a time when the carp are not engaged in spawning, and those that have a fair proportion of eggs on are removed to a small shallow pond of 12 feet square or upwards, and placed in the water. This is continued until the carp are through spawning. The eggs hatch in the small improvised pond, and the young carp are fed there until they attain the size of 1 1-2 to 2 inches long, or as long as they give evidence of doing well and growing rapidly. When for any reason they do not seem to be doing well they should be removed to the larger pond. They require but little water and food for the first two months of their life, though in so small a pond they should be fed regularly (see chapter on artificial feeding). At the end of the two months they can be transferred to the larger pond as they will have passed beyond the reach of the greater part of their enemies.

In a new pond used for mixed culture there is generally little or no vegetation about the margins. The boughs will serve a good purpose here by being placed about the margins, even if there is no small pond to remove them to. The leaves will catch the eggs and hold them until they hatch. In fact in such ponds any floating material such as grass, hay, leaves of water plants, fine chips from the wood yard, anything except wide or heavy boards, will be found better than nothing. We recommend these only in an emergency. The natural water plants are, of course, the very best material for catching and holding the eggs. And there is no excuse for a pond being without this vegetation the second year.



## CHAPTER VI.

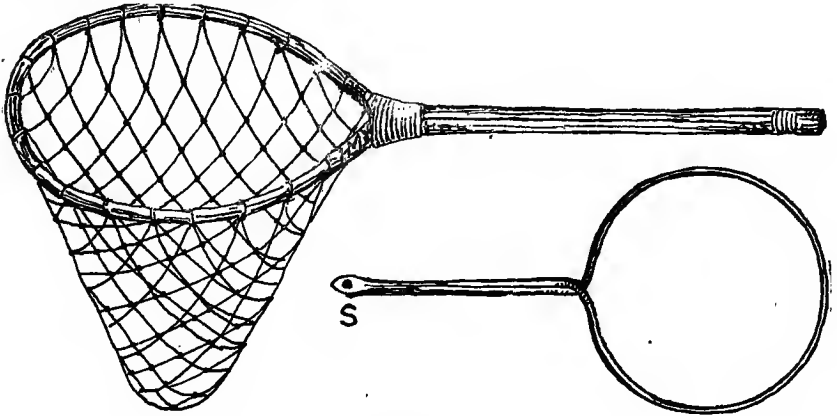
### TAKING THE FISH FROM THE PONDS—IMPLEMENTS FOR HANDLING THEM— THE SHIPMENT OF YOUNG FRY.

The gathering of the harvest and the examination of the crop is one of the pleasantest features of carp culture. The preparatory step to the taking of the fish is the emptying out of the ponds, and this operation demands both caution and the closest of attention. This is particularly so in the stock and market ponds, though the principle holds good in the hatching pond as well, but because of the smallness of the fish in this pond, a panic is not so likely to occur among them. Shut off the water supply, open the outlet, if the pond is large and supplied with more than one outlet, open them all and let the water flow slowly and gradually off. As it settles, in large ponds, boats are used around the edges to drive the fish into the center. This is done very quietly until the last day of the drawing off, or until the water has reached the ditches, for if the fish get badly scared they sometimes settle into the mud in large numbers. The only way to remedy such a catastrophe is to shut off the outlets and turn on as large a supply of water as possible until the fish have recovered themselves, when the drawing off is resumed. When the level of the water has reached the ditches some noise is made to drive them down to the collector. Where there are a great many large fish do not draw the water down too close before beginning to take them out. When crowded into too small a compass they get greatly excited and rush about seeking escape, which results in injury and frequent loss of fish. The safest method then is to begin taking the fish as soon as they gather in sufficient numbers at the collector. This may be done in market and stock ponds with a course meshed seine handled by two men. The fish should be weighed as they are taken out in lots of 100 pounds or thereabouts, a record kept of the weight and the fish either sent direct to the market or placed in the sale pond. With this record of weights, and a corresponding record of weights sold, you will know how much fish your pond has yielded, how much you have sold, and what weight you have on hand to supply orders. To return to the fishing out. When the collector is relieved of fish the water is drawn down still further and the operation repeated until the pond is completely dry and every fish is out. When the water gets too low for seining dip nets are used, to lift out the remaining fish.

The best general purpose seine where but one is to be used in the establishment for both large and small fish, is one whose meshes measure one-half of an inch. It should be of strong twine, well knotted, and not to exceed 50 feet in length. One longer than this of that mesh will be hard dragging over the mud. It must be provided with floats and sinkers.

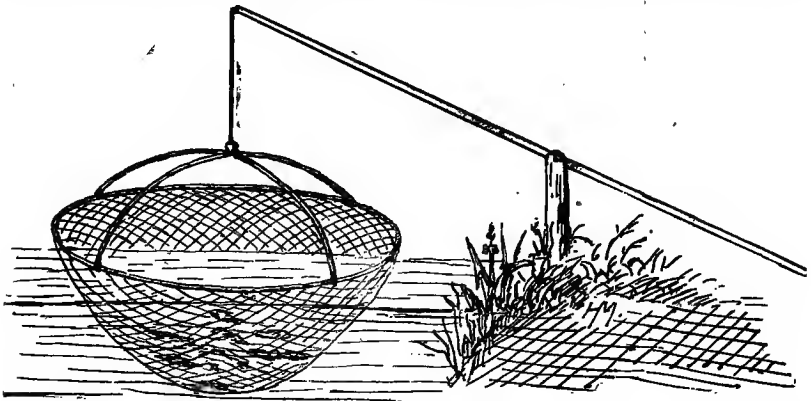
For clear water seining two or more seines of this length may be fastened end to end.

In smaller ponds various kinds of home made dip nets, bag nets, and lift nets are used to take out the fish.



BAG NET.

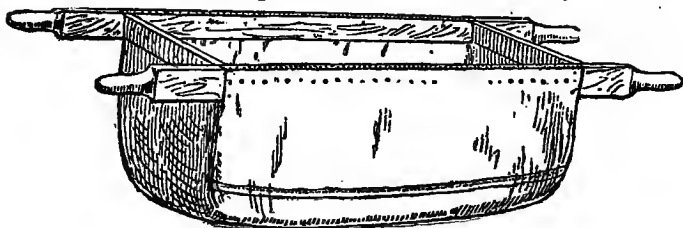
The illustration represents a bag net that may be made by any farmer. The handle is 7 or 8 feet long and made of hickory wood; the ring is made of  $\frac{3}{8}$  inch iron with ends welded together and 18 to 21 inches in diameter. At S a screw is placed to keep the net and ring from slipping off the handle; the material used to form the bag is bobby netting.



SINKER NET.

This net may be made almost any size to suit. The ring and cross bows are made of an iron thick in proportion to its size, and constitute the only sinker necessary. The material attached to the ring is minnow

netting and is sold by the yard. A little flower paste daubed on the inside of the bottom occasionally will quickly accustom the fish to visiting it. The illustration is so simple as to need no further explanation.



CANVASS STRETCHER FOR HANDLING CARP.

In transferring carp from one pond to another, buckets, tubs, casks, etc., are brought into use. Where the ponds are not so far apart but that the transfer is made by hand instead of by vehicle, a stretcher such as presented in the cut, will be much better than buckets, casks, or cans. Contact with sides or bottom will not injure the fish and the carriers can use both hands to the load. If the canvass is heavy it will hold water. By placing uprights under the handles it can be used in a wagon instead of casks.

In large ponds a boat is a necessity, in small ones it is desirable. The best for use is a flat bottomed skiff. At the fishing out rubber boots are indispensable to every boy and man engaged.

#### HOW TO TAKE CARP ALIVE TO MARKET.

Thus far in the history of carp in America, few, if any have been placed on the market alive for table use. Many have been sold alive at the ponds and a great many have been carted to market and sold in the ordinary way—dead—and at prices ranging from 10 to 20 cents a pound, and those persons once eating them clamored for more. But we believe we are on the eve of the transition period. The chartering of a stock company in Illinois referred to (page 32) is evidence of it. That time will come when the supply is ready to keep market tanks stocked. The method of getting them alive to such depots will have to rest largely with each individual culturist. In Germany the plan is to place them in tanks on wagons and rush the wagons to the nearest navigated water course, empty the tanks into boats with perforated bottoms, and in these boats transfer them to the market towns, where they are placed in the tanks of the dealer. In this country railroad cars will have to take the place of boats. But when the supply is ready and the demand created, railroad companies, ever ready for fast freights, will afford facilities in the shape of tanked cars. The one question then is their transportation alive to the railroad stations, at that time, and to the local markets in the meantime. This may be done in barrels and casks, or better in water tight boxes from 2 to 2½ feet wide, and long enough to slip comfortably into a wagon box crossways, and of any height to suit. The advantage of such boxes are that they fit close together and no space is wasted, and in

going up or down hill the water level is formed on a narrow bed, and does not change the weight and stress from one end of the wagon to the other, as in the case of a wagon length tank, neither are the fish so liable to injury by crowding. These boxes may be made either of tin or wood with close-fitting, lifting covers, each cover to have in its center an aperture six inches in diameter; this aperture to have a rim projecting below the cover about two inches; this rim at the bottom to be covered with meshed wire. If the boxes are made of tin, the material should be the very best XXXX quality, with the sides and ends projecting below the tin bottom at least  $\frac{3}{4}$  of an inch, then in this space below the tin bottom fit in a false bottom of one inch lumber and tack it to the projecting sides and ends; this false bottom then projects  $\frac{1}{4}$  of an inch beyond the tin sides and ends and protects it from grating and wearing out. A wagon loaded with such boxes and driven rapidly will convey a great many fish without injury, and with comparatively little or no slopping. If the journey is a long one the water can be changed by the way as necessary.

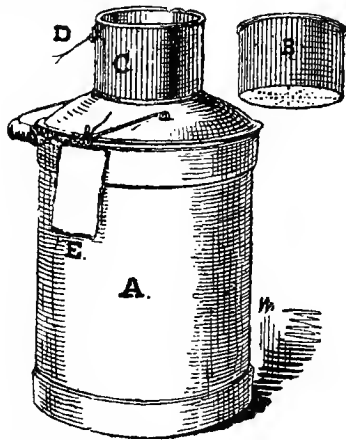
The sale of carp alive for table use is of great importance to the young industry, and we cannot insist too strenuously upon the necessity of culturists everywhere encouraging market men to engage in so handling them. Where necessary in the introduction of it culturists will find it a good investment to go to the extent even of helping the market men provide tanks for the keeping of them alive, and advertising the fact broadly, that they are on sale alive, and in educating the people of a community, through circulars and public prints, to the difference between a fish that dies of suffocation and has been shipped dying and dead from one end of the country to the other, and a fish that has been taken from pure fresh water and immediately killed.

All fish used for food should be killed, not allowed to die or smother to death, out of their element. Mercy and humanity should lead us to shorten their sufferings. Hygienic considerations should cause us to draw their blood, which cannot be done in death. The blade of a common pocket knife pressed in at the juncture of the head and body; severing the spinal column, and pressed downward to the lower edge of the gill, will both kill suddenly and draw the blood. The thought of eating a drowned chicken, hog, or beef critter would be sufficient to turn the stomachs of most people. To offer the same for sale would be an offense punishable by law. And yet are not the cases of the drowned chicken and smothered fish parallels? Both die of suffocation. Custom and habit are all that render the eating of the one less repulsive than the eating of the other. The culture of carp, if it does not revolutionize this custom of eating fish that have died, will at least afford opportunity to those who desire it, to have their fish taken from the water, killed, dressed, and prepared for cooking before their eyes, for carp will be brought to market in tanks, and fish markets will no longer be places of stale odors that you want to get out of as soon as you can, but places where you will delight to linger, and watch the sporting of the carp in their glass-faced tanks, where you can select the one you want, and take it home with you, ready for the pot, the pan, or the oven.

Ideas as pertinent to common sense, taste and judgment as are these, quickly take hold of the public mind, and with the increasing demand for live fish up will go the price of carp, as it is practically the only fish that can be so furnished. Thus in encouraging and aiding the market man in the construction of tanks, etc., you are but making a sale for your fish at advanced prices. In a short time after the placing of live carp on the market, dealers will compete with each other to get the handling of them.

## SHIPPING CARP.

The shipment of Carp for stocking purposes has in the past been the leading source of revenue to the culturists in this country. In the future it will continue a source of revenue and a prominent feature of the business. So few losses have occurred by death in the shipment of carp, as to make it quite remarkable, when we consider the newness of the business and the inexperience of those engaged in it. This is owing in part to the care exercised by the shippers and in part to the great vitality of the carp. Some special cases demonstrating this wonderful vitality you will find related in the "*Miscellaneous Appendix.*"



A WOODEN JACKET SHIPPING CAN.

The wooden jacket A protects the tin from injury. The neck C and the strainer B prevent the water from splashing out during the transit. The can should only be filled to within one inch of the shoulder. At D the strainer B is fastened by a wire and sealed if necessary to prevent promiscuous handling of the fish. If necessary in warm weather a small lump of ice can be kept in the strainer. As the strainer is perforated at the bottom, the water in the can can be changed at will. Under no circumstances place a close cover on the can as it shuts off the air from the water, and the fish will quickly exhaust the oxygen in the can and then die.

The size of can to be used in the shipment of fish for stocking pur-

poses depends on the size and number of fish to be shipped, the distance they are to travel and the length of time it will take them to reach their destination. Carp kept in clear running water a few days previous to shipment, without food, will travel much farther, and in better condition, than when taken directly from their food and from dirty water. In the latter case they pollute the water. The temperature of the water has much to do with the distance they can be shipped. The best temperature is from 40° to 50° F. Max Von Demborne, a German authority, gives the following table, which will furnish an excellent base of calculation:

Excess of weight of water over the weight of the carp during a journey of 10 to 40 hours.

Length of time of journey.	Water should weigh.
10 hours.....	9 times the weight of carp.
20 " .....	12 " " " "
30 " .....	15 " " " "
40 " .....	18 " " " "

A little judicious work with the express agent at the shipping point will materially aid in the successful transportation of the carp. This is particularly true where more than one express company is represented at the place of shipment, as each will desire to secure the patronage. A way bill accompanies every package they send out. This way bill, as a rule, passes through the hands of the several agents on the different lines of railroad over which the package passes. Such a bill will accompany every can of carp. Require the agent, then, at the shipping point, to insert in the way bill a statement that the water on the fish is to be changed every 24 hours, for any other water that is fit to drink. A printed statement pasted on the can and addressed to the express messengers on the trains, calling attention to the statement in the way bill, and explaining how the water may be shired off through the wire grating of the top, and if other good water is not convenient, the same water can be poured back again, it being aerated by the process, will generally secure the attention desired, and will enable the culturist to ship a greater weight of carp in a lesser weight of water than would otherwise be possible.

Wooden jacket cans are advantageous in that they receive little damage in transportation. They are, however, more expensive than other cans, and besides are not always available, while any tinsmith can make an ordinary shipping can. Many styles of can have been tried, and there is a field for thought in the construction of a can that will be self-operating and keep the water within it aerated. There is a natural principle, however, that the greater the surface of water exposed to the air, in a given body of water, the more oxygen will it absorb from the atmosphere. In harmony with this principle, cans should be built low and broad, narrower on the bottom and flaring up to the shoulders. A can 14 inches high to the shoulder should be from 5 to 7 inches greater in diameter at the shoulder than at the bottom. The bottom should be broad enough to prevent all possibility of upsetting. This gives a shallower body of water with a larger surface area. These cans should be constructed of XXXX

tin, with the sides projecting  $\frac{3}{4}$  of an inch below the bottom, and a false bottom made of 1-inch lumber fitted into this rim; this will let the wood project  $\frac{1}{4}$  of an inch and be the best possible protection to the bottom of the can. The flaring sides keep all other packages from coming in contact with it except at the shoulders, where resistance is the greatest, and where if by any accident a hole should be punched, it will not be fatal to the fish. The aperture or neck of the can should not be less than 6 inches in diameter, as in the shipment of spawners or large fish it is quite difficult to get them out of a hole that you easily get them in at. The reason is that you present them head first to the hole, the scales and fin projections then are favorable to the easy passage of the body. You shire the water out of a can and the fish presents itself tail first; the scales and fins are then unfavorable to the passage of the body, and the hole is too small to facilitate the turning of the fish, and there is a chance of damage in taking out tail first, unless the aperture in the neck is amply large. In filling a can for shipment never fill quite up to the shoulder. When the water is above the shoulder the area upon which the atmosphere acts narrows very rapidly, and in the jolting of the car there is very little breaking up of the water. On the other hand, with the water below the shoulder, you get the greatest possible surface and with every movement of the car the water pitching up the side of the can comes in contact with the shoulders is broken up, aerated and falls back in better condition for the fish than before leaving the body. So far very few carp have been successfully shipped during hot weather. The practical shipping season may be said to extend from the first of October to the first of the following June.

Spring or well water may be used to ship carp in, but before using it should be very thoroughly broken up and aerated. This may be accomplished by whipping the water with a wire dip net or by passing it through a sieve, letting it drop some distance through the air to a tub or other vessel.

## CHAPTER VII.

### ENEMIES OF THE CARP—HOW TO DESTROY THEM.

One of the great essentials to successful carp culture is their protection against their enemies, which are legion. It is not within the province of this work to enter into a detailed description of each of these enemies, but simply to point out the most destructive of them, and provide the remedy for their extinction. Giving an outline of the natural history with illustrations of those, with which the general reader would be least familiar. It is only through a knowledge of these enemies that we can successfully combat them. Many of these enemies are dangerous only to the eggs and young fish, while others attack even the largest of carp. But it is among the young that danger and loss are greatest. The eggs and young fry being much sought after by other fish, bugs, larvæ, etc.

The first in the list of destroyers we must place the carp itself. That the spawners will prey on their own eggs and young is not disputed. It is also true that in mixed culture, where the spawners are not by themselves, that those not spawning will join in the work of eating the eggs and young. This may be largely overcome by furnishing them plenty of other food; but the better plan is to catch the eggs on evergreen or willow branches and remove them to a small improvised pond, where they remain until large enough to get out of the way or protect themselves. If in a regular hatching pond remove the spawners when their work of spawning is done.

Among the domesticated fowls geese and ducks allowed access to the pond become the most persevering and inveterate of fishers, and it is really surprising how large a fish they will catch. If too large to swallow whole they will none the less hang on until they take a piece of the body or tail with them. The maimed fish, if it lives, is subject to disease and liable to spread it among the other fish. Carp and these fowls cannot be all successfully raised in and on the same water. In ponds of shallow water the hog quickly learns to fish successfully, and must be debarred the water privileges of the fish pond. The access of cattle and horses to the pond is not injurious.

### WATER SNAKES

Are very hard on young carp, and each snake will require from 25 to 40 young fish a day to satisfy his appetite. During the summer of 1883 Dr. Rud. Hessel killed at the Government carp ponds at Washington, D. C., 1,050 snakes, almost every one had young carp in their stomach. Similar reports come from many culturists. The remedy is an active shot-gun policy: use fine bird shot. In the list of active reptile, and animal enemies of the carp may be included roaches, crawfish



tadpoles, frogs, terrapins, turtles, muskrats, water-rats, coons and mink. The shot-gun policy will lessen the number of these, but ingenious devices and traps will also be required. Rake the frog spawn out on the bank and let it dry in the sun, and a boy with a light shot-gun will have great sport in getting rid of the old frogs, whose chief deprecation is on the eggs of the fish. Though they will swallow fish so large that the tail will stick out of their mouths.

#### CRAWFISH.

Dr. E. Sterling, of Cleveland, Ohio, gives the following method of capturing crawfish: Take 30 to 50 osier twigs, or split white ash sticks, according to the size used, and three feet in length, form a bundle of the whole and bind at each end with strong cord or wire, separate the twigs or splints in the center of the bundle by means of sticks 10, 15 and 20 inches long and forked at each end, so that when in place the trap will be spindle-like in shape, with the twigs evenly distributed about its circumference and centre, and far enough apart to allow easy entrance for the fish, but from which they will not readily escape. Bait the inside with fresh meat of any kind, only see that it is fresh and bloody if possible; set the same with the current in running water; if blood can be procured, pour a pint or so on the bait; it will taint the stream for a long distance. I have watched crawfish in great numbers follow up the track or scent thus made from 30 rods below the trap, and have known six and eight quarts taken at a single lift. Should one desire a more substantial and comely rig, it can be made by driving a smooth, stout stick lengthwise through the center of the bundle, slide the tied ends down on the stick until the whole bulges to a diameter of 20 inches or more in the centre, fasten the tied ends of the twigs to the centre stick, put three hoops of proper size over the whole and fasten with fine copper wire. In order to make hiding places for the crawfish and so retain them in the trap, numbers of the twigs should also traverse in various directions.

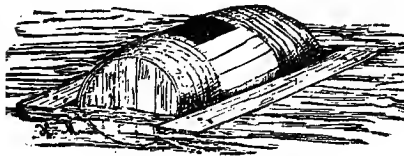
Another and simpler method of dealing with the crawfish is to take an ordinary minnow net, tie some fresh beef (the bloodier the better) inside the bottom of the net, sink it in the water where the crawfish are most plentiful. The scent of the bloody meat will attract them, and greedily they fasten to it and will hold on until taken off.

The Bulletin of the United States Fish Commission says of them: Great quantities of these crustacea are captured in Louisiana for the New Orleans market, where they are highly esteemed for making "gumbo," a dish prepared by the creole cooks. The method of capture is simple. A piece of cord two foot long is tied at one end to the middle of a light stick about a foot long. To the other end of the cord is securely tied a small bit of meat, usually fat bacon. An indefinite number of these machines, perhaps two dozen, may be used by one person. He tosses them out into the muddy ponds or "burrow pits," near the levees. He then wades gently through the pond with a pail or basket in one hand, and, visiting each line in turn, slowly raises it out of the water and drops the catch into the receptacle provided.

The crawfish not only prey on the eggs and small fish, but are a constant menace to the dams and embankments of ponds. Many means have been devised to prevent their boring the dams; such as a close sheeting of lumber in the dam; lining the inside of the dam with clippings from a tin shop, on the plan of shingling a building, one course overlapping the other; either of these will undoubtedly aid in preventing their work, but in instances both have failed. The best method we know of completely circumventing them, is in constructing the embankments, beginning at the pond bottom lay a course of fine sand from 8 to 12 inches wide clear up through to the inner breast of the top of the dam. The clay or loam of the dam must not be allowed to mix with this sand vein, boards set up on edge along side of stakes and raised with the dam and the sand vein will facilitate the keeping of them apart. A dam thus completed has the regular material of the dam on either side of the sand vein, the great bulk being on the outer side. The crawfish begins his work, he penetrates as far as the sand vein and as fast as he drills it falls in on him. He may start other holes, but the sand will invariably beat him, and disgusted with himself he falls an easy victim to any of the traps described.

#### MUSKRATS.

The depredations of muskrats on the embankments of carp ponds and on the carp themselves have been a prolific source of annoyance and trouble to the culturist, and consequently have been the subject of much thought. The greatest danger from them is the burrowing of the embankments and starting of leaks that may result in washouts and great loss. The first step, then, in protection against this danger, is to build the dams and embankments only from 12 to 15 inches above high water level. Their nests must be above the water, and this narrow margin brings them too close to the surface of the dam, and they will not attempt it. If they build nests or houses on the high ground side of the pond, there is no danger of a washout, and they will sooner or later become victims of a persistent persecution. The following trap will be an efficient aid in their extermination:



MUSK RAT TRAP.

Any old barrel will do to make the trap out of. Build a platform all around it, as shown in the illustration, bore small auger holes in those parts of the heads of the barrel which are below water, cut a six inch square hole in the upper side of the barrel, place parsnips, carrots, potatoes, apples, etc., in the barrel, launch it convenient to their nests, attaching a small rope to it to haul it in with, keep your trap baited, kill those that

you trap as soon as caught, if not the others become wary, and the rodents will soon become scarce. We are indebted for the idea of this trap to Charles Sturr, of Preston, Ohio.

Steel traps placed lengthwise of their holes and slightly concealed will capture them as they go in or come out. Whenever their holes or the entrance to their nest is exposed the following will be found a certain method of extinction. Finely powdered brimstone and saltpetre in the proportion of six pounds of brimstone to one of saltpetre. Use about one pound of the mixture to a hole. Place the mixture on a piece of tin, sheet iron, board or flat stone, place in the hole and light the mixture. After fairly burning close the hole with sods. The saltpetre insures the combustion of the brimstone and the fumes will penetrate every minute ramification of the nest, assuring death to everything within.

#### MINK.

There is, perhaps, no greater enemy of the carp pond than the mink. It is hardly credible the number of carp that a single mink will destroy in one night. This is particularly true in the winter season, when the pond is covered with ice and the carp are lethargic and dull, if there is any opening through which the mink can go in and out, he will bring the carp out as fast as he can make the trip, and pile them, generally, heads all one way. He nips them usually, in cold weather when he can get the hold he wants, just back of the neck, and the marks left are so fine as to almost need a microscope to see them. The mink is a luxury too expensive for carp ponds. He has, however, a fatal weakness, and almost invariably enters a pond at the same place and in the same way, by sliding down the bank; these tracks lead to his discovery and doom. Set a steel trap on his slide-way, just under the water, where he may slide into it. C. B. Pettie, of Blooming Prairie, Minn., after having all his carp destroyed in a single night in the winter of '87 and '88, by a single mink, caught the fellow in four steel traps.

#### TURTLES

May be caught on large cat-fish hooks baited with chunks of raw meat, too large for the carp to swallow. A few boards placed in the pond for them to sun themselves on, makes them a good mark for the rifle, which is their surest exterminator.

#### BIRDS,

Eagles, herons, cranes, bitterns, rails, marsh hens, owls, fish hawks, wild geese and ducks, and the king fisher, all of these are great fishers; they may be trapped and shot. Perhaps the most inveterate of them all is the king fisher. He may be trapped in numerous ways. We will only give two: First, by driving three or four stakes in the shallow part of the pond, allowing them to project above the water from 4 to 6 feet. On the top of these stakes nail pieces of bards large enough to hold steel traps; set the traps and fasten them with wires or chains to the stakes. The birds alight to watch for food and are caught. Second, fix a dead fish from 2 to 4 inches long in a natural position on a piece of board 8 inches

wide and about 4 feet long, anchor this board about 2 inches beneath the water; the king fisher diving for the fish will strike the board hard enough to kill himself. With the steel traps unite the shot-gun policy on all other birds and larger enemies of the carp.

#### OTHER FISH.

All other kinds of fish in the pond are inimical to the best interests of the carp, and their presence should be persistently fought. If there be any that do not prey directly on the carp, they indirectly do so by consuming the food that the carp should have. Despite the best efforts of the culturist these stranger fish are continually getting into the ponds. Some undoubtedly are transferred in the egg, by being attached to the fur of water animals and the feathers of aquatic birds that have come from other bodies of water, while others undoubtedly come up from crawfish holes, as most ponds are located where water has formerly stood, and as the spot is again overflowed they rise with the water. Among the worst of these foreign pests and the hardest to get rid of is

#### THE BLACK-HEADED MINNOW—(PIMEPHALES PROMELAS, RAF.)

Hugo Mulertt, of Cincinnati, O., writing of this species in *American Carp Culture*, of June 1887, says: The head is almost globular and blackish in males, body much elongated and strong, but little compressed on sides, scales small and crowded, eyes and mouth very small, the dorsal fin showing a dark blotch, color of body dusky. Females smaller, more delicate in structure, compressed on sides and of lighter color, with an indistinct lateral band.

This is one of the most common species of minnows found in this country, and being only a minnow, this little fish has heretofore been very little noticed, more particularly in regard to the method of its reproduction.

As their breeding season approaches in the spring, the head of the male turns jet black, and numerous prominent white and horny tubercles appear on the forehead, the entire body becoming blackish, darkest on the back, leaving two lighter vertical bars of a quarter of an inch in width on each side, one of these right back of the gills, and the other immediately under the dorsal fin. The fins also undergo changes in their coloring, the dorsal, pectoral and caudal fins become shaded with black, and the dark spot in the dorsal fin becomes larger and deep black. In addition to this shading on the fins, the two smaller spines in front of the largest one in the dorsal appear inflamed and are spread in a position pointing toward the head of the fish, which, at casual examination, makes this fin appear injured. The female keeps its customary appearance, with perhaps the only difference that the lateral band is more distinct than usual and its belly larger.

At this time the male selects a stand, under a floating broad leaf, for instance that of the pond lily, and induces the females to come and deposit their eggs. The eggs are deposited on the lower side of this leaf, one at a time, and, being adhesive, remain there. To accomplish this, the fish twists its body and, darting against the leaf, deposits the egg in the

moment of contact. After one female has deposited all her eggs, others are induced to do the same on the same leaf; thus leaves may be found containing, in large patches, deposits in different stages of maturity; some ready to hatch, while others may have been deposited only an hour before. The male remains below the leaf until the eggs are all hatched, allowing nothing to approach them. He does that with so much energy that even carp fifty times his own size he will attack and drive away, and should a dragon-fly alight on his leaf, he will jump out of the water and scare it off.

As the minnow is very destructive to fish spawn himself, he seems to judge others by his own character, and with good reason, as such deposits, deprived of his protection, are invariably soon devoured by other fishes.

The black-headed minnow begins to spawn at the age of one year, beginning early in the spring and continuing throughout the summer. Their eggs hatch after four to six days, according to the temperature. The male attains a size of three inches, while the female rarely measures more than two inches in length. When quite young, minnows swim in shoals near the surface.

Although minnows are not a worthless fish in one sense of the word, as they constitute the almost exclusive food of many of our table fish, they are a nuisance to the fish-culturist, and may be ranked among fishes as the English sparrow is among birds. Its destructiveness knows no limits; it devours spawn and young of other fish, and continually worries other more useful and peaceful varieties. The species above described frequent water of any quality, and it is often wondered how minnows ever came into certain water basins which had no connection whatever with creeks or springs. This, however, may be explained by considering the adhesive nature of their eggs, and the fact that frogs and toads frequent the same waters and deposit their spawn upon similar objects and at the same time as the minnow. What would be more natural than to suspect that these amphibians transplant the eggs from one locality to another on the moist skin of their backs? The practical aspect of this discovery the pisciculturist will readily appreciate, for he can exclude the destructive minnows by excluding the frog and toad, when already present, by destroying their spawn or capturing the male from under the leaf.

#### INSECTS, LARVÆ, AND BUGS.

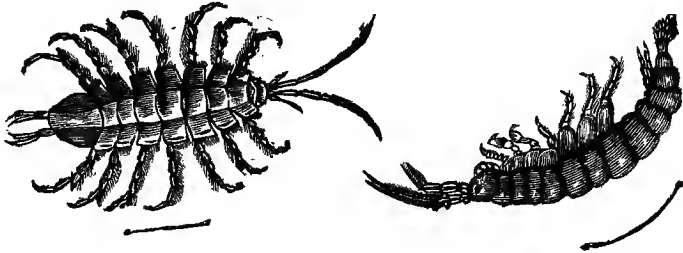
Carp ponds have suffered far more from this class of enemies than culturists are generally aware of. A knowledge of their habits and natural history is essential to successful protection against their ravages, which are confined largely to the eating of the fish eggs, and capture of the young fish under two inches in length. Prominent among those that feed on the eggs, but do not harm the fish, is

#### THE WATER ASELL.

(*Asellus aquaticus*.)

The illustration presents a good idea of this little crustacean, which is not more than one-half of an inch long. It crawls upon the bottom of the

pond and over the water plants searching for food. They will make three meals a day on fish eggs, if they can find them, and lunch frequently between meals on the same dainty.



THE WATER FLEA (enlarged.)

THE WATER ASEIL (enlarged.)

THE WATER FLEA.  
(*Gammarus pulex*.)

Known as flea crab, buck crab, etc., is another voracious enemy of the crustacean tribe. It is closely related to the shrimp found in the ocean. It has a curved back, as shown in the illustration, and lies on its side while burrowing through the water. In all stages of its life it feeds upon fish eggs. It makes some return, however, by becoming itself an excellent morsel of food for young fish.

THE COMMON POND SNAIL,  
(*Lymnea fragilis*.)

Which consumes large numbers of them, and is too well known to need any description.

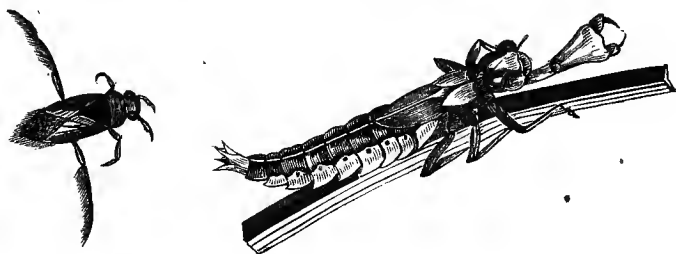
THE BOAT FLY,  
(*Notonecta glanca*.)

Commonly known as the "Shoemaker" is a most voracious insect and very destructive of young fish. The following description of it, together with the descriptions of the dragon fly and its larva; the yellow banded water beetle and its larva and the black water beetle are all taken from Hugo Murlert's excellent work on Goldfish and its Culture.

The body of the boat fly is long, contracted posteriorly, convex above and flat below, having hair at the sides and extremities, which, when spread out, supports the insect upon the water. The head is large and presents a large eye upon each side, giving the possessor the power of vision in all directions. The color of the body is a greenish grey, the wings are white, of the legs, the four nearest the head are short, but the third pair are very long, different in shape from the others, very much resembling boat oars. When in the water, the insect swims upon its back, using the hind legs as oars for propulsion, while the front ones are instrumental in seizing its prey. Young fish, tad-poles, and other insects, all contribute to supply it with food, to the former, especially, it is a very

dangerous enemy. The instrument or weapon with which the insect makes the attack upon the victim is a strong, conical beak.

It is believed that when making the attack, the boat-fly injects poison into the wound it makes, as seems to be proven by the fact that when once



THE BOAT FLY.

LARVA OF DRAGON FLY.

attacked, though subsequently escaping, the victim always dies in a short time. When upon land, this fly crawls along, in an upright position, dragging its oars behind it. In the evening, and at night, it likes to leave the water and make excursions to other ponds or creeks; from this habit the culturist may take warning. Its eggs are deposited against the stems of aquatic plants in the early spring, and again in mid-summer, so that one season produces two crops of them.

The young make their appearance soon after, immediately following the example of the parents by swimming upon the back and eating almost anything they happen to meet. The accompanying illustration shows the insect as seen from below when in the water.

There are two or more varieties of this fly that differ in coloring, and of smaller size than the one described, though all are extremely destructive to the young fish—the one delineated, more especially.

THE YELLOW-BANDED WATER BEETLE.

(Dytiscus marginalis.)



YELLOW-BANDED BEETLE AND ITS LARVA.

This rather pretty beetle, lives entirely below the surface of the water, never leaving it, except during the night when the air is damp or in rainy

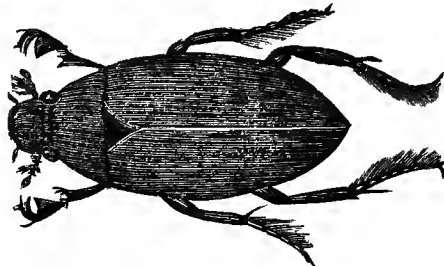
weather, and then for the purpose of making excursions to other localities. The body is of a greenish black color, encircled with a brownish yellow band—this feature giving it its name. When taken from the water it exudes a milky fluid of a most offensive and disgusting odor. The hind legs are shaped very much like those of the boat-fly, and serve the same purpose. The beetle is very courageous, attacking fish of any size, as large ones have been caught, into whose flesh the beetle had eaten large holes, the beetle itself found in the hole hard at work eating up the fish. The larva, which is produced twice within the same season, lives and grows upon tadpoles and young fish.

When of sufficient size, and the proper time has arrived, it changes into a pupa, which in turn, becomes the perfect beetle. (See illustration.

#### THE BLACK WATER BEETLE.

(*Hydrophyllus piceus*.)

As the name indicates, this beetle is black, shining with a rich, purple lustre. (See illustration.) It is of larger size than the preceding, and strong in proportion.



THE BLACK WATER BEETLE.

The beetle itself is a vegetarian, and as such, is not directly dangerous to the fish, its larva, however, is voracious without limit, destroying all that comes in its way.

The female of this species spins a white cocoon around the posterior portion of its body, with the aid of its hind legs, the cocoon, when completed, being the size of a hazel nut. In this it deposits its eggs, and after closing it carefully, fastens it to a floating leaf, adding to it a little projecting point on the top, which by the way resembles a small mast, retires to the water underneath and mounts guard. After a few days the young grubs make their appearance, at first resembling little whitish worms, but possessing six legs near the yellow head.

It is by the motion of these legs that the grub is propelled through the water, continually on the search for something to eat. When at rest on a water-plant, the head with its fearful apparatus, formed of a strong pincher with two pair of adjuncts, which can be moved in any direction, is placed in such a deceiving position as to almost always lure an unsuspecting little fish, tadpole or insect, within its reach.



As the grub gets larger, it turns darker in color, until having attained a size of about four inches in length, it has become nearly black on the back; the under part is then of a creamy white, and the sides have been fringed with hair. In this state its appearance is extremely repulsive, being about as ugly as anything can be imagined. The earliest and best time to destroy them is when the cocoon has been finished, and the female is standing guard in the water beneath, both can then be captured and obliterated, in this way great damage is prevented before there has been an opportunity for development; very much on the principle of the old proverb: "A stitch in time saves nine."

The grubs breathe through the posterior part of the body, and have to come to the surface occasionally for that purpose, at which time they are easily caught with a dip-net.

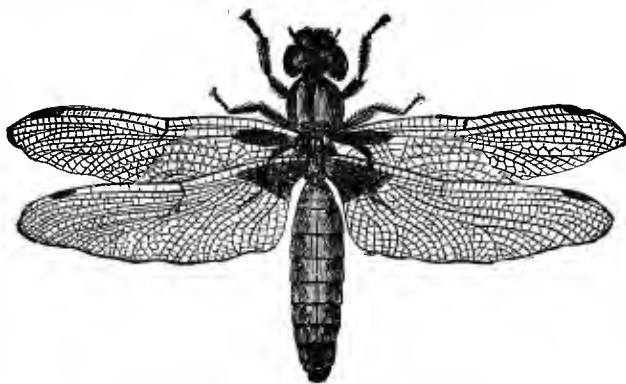
In general appearance, the color excepted, the grub of the black water-beetle resembles that of the preceding.

The beetle, moreover, is very prolific, spinning several cocoons at two different periods, namely, in the spring and high summer.

Other varieties of this insect exist, the one under discussion being the most dangerous to the fish. So far as the others are concerned, it is sufficient to remember the injunction, allow nothing alive to remain in the company of the fish when newly hatched.

#### THE DRAGON FLIES.

The dragon flies (commonly known as snake-feeders) may be divided into three classes, all very destructive enemies of the fish.



THE DRAGON FLY.

1. The *Libellula* possesses a short, flat body, about two inches in length. (See illustration.)

2. The *Aeshma* is longer than the above, its slender, round body sometimes measuring six inches in length.

3. The *Agrion* is not large, the body small and slender, varying in length from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches.

The wings of the first two named, are, when the insect is at rest, always expanded horizontally, while those of the latter are folded together, pointing backward.

The hind part of the body in all of them is long, slender, and composed of ten rings. On the forepart of the body, they have three pairs of legs, and two pairs of transparent, webbed wings, the latter in some species glitter like gold, in others they are dotted with spots of different color; in the *Agrion* species they are of the same color as the body. The coloring of the bodies of all, especially the *æshma*, is very brilliant, being of a bright green, blue or scarlet, and sometimes mottled and spotted with various colors.

The eyes are large and prominent, giving the insects a very large field of vision.

They all fly very rapidly, feed upon insects of every description that they catch flying about, and from this fact they may be made useful to destroy the mosquitoes in bedrooms and elsewhere. Although very voracious, they are perfectly harmless to man—they cannot injure him in any way. The manner of their copulation is somewhat curious. The male fastens the extreme back part of its body to the neck of the female, and thus attached, both fly about for one or two hours, when, over some water, they separate. The female then deposits her small white eggs by immersing the posterior part of the body in the water, attaching them to the submerged surfaces of water-plants; there they remain until hatched.

The larvæ or grubs of the dragon-flies live in the water; those of the *libellula* are short and thick, while those of the other genera are more slender, corresponding with the shape of the adult. The color of these grubs varies from blackish-brown to a brilliant green. They breathe through the posterior part of the body, which apparatus is also used to propel them forwards through the water, making them good swimmers.

They are extremely destructive to young fish and fish-eggs, upon which, together with tadpoles and snails, they manage to make a good living. Instead of hunting their victims, they lay concealed in the mud with the eyes only protruding from the surface. Whenever a victim comes within reach, they produce their concealed pincers by a rapid motion, rarely missing the mark they aim at. (See illustration.)

There are instances on record where one of the larvæ of the *libellulæ*, which was overlooked in the fish tank, destroyed two thousand (2,000) young fish in a week's time.

After they have attained their full growth, the grubs leave the water, climb upon some object projecting from it, when the perfect fly makes its appearance through the back of the grub, rising upon its wings into the air as soon as they are unfolded and dry.

The eggs are also produced twice in a season, the grubs from the last deposit, living in the mud during the winter, and produce in the early spring the first dragon flies of the season.

Their natural enemies are the frog and the water-spider. The latter, small as it is, compared with their own size, is, nevertheless a powerful antagonist, attacking them when in the act of depositing their eggs. The attack is made directly upon the eye, the largest dragon-fly thus being easily overpowered by its small but intelligent enemy.

How strange it is that just those animals with which man has the least sympathy are among his best friends! Such are the toad and the spider!"

#### AN INTERESTING ENEMY.

Among the strangest and most interesting enemies of the carp, are a class of carnivorous plants, that until recent years were not known to capture any other animal life than that of insects and the smaller crustaceans. Among the earliest to call attention to the fact that a specie of these plants captured young fish, was Hugo Mulertt, so often quoted in this work, and it is but justice to call attention to this fact, while we give the description and illustration of an other taken from the Bulletin of the United States Fish Commission.

#### PISCIVOROUS PLANTS.

By E. Halperine.

"The so-called carnivorous plants for, some years, especially since Charles Darwin made his interesting researches, have attracted the attention of naturalists, not only on account of the curious phenomenon itself, but more particularly because of the philosophical conclusion which may be drawn from it.

It is known that the ordinary plants draw from the soil by means of their roots the nutritive inorganic elements which they need, and absorb by means of their leaves and stems the carbonic acid of the atmosphere it has thus been said that the plants play the part of intermediate working agents, transforming inorganic matter into organic elements such as alone can serve as food for beings belonging to the animal kingdom.

Although it was already known that nitrogenous manures or fertilizers of an organic nature were just as indispensable for the formation of plants, botanists were nevertheless surprised to learn that in carnivorous plants the absorption of organic elements was no longer going on as usual by means of their roots alone, but also by their leaves, which are more or less adapted to these new functions, secreting a genuine gastric juice, and transforming organic matter by a chemical process identical with the digestion of animals.

In fact all the experience, and the facts observed by Charles Darwin and his son Francis, by Hooker, F. Cohn, Mrs. Treat, of New Jersey, and many other naturalists, prove sufficiently the fact of animal digestion by the leaves in these plants, particularly in *Dionæa muscipula*, and in different kinds of the *Rosolis* or *Drosera*. Many other plants, like the *Aldrovanda*, *Drosophyllum*, the *Pinguicula*, and the *Utricularia*, of which we shall have to speak specially, have also been mentioned as carnivorous plants. Professor Hooker adds the *Nepenthes*, and Drs. Melli-

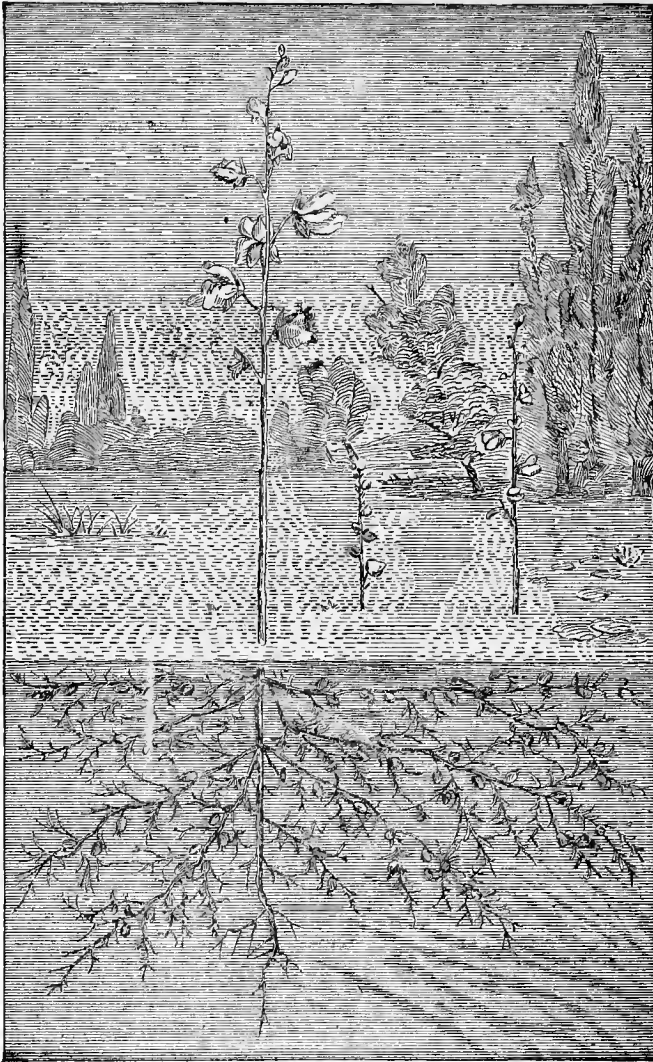


PLATE I.

UTRICULARIA VULGARIS (Bladderwort.)

clamp and Canby also class among them the *Sarracenia* and the *Darlingtonia*. It should be observed, however, that these last two kinds, as well as the *Utricularia*, cannot, properly speaking, digest nitrogenous matter. They simply absorb the products of the decomposition of the animals which they capture by means of their bladders, which constitute genuine traps, acting like mouse-traps when in the air, and like fish-traps when in the water or in a very humid soil.

As regards other carnivorous plants, nothing is wanting to make the analogy of their digestion with that of animals complete. There is the preparatory act, the capture of the living prey, and the essential act characterizing digestion, namely, the dissolution of an acid, and of a special juice over food of a proteinous nature; that is, food that among its component parts contains nitrogen. Numerous experiments made by many botanists, especially those made by Francis Darwin, have clearly shown, in spite of the doubts expressed by other naturalists, that animal matter, absorbed in the manner described, enters directly into the composition of these plants, and is exceedingly useful if not indispensable to their normal development.

Among the victims commonly found in the traps of carnivorous plants, as far as known till quite recently, there were only insects and small crustaceans. But a short time ago Mr. Simms, of Oxford, brought to Professor Moseley a vessel containing a specimen of *Utricularia vulgaris* (Plate 1), and a number of small *Leuciscus rutilus*, recently hatched. Many of these small fish were dead, and were held firmly between the valves of the bladders of this voracious plant. The English professor, being interested in this remarkable discovery, procured another specimen of the *Utricularia* and a supply of eggs and young of the *Leuciscus rutilus*. Six hours later he noticed that more than a dozen of the young fish had been seized by the plant. In most cases the fish are seized by the head (Plate 2, Fig. 1), and sometimes by the tail (Plate 2, Fig. 2). One of the little fish has even been seized by the belly, and another by its two extremities by two bladders at a time (Plate 2, Fig. 3). These last mentioned facts seem to confirm the opinion of Mrs. Treat that the carnivorous plants seize the animal of their own accord, and from this opinion she draws the conclusion that there actually exists in these plants a characteristic nervous tissue. But numerous experiments made by Charles Darwin with one of these plants, the *Drosera*, by applying to it acids, alkalies, and alkaloids, of various mineral or organic salts, show too great a diversity in their results to allow us to draw therefrom any definite conclusion. Mr. Planchou says with regard to this subject: 'The physiological equivalent of nerves is perhaps found in some of the elements constituting the tissue or the cellular contents of plants, which cannot be denied *a priori*: but sensibility, properly so-called, presupposes a perception of pleasure or pain, which, without further proof, cannot be attributed to the most excitable plant.'

"However this may be, once seized, the victim cannot escape from the jaws of the voracious plant. The numerous glandular thorns (or

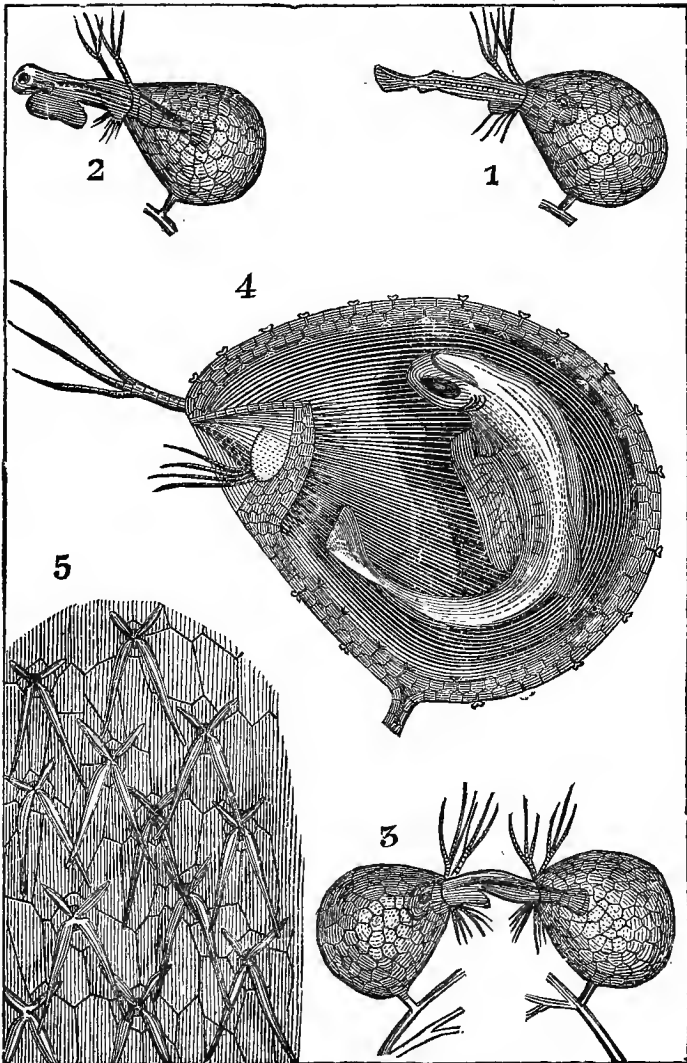


PLATE 2  
DETAILS OF THE MODE OF CAPTURE OF A FISH BY THE UTRICULARIA  
VULGARIS.

“processes,” as Darwin calls them) which are found on the inside of the bladder, and protrude obliquely and in the back (see Plate 2, Fig. 5), resembling the barbs of a hook, prevent the prey from escaping, and by every movement entangle it still more in this trap. After having been swallowed completely the animal begins to decompose, assumes a viscous appearance, and is rapidly absorbed by the same glandular thorns which have in the beginning aided in the capture of the little fish. This is at least the supposition at present entertained by most botanists. Mrs. Treat, however, thought she could see in the bladder of the *Utricularia* a stomach, digesting in the same manner as in the *Drosera*; but Darwin entertains grave doubts as to the correctness of this opinion, for he has observed flesh and hardened portions of the white of an egg remain for three days in the space where the little animals died, without undergoing any change. He is rather inclined to think that they died of asphyxia, after having entirely consumed the oxygen of the water in the bladder. He admits, however, that some special juice may accelerate the decomposition of the dead fish, in the same manner as the juice of the papaw-tree, well known in the tropical regions, at first softens and afterwards rapidly decomposes meat exposed to its action. Planchon says, “We have here reached the vague line where different modes of nutrition seem to combine and intermingle.” Whatever the process may be, when it is once changed the animal matter enters definitely into the composition of the carnivorous plant.

The beautiful *Utricularia*, whose handsome yellow flowers form an ornament of ponds, both in the Old and the New World, is therefore a genuine piscivorous plant. But curious and interesting as the discovery of this new phenomenon in plant life may appear at first sight, it is in reality only a special illustration of a general law, a necessary adaptation to the conditions of the element in which the plant lives.

In all the so-called carnivorous plants the roots, according to the observations of Darwin, are very little developed, and scarcely suffice to draw into the plant the water and the salts found in it in a dissolved condition. It is therefore quite natural that these plants should endeavor to obtain by some other process the nitrogen which is necessary for their life, and that their leaves should aid in performing the functions which their roots cannot entirely fulfill. In reality we must say, with Van Tieghem, that all plants are carnivorous, and we add that it cannot be otherwise, for how could we in any other way explain the various transformations and the infinite changes of matter which constitute the marvelous equilibrium of nature.”

Another very interesting description of and experience with this same plant is given in the following article taken from the *Fishing Gazette*, May 31, 1884:

A FISH-EATING PLANT.

By. G. E. Simms, Jr.

“I have recently discovered amongst the aquatic weeds placed in my

aquarium, where I have also a large number of newly-hatched perch and roach, a novel and unexpected enemy to the pisciculturist in the bladder traps of *Utricularia vulgaris*, which is capable of catching and killing young fry.

My attention was first drawn to it by observing that several of the tiny fish, without any apparent cause, were lying dead on the weeds, while the rest of the brood looked perfectly healthy and in good condition. At first I was somewhat puzzled at the strange position in which they were lying, and in trying to move one with a small twig I was still more surprised to find it was held fast by the head, in what I thought when I pulled the plant from the water, were the seed vessels; and a still, closer examination revealed the strange fact that others of the little fish had been trapped by the tail, and in one or two instances the head and tail of the same fish had been swallowed by adjacent bladders, thus forming with its body a connecting bar between the two.

At first I was undecided how to act, for I could bring to memory no instance in which I had seen the existence of a piscivorous plant—*i. e.*, one preying on vertebrates—recorded in any book I had ever read, and I was unwilling to make an assertion without the opinion of some one better capable of forming a judgment on the subject than myself; so I placed one or two good specimens in a glass jar and went to the Museum, where I was fortunate enough to see professor Moseley, who immediately verified my suspicions.

According to Bentham's Handbook of British Flowering Plants, the *Utricularia vulgaris*, or greater bladderwort, is widely distributed over Britain, and although it is local, yet where it is found it grows luxuriantly, seldom appearing in the rivers, but chiefly confining its presence to still ponds and deep ditches, the places where it is most likely to work mischief to the young fry. A peculiar fact in connection with it is that it has no roots at any time of its life, and the floating, root-like branches which are covered with numerous capillary and much divided leaves are interspersed with tiny green vesicles, which were supposed by a former school of botanists to be filled with water, by which means the plant was kept at the bottom until the time of flowering, when the water gave place to air, and the plant then rose to the surface to allow its bloom to expand.

As a matter of fact, the vesicles exercised no such function, their real work being to entrap minute crustaceans, worms, larvæ, &c., for its support, and without a good supply of which it is impossible to keep it alive in an aquarium.

This form is that of a flattened ovoid sac, or, in other words, when seen under a low-power microscope, they are precisely like a human stomach, and they are attached to their hinder extremities each by a very short and fine pedicle or foot-stalk in the axle of the leaves.

Each, too, has an opening at the opposite free extremity, somewhat quadrangular in outline, from either side of which project two branched processes, called by Mr. Darwin antennæ.



In fact, I do not suppose they could have received a more appropriate name, because in appearance the whole bladder intimately resembles an entomostracou crustacean, the short foot-stalk representing the tail.

On either side of the quadrangular entrance several long bristles project outwards, and these bristles, together with the branches of the antennæ, form a sort of hollow cone surrounding the entrance, and there cannot be the slightest doubt that they act as a guide for the prey.

The entrance is closed by a valve, which being attached above slopes into the cavity of the bladder, and is attached to it on all sides except at its posterior or lower margin, which is free, and forms one side of the slit-like opening leading into the bladder.

Differing materially from the color of the bladder itself, which is of a brilliant green, the valve is colorless and transparent, and is extremely flexible and elastic.

Animals enter the bladder by bending inwards the posterior free edge of the valve, which, from being highly elastic, shuts again immediately.

The edge is extremely thin and fits closely against the edge of the collar, both projecting into the bladder, and it is extremely difficult, if not impossible, for any animal to escape, although I have observed a long worm do so at the expense of a part of its body; yet, as a rule, it is a case of "all who enter here lose hope."

To show how closely the edge fits, it was found that a daphnia, which had inserted its antennæ into the slit, was held fast a whole day, and on other occasions long, narrow larvæ, both dead and alive, were seen wedged between the valve and the collar with their bodies half in and half out the vesicle.

When a fish is caught, the head is usually pushed as far into the bladder as possible till the snout touches the hinder wall. The two black eyes of the fish then show out conspicuously through the wall of the bladder.

So far as known there is no digestive process in *Utricularia* neither is there any sensibility to irritation. Mr. Darwin was unable to detect either, his opinion being that whatever nutriment the plant obtained from its prey was by absorption of the decaying matter, and it would appear that the longer of the two pair of projections composing the quadrifid processes by which the vesicles are lined, which project obliquely inwards and towards the end of the bladder, acts, together with the spring valves at the mouth of the bladder, in utilizing each fresh struggle of the captive for the purpose of pushing it further inwards. If any of my readers wish for specimens of this interesting plant I shall be enabled in a few days to forward them at a very nominal cost.

Of its destructive powers all I can say is, that out of 150 newly-hatched perch placed in a glass vessel only one or two were alive two days subsequently.'

We have given this much space to this plant not only because of the novel and interesting character that these discoveries give it, but because it thrives in a large range of our country, including the North and West,

and as these articles demonstrate is capable of great havoc in ponds where young fish are raised, and in any pond it lives on that which properly belongs to the fish, and should therefore find a home in no fish pond.

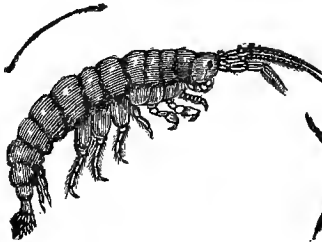
#### HOW TO GET RID OF THE ENEMIES.

We have pointed out the means of destroying many of them, and while the ponds are full of water it is impossible to get at the others, such as foreign fish, etc. But when the water is turned off of the ponds and the bottoms lie exposed you have them at your mercy. For this reason it is well to draw the ponds twice a year, spring and fall, where the water supply is good and they can readily be refilled, otherwise, as we have before said, draw them but once a year and that in the fall when you will have the winter months in which to fill them. To destroy the enemies, when the ponds are empty take quicklime and scatter in such portions of the bottom as is likely to conceal those enemies. Use enough of it to destroy all remaining animal life. Let the pond stand empty for about one week. When the water is again turned on let it stand a few days before putting in the carp. The lime will serve a three-fold purpose. First, it will destroy the animal life with which it comes in contact. Second, and we believe, almost equally important, by sweetening the bottom of the pond, it will neutralize the poisonous gases, and in part destroy such animal and vegetable matter as generates these gases. If not entirely successful in this latter purpose, we are confident that it will contribute greatly to the aid of the other agencies employed. Third, it will act as a fertilizer, and make the pond more prolific in vegetable growth, which in turn will furnish food for the carp.

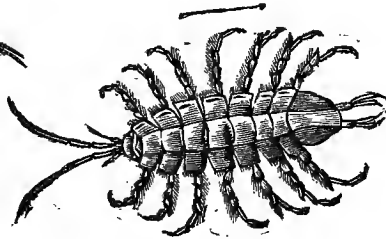
---

#### ERRATUM.

By an accident, the cut on page 54, was run through a part of the edition upside down. This was serious only in the fact that it made a water flea out of the water asell. The cut should have been thus:—



THE WATER FLEA (enlarged.)



THE WATER ASELL (enlarged.)

## CHAPTER VIII.

### THE DISEASES OF THE CARP AND ALLIED DIFFICULTIES IN POND CULTURE.

The cold-blooded, like the warm-blooded, animals are subject to disease. In most cases it is the result of bad treatment somewhere, or accident at some time. In discovering and treating their ailments, we labor under the disadvantage of not having them under our eye to study their case and the effect of treatment upon it.

The indications of disease are found in the bearing and general appearance of the fish. In health the body is clean, the fins are clear, and move with ease and grace, while the gills which supply the blood with oxygen are a deep bright red. In disease the contrary is the case; the body is coated, or has protuberances of false growths on portions of it, the fins droop, hang close to the body, do not spread out well, and appear as if held together, and occasionally bloody streaks appear along the belly of the fish. These characteristics of health and disease are not infallible, but will serve the purpose of a rule.

#### FUNGUS GROWTH.

This is most frequently found in its early stages at the back of the head, unless some other part of the body has been wounded, when it may begin at the wounded point. It resembles proud flesh, and if allowed to develop a coating of white matter like slime spreads over the body of the fish. It may be caused, too, by impurity of the water. In this latter case it will generally be found in ponds without much vegetation. As plant life contributes to insect life, which cleanse the water of the *bacteriae*, of which the fungus growth is composed, unless, as is most frequently the case, the disease appears in cold weather, which arises from the same cause, lack of purifying insect life in the water.

Examined under a microscope it shows numberless small parasites that are preying upon and irritating the fish. Prevention is the best remedy and the only one that we have yet seen prescribed by any author. But this is small consolation where the disease is present. By analogy with similar afflictions in the human family, diphtheria, for instance, which is a dread parasitical growth; we make the following prescription, which, by the way, is one of the best specifics ever used for diphtheria, and which, if you will bear it in mind, may save the life of some one dear to you, though you found it in a fish book. For diphtheria give the patient small and frequent doses of alcohol and water in equal parts. For the disease in fish, wash the affected parts with salt water, then apply the mixture of equal parts of alcohol and water. Another remedy is sulphur applied to the affected parts. We have full confidence in the efficacy of

this treatment, if continued once a day for a few days, keeping the carp out of water for a few minutes, giving either treatment time to have an effect.

#### POLYP

Is a disease similar in character to the former. The body of this parasite is cylindrical, with the mouth, at one extremity, surrounded by one or a series of arms, or tentacles, it not only multiplies in the usual way by ova, but by buds and sections as well. The *Hydra Polyp* has several heads from one body, and like the fabled serpent of mythology, one head taken off another will grow, with chances that the decapitated head will form another body of its own. Examined by the naked eye the affected parts look as if covered with a gelatinous matter. The remedies for this disease are the same as those given above

#### ASPHYXIA.

The characteristics of this disease is general weakness and lack of appetite, and is the result of sudden changes of temperature, or poisonous gases in the pond. Change of water is the best remedy.

#### DROPSY

In its early stages, is a swelling of the body at any part which gradually extends over the entire body until it becomes almost spherical. It does not affect the appetite and is no respecter of season or age. It runs its course in from three to six months and is generally fatal. We know of no remedy but change of water.

Other diseases, no doubt, attack the carp, but those named are the principal ones. Time and experience may show the seriousness of others.

#### INJURIES.

In the frequent handling of carp, in the changes from one pond to another, and in the shipping of them, accidents are almost unavoidable, eyes are put out, scales knocked off, fins and tails injured, &c. If the water of the pond is in good healthy condition nature will do much in healing the eye, and in reproducing the scales, and patching up the fins and tails.

#### HOSPITAL POND.

Where many fish are affected, injured or sick, a small hospital pond will make them accessible, render their treatment easier, and enhance the chances of ultimate recovery. Such a pond should have an average depth of about 12 inches and a temperature of from 70 to 80 degrees Fahrenheit, maintained, if possible. The water should be slightly saltish; this can be accomplished by making brine and pouring into it. There are few diseases of fish to which salt water will not contribute in affecting a cure.

#### POND DIFFICULTIES IN SUMMER.

The great majority of difficulties that have been reported to us during

the past three years, as befalling the ponds and fish during the warm season, may be grouped under the one head,

#### LACK OF WATER SUPPLY.

These reports were generally of sky ponds, dependent on the rainfall for water. Long continued drouths, demands made on the water by stock, etc., would reduce the pond to a mere pool, of a few rods in area, with an average depth of only a few inches, and literally swarming with fish. They described the fish as coming open-mouthed to the surface, and numbers of them dying, asked what was the matter, and how to remedy it. History is a repetition. The past repeats itself. So that this matter is worthy of consideration here, to guard others against the affliction, help them to remedy it, if it comes.

This condition of things will rarely come to pass in any other than sky ponds, except in long continued drouths when supplying streams dry up. In either case the remedy is the same.

What caused the fish to come open-mouthed to the surface? Lack of oxygen in the water is the natural answer, and under ordinary circumstances would be correct. But if correct in these instances, the mortality in many places would have been much greater, as efforts of relief and fresh water did not come soon enough to stay death, if lack of oxygen were the cause. Unfortunately no trials of the temperature of the water were made in those days. It is to be remembered, however, that during the period of the lessening of the water surface, and while the quarters of the fish grew more and more confined, and the absorption of oxygen by the water less and less, that the water became more and more foul, through the excrements of the fish, etc. This condition itself would breed disease in the fish. Then the pool at its lowest, a few inches of water, parched and baked surroundings and a scorching sun pouring its rays down upon it, and you get a temperature of water ranging from 85 to 95 degrees. And here, in our opinion, was the great cause of the fish coming to the surface of the water. It was in a vain search for that they could not find: a cool place, a lower temperature. In support of this theory we have the testimony of many who put water fresh from the well into their ponds, with the sole purpose of supplying fresh water, but it would likewise result in a change of temperature. Wm. Todd, of Vermillion, Ohio, writing of such an experience, said that after putting in the cold water the fish settled down, and by its repetition for a few days he saved his fish, and was satisfied that it was by this means only.

In similar cases it can be quickly demonstrated whether it is the lack of oxygen or heat that produces the result, by getting the mean temperature of the water, with a thermometer. If it is above 88 degrees Fahrenheit, heat is causing it, as the carp will die in water of 91 degrees or higher. If the mean temperature is less than 88 degrees, it is foul water or lack of oxygen. In the latter case a thorough combing back and forth of the water with a wooden-toothed hayrake, or a thorough whipping of it with a wire dip net, will break it up, make it foam and introduce oxygen

into it. In either of the former cases the only hope is in the introduction of cold water.

The preventative of such a catastrophe lies in making the pond deeper in all its parts. This can be easiest accomplished by excavating the shallow places and placing the material taken out, on the dam and embankments, making every scraperful count double in the water holding capacity of the pond.

Where the pond is so situated as to make it practicable, the overflow of a cattle trough, supplied by a windmill, conducted in pipes to the pond, will supplement the rainfall and reinforce the pond against the work of absorption and evaporation, which aggregates every 24 hours about 6,000 gals. to every acre.

#### WINTER DIFFICULTIES

Consist chiefly in the death of fish under the ice. In our opinion two causes contribute to this effect: Shallow water and poisonous gases.

#### THE DEPTH OF WATER.

This must be governed by the latitude in which the pond is located: the climate having much to do with the depth of water required. In Texas the deep water is needed in the hot season, that the fish may have cool water to retreat too. In Minnesota they need deep water in winter to have a warm place to retreat too. We have received accounts of carp wintering successfully in water 3 feet deep and the ice from 20 to 24 inches thick, leaving only 12 to 16 inches of water. Now this is evidence only of the hardihood of the carp and not of the skill of the culturist; and the carp are not the better for such a wintering. In a climate where ice forms from 20 to 24 inches thick, the wintering part of the pond, the collector and ditches, should not be less than 8 feet deep; in warm climates, 4 to 6 feet deep. To winter carp well, keep them as warm as possible.

#### POISONOUS GASES.

Enough has been said and written on the subject of keeping air holes in the ice for carp during the winter, to fill several books and to confuse the authors themselves, let alone their readers. It has been argued that these holes were necessary for the introduction of oxygen into the pond. Where it is cold enough to form ice on ponds that lasts any considerable length of time, the carp will need but very little oxygen, and to cut holes in the ice for this purpose is the height of folly.

The decomposition of vegetable matter, animal matter, the food unconsumed by the carp, all generate gases that are poisonous. These gases will be found most plentiful in new ponds, formed by embankments, not by excavation. Such ponds are usually formed with swales, or morasses for their bottoms, and these bottoms contain a mass of vegetable matter that has been for years in gathering, and as it decomposes gives off these gases. The gases arising from either of the above sources, are injurious to the fish, and if they are long subjected to them, results in asphyxia and death. The holes cut in the ice are to allow the

escape of these gases rather than the introduction of oxygen.

As the ponds grow older this difficulty will disappear, as the mass of vegetable matter, almost inseparable from new ponds, exhausts itself by decomposition, and is removed from the ponds after the fall fishing. To tide over this time many devices, are resorted to, the best of which is, we believe, to drive stakes firmly in several places in the pond, then bind cornstocks or rye straw closely around them to a diameter of between 3 and 4 feet, and projecting above the water about 2 feet. If the water is deep, the cornstocks or straw may be bound  $\frac{2}{3}$  the way to the top and slipped over the stake, then loosely bound below and above.

The cutting of holes in the ice, we believe to be the poorest plan of all; as the water quickly congeals again and the temperature of the pond is reduced.

A plan much commended, though we can see but little virtue in it, is to build a flume from a point under water, below where the water will congeal too, into the most abrupt bank of the pond, far enough so that a second flume at right angle to the first will stand perpendicular to the water, and come up through the earth where it is high enough above the water level to prevent freezing. The top of the flume then is left open, and allows the gas to escape, and the oxygen to enter the pond. The difficulty with this plan is that the pressure of the gas is upward, and it will lay heaviest next to the ice, and it will pass out of the flume only when enough has accumulated to thoroughly saturate the water above the flume and between it and the ice. When this condition is reached the gas next to the flume will begin to pass out of the flume. But we do not see that the flume is going to have any great draft on the gas from other parts of the pond, than just at the mouth of the flume. As an oxygen introducer, we have as little faith in the flume as we have in it for a gas escape. The reason is that the surface of the water exposed to the oxygen in the land end of the flume is too insignificant when compared with the area of the pond, and again, being under the earth, down a chimney, the oxygen has but poor opportunity to enter the water. We would rather put our faith in the rye straw and cornstock plan, with the proper cleaning and liming of the pond bottoms (see page 66) in the fall, where they cannot lie exposed during the winter.

## CHAPTER IX.

### THE ARTIFICIAL FEEDING OF CARP.

It is not the purpose of this chapter to either establish a standard of food for the carp, or to lay down any scientific rules for the composition of the best food, to give them. Though carp have been fed quite generally by the culturists of this country, yet we know of no scientific experiments having been conducted along this line. The one great difficulty in such an investigation is to gather all the excrements of the fish from the water, for analysis and comparison with the elements of the food given, and only by such a searching and thorough sifting of all the accompanying circumstances, temperature, etc., could a strictly correct rule for the proportion of the elements composing the food be arrived at. By analogous reasoning, using such facts as have been gathered by the experiments that have been conducted in Europe, and by the analysis of the natural food of the carp, an approximately correct rule may be arrived at. With such a rule established, and the principal parts of the ingredients to be purchased, while the outlay and the labor would undoubtedly be well rewarded in the harvest, it is a question whether many culturists would make the outlay or perform the labor required.

Without questioning the motives of our earlier American writers upon this subject, we discard the proposition they laid down, to-wit: That carp were vegetarians and would live and grow fat on the vegetation of the pond, and if placed in a mud hole barren of vegetation you had only to supply them with grass, lettuce, cabbage leaves, potato tops, etc., etc. We are of the opinion that carp rarely, if ever, partake of any vegetation, and if they do it is only when great hunger drives them to it, and that, then, they confine themselves to the tender shoots of some of the water plants. We have never found either the leaves or roots of plants in their stomach. We have watched them feeding, by the hour, and have never seen them attacking the vegetation of the pond. Occasionally they would take the leaf of a plant in their mouth, but invariably spew it out again. Whether hunger was compelling and nature resisting, or whether they took the leaf into the mouth to gather the insect life from it, we are unable to determine, but think it the latter. The very face of the matter declares against it. A great many of the smaller ponds of America, are very largely overstocked with carp, and yet year after year the vegetation of these ponds increase. You may say the fish in those ponds were artificially fed; grant it, but if they were vegetarians they would only take the food supplied, after they had exhausted the vegetable supplies of the pond, and instead of the vegetation of the pond increasing it would finally

•

•



become extinct. An army of carp eating pond lillies, water grasses, etc., would quickly clean the pond out. We have seen in a three-acre pond a floating island about 30 feet square composed almost entirely of pond lillies. An examination of them showed the roots to be almost clean of dirt, with some of them broken off, not bitten off. What caused them to float? They came from an end of the pond where the carp fed a good deal of the time, and in their search for food at their roots, worms, larvæ, &c., they gradually undermined them, the interlacing of roots holding them together until a body large enough to be affected by the wind, the leaves acting as sails, broke loose and floated over the pond.

Again, the digestive organs, alone, of plant-eating animals, average from 15 to 20 per centum of the entire weight of the body, While in flesh-eating animals the digestive organs, alone, average only from 5 to 6 per centum. In the carp the entire entrails and internal organs of the body will not reach over 5 per centum of its entire weight. This fact of itself is sufficient to determine that they are not vegetarians.

The natural food of the carp, universally found in their stomachs, where not artificially fed, consists of maggots, worms, snails, insects, larvæ, bugs and beetles. So far as analysis and experiment demonstrate, these contain an average of about 20 to 1 of nutritive matter. Taking this natural food as a base of operations, and considering in connection with it, that carp are of the cold blooded order, and have no bodily heat to maintain, and by comparison with the hog which they most resemble in appetite and rapidity of growth; we may any of us formulate a reasonable rule for the composition of the food to be given them that will result in the least waste of material and the greatest increase of fish flesh.

That the natural food is the best that can be supplied the carp, has been demonstrated, in nearly every State in the Union, by the marvelous growth they have made in ponds where there were but few carp and an abundance of natural food. In Northern Ohio they have reached a weight of six pounds in 18 months. In Texas a weight of over 20 pounds in four years, full accounts of which were published in "American Carp Culture." We must endeavor then in the artificial food to approximate the elements of the natural. The growth of the carp will then be in ratio to the amount of food taken, digested and assimilated.

The nutritious matter in the natural food is in the proportion of 20 to 1, nutritious matter, or substances are found in

1. Albumen, or proteids.
2. Fats, or oils.
3. Starches, or carbohydrates.

To the first group belong some of the most important food stuffs, and all of them contain nitrogen and are therefore sometimes termed "nitrogenous constituents. Of this group adapted to fish food are, meat of any kind of animals, containing on an average about 19 per cent. of albumen; peas and beans an average of about 25 per cent; grains and flour and meals, about 9 per cent., potatoes about 2 per cent. The chief constituents of the vital organs, the muscles and the blood, and it is through the blood

that tissue and flesh is formed, are the proteids or albumens. .

Fats and starches or carbohydrates, perform like functions in the body, producing heat, energy and force. A majority of the carbohydrates belong to the vegetable food, starch, sugar, gum and dextrine are the most important. The cell structure of plants is allied to this group, but when absorbed must first be converted into sugar.

It is from the first group that we will have chiefly to draw in the composition of food for carp, they having no animal heat to maintain. The demand for carbon is confined to enough to give them vital force, and to consume or burn such matter as becomes waste in the process of life. In the food of man the proportion of carbohydrates to albumen is about 4 to 1, this amount of carbohydrates and fat are required to keep up animal heat and give vital force and energy to the body. To greatly change these proportions by increasing the albumen and decreasing the carbohydrates might give him flesh, but it would lose him his vigor. Fish require but little force to move through the water, because the weight of the water displaced by its body is equal to the weight of the body itself. Owing to these reasons, to rapidly develop weight in the fish the albumen must be in excess of the carbohydrates. The rule which has largely obtained in Germany is a proportion of two pounds of the former to one pound of the latter. As in the case of the food of man there is no absolute necessity of adhering strictly to these proportions, as some of the carbohydrates not used in producing heat and consuming waste matter are probably converted into flesh.

Carl Nicklas lays down the rule which has largely been adopted in Germany with good results, of nine pounds of dry substance, containing four pounds of albumen and two pounds of carbohydrates, inclusive of fat, for each 1,000 pounds of carp.

This would allow to each pound of carp a ration of a little less than one-seventh of an ounce a day. This looks very small, but it is not so. A laboring man requires only one-fifth of an ounce a day to each pound of weight, and in this the proportion of carbohydrate is four to one of albumen.

The difficulty, however, lies in the execution of the rule of Carl Nicklas. We know of but one substance capable of sufficient condensation to reach the proportion of four pounds of albumen in nine of matter, and whose cost would permit its use, and that is cheap meats. These by a drying process at a proper temperature, excluding the water, would leave the albumen in sufficient proportion. It is those dried meats converted into meat flour that are used under the Nicklas' rule. In Germany, too, it must be a specific for carp food, as we do not find the German name, Futter fleischmehl, defined in any of the standard German encyclopedias or dictionaries, nor is the article yet manufactured in this country, though something similar is manufactured for poultry food.

Carp, however, will eat about four times the weight of the rations allowed to each pound in the Nicklas rule, so that the weight of the food taken being elastic, it gives better opportunity of reaching the proportions

of albumen, allowing the carbohydrates to be in excess.

Farmers, who constitute the general culturists of this country, cannot afford to enter into lengthy calculations of combinations to secure these proportions, but must make the best use of the material at hand. So to aid him in this we will present a few combinations that will serve the purpose with the least waste.

The great desideratum in artificial food is the albumen. The fish will find the carbohydrates in the pond. Though there is little food except meat that does not contain the carbohydrates, and that contains fat which answers a similar purpose.

First. The flesh of any kind of dead animals, birds, fish, frogs, etc., may be utilized and will contain about the right per cent of nutritive substances. They should be chopped up fine before being fed.

Second. Fresh blood mixed with any of the following substances in a proportion of five pounds of blood to one pound of the other matter. Flour, wheat bran, ground oats, barley meal, corn meal, linseed meal, ground peas and beans, (these two latter contain each about 25 per cent of albumen,) making the preparation thick enough to form balls or cakes, which place in about ten inches of water, where the sun strikes.

Third. The flesh of animals above mentioned may be mixed with the cereal products named in the second preparation, and boiled potatoes in the proportion of five pounds of the flesh to one pound each of the potatoes and the cereal selected. In this case they should be thoroughly mixed and incorporated each with the other, and about one pound of coarse salt added to each fifteen pounds of the mixture.

These two last preparations may be preserved by mixing finely pulverized clay or loam soil with them, spreading them a half to three-quarters of an inch thick on a level surface, and cutting into cubes about one-half inch square, and letting them dry in the sun.

#### FOOD FOR YOUNG FRY.

Fourth. The umbilical sack or yolk bag, with which the young carp come into the world, supplies their nourishment for four or five days. Then they need food and begin an unlearned search for it. A supply of the right kind of food at this stage of their existence is particularly important in preserving many of them from starvation. It may be a very simple material, dry bread finely crumbed, or pulverized crackers, or even dry bran or shorts scattered along the edge of the water on the grass and vegetation of the pond. A better preparation may be composed of worms, snails, the brains of animals, ground or chopped up fine and mixed with flour or equal parts of flour and soft cooked potatoes, and thoroughly mixed and incorporated with each other. It will keep in a cool place for a week, and small portions of it can be fed daily. It should be pulverized into small particles for feeding. This can be accomplished by drying in the sun or in an oven, and forcing through a coarse sieve or fine meshed screen. A half pound of this mixture each day will supply thousands of young fish the second week of their existence, and each succeeding week, they need

a little more. A similar mixture of flour and blood and potatoes, will answer the same purpose and may be handled in the same way.

The home food supply of the carp, like the compost heap, may be greatly increased by economy and thought. In slaughtering cattle, hogs, poultry, etc., never waste the blood and the offal. They are life and flesh for the carp. The scraps from the table are the same. The grass hoppers that scourge the west will make good food for them. In the plowing season a boy following after the plow will pick up gallons of worms and grubs, than which nothing is better for the fish. The excrements of cattle dropped in the pasture dry quickly in the sun and are soon full of insects, maggots and beetles, which are the natural food of the carp. Gather them in a wheelbarrow and throw them into the pond.

To produce the natural food of the carp Carl Nicklas gives the following simple method:

"If there are clover fields or meadows near the ponds, the carp may be supplied with ample natural food by cutting grass, clover, or lucern, during the months between May and August, chopping it fine, pouring water on it, and then distributing it in small stacks in sunny places near the banks of the pond, so that it may be thoroughly warmed. On the following morning water should be again poured on these stacks, and, without being disturbed in any way, they should be again exposed to the rays of the sun, which quickly heats them and produces putrefaction. During the following night already numberless beetles and other insects will creep into the steaming stacks and deposit their eggs. After three days the stacks are fairly alive with insects and their larvæ, and the stacks are then thrown just as they are, into the water near the banks. The exhalation from the decaying vegetable matter acts like a bait upon the carp. They eagerly seek it, devouring the insects contained in it, and also particles of the decaying matter. The places where the grass has been thrown into the water become gathering places for many other small animals which breed there, and thus supply ample food for the carp. These places should be kept up. As grass can generally be had near the banks of ponds, this food is cheap and can be obtained with very little trouble."

Where slaughter houses, breweries, distilleries or starch factories are within reach, the refuse matter from these will make a good and cheap food, though care must be exercised to not so overfeed as to have masses of the material collect, decay and poison the water of the ponds. To these may be added any vegetables that are inferior or in which decay has set in. These latter should be boiled and mixed with bran.

If it is not convenient to chop fine the flesh of dead horses, sheep, or other animals, they should at least be cut in chunks and distributed over the pond, not the carcass thrown in whole, as poisoning of the water may result from its decomposition. Such chunks of animal matter suspended to stakes above the water will produce maggots without number that will in their turn drop off into the water and form a continued supply of food for the fish.

A few culturists in America have been feeding whole wheat, which

after being in the water for a time swells and softens, and occasionally sprouts. In this latter condition it makes a good food. No results, however, of these experiments have been noted. A great many culturists have been feeding bread made from coarse shorts or bran, and report great satisfaction with the results. The results no doubt would have been more satisfactory had the bran been moistened with blood instead of water, and then baked.

The plan adopted by some of feeding on platforms some distance below the water level, with rimmed edges to keep the food from slipping off into the water, has advantages and disadvantages. Where the carp are generally fed, and depend on the food supplied, it is to be commended, as you can always tell when you are overfeeding by the remains. But where the feeding is intended as an aid or relief to the food supply of the pond, then the matter given them had better be distributed around in the shallow water of the pond, where any remaining will stimulate the insect life of the pond and contribute to the future food supply of the fish.

In connection with artificial feeding of the carp, many culturists have practiced the blowing of a horn, the ringing of a bell, or the making of some other noise to call the fish to their meals. They report that the fish very soon learn to come at the call. One very ingenious contrivance worked automatically, at regular intervals rung a bell and dumped the measure of food on the feeding ground, and at the clang of the bell the fish would swarm to the spot. These many things resurrected the long mooted question: "Do fish hear?" In the hope of throwing some additional light on this very interesting, if not important question, we entered into arrangements with Prof. E. W. Claypole, B. A. B. Sc., F. G. S., &c., occupying the chair of Natural Science, at Buchtel College, Akron, Ohio, (author of "The Lake Age in Ohio," and one of the publishers and editors of "The American Geologist,") whereby he has furnished an illustrated article upon this subject, which we present in the next chapter.

## CHAPTER X.

### ON THE HEARING OF FISH.

By Prof. E. W. Claypole, B. A. B. Sc., F. G. S., &c., Buchtel College, Akron, Ohio.

There has been and is still not a little controversy regarding the hearing faculty in fish. Some have gone so far as to declare that they cannot hear at all. Evidence has been freely quoted on both sides and both parties have apparently made out a case at least to their own satisfaction. When so decided a difference of opinion exists in regard to a question of fact, there must be reason on both sides, and it is necessary to take all these into consideration in order to arrive at the truth.

Now there are two methods of working in a problem of this kind. They may be called the structural and the experimental methods. Both should be followed up and if the results coincide each will be confirmatory of the other. The former seeks by dissection to show that the organs required for hearing are present in the fish. The latter seeks to prove from their behaviour that fish do hear because they *act as if they heard*. The former of these methods will be chiefly followed in this paper. The latter can be employed by any one who has access to a fish pond to test the conclusion reached below.

No one will dispute the premise that if an animal has an ear or ears that animal should in some degree at least possess the faculty of hearing. Unused organs soon become rudimentary and finally disappear. If consequently, fish have ears, we must infer that in some manner or degree they can hear.

It is not necessary for this conclusion that the sense of hearing should be as perfect or complete as in ourselves, or that the ear should show the same marvelous complexity as it does in man. This would be highly improbable. The fish zoologically is lower than man—equally fitted to get his living in the circumstances wherein he is placed, but not capable of the variety and complexity of actions for which we are adapted. Zoologically speaking therefore, we shall expect to find many if not all of the organs of the fish less complete—that is less perfect—than our own. With increasing complexity of structure comes increasing diversity of function. The complex organ enables its possessor to do what without it would be impossible. New avenues between the outer world and the conscious centre are opened. Possibility of pleasure and of pain previously unrealized and unconceived comes into existence. The animal is higher in the zoological scale. All this will be denied by few and will be at once admitted by all zoologists. In fact simplicity of structure is usually tantamount

to lowness of station. Rank in the organic world can in most cases be estimated by structure.

Applying this principle to the case in question let us examine the organs of the fish and see what light they throw upon the problem.

It will, however, be well before doing so, to pause and give a short account of the structure of the human ear, in order that what is to follow may be more easily understood.

The ear in its highest development consists of three parts—the outer, middle and inner ear. These rise in importance from the first to the last. The outer ear consists of the “ear” so-called, or “concha,” of the anatomist, (seen on the outside of the head), and of the blind tube leading inward from it. These serve to catch the waves of sound in the surrounding medium and conduct them to the machinery situated within. Their use and importance, it may be therefore said, are strictly subsidiary and their absence but slightly affects the action of the organ and in no way abolishes the sense.

It may be well to mention that by the sense of hearing will here be meant that communication between the conscious centre and the outer world which is effected by waves produced in or conducted through a surrounding medium, solid, liquid or gaseous. These waves by striking various parts of the organ awaken nervous movement, is translated by the conscious centre into the sensation which we call sound.

It will consequently make no difference whether the wave or vibration be transmitted through the air as in ordinary hearing, or through water as when a sound is heard by a diver, as through a solid pipe or rod as along the metals of a railway. All these waves alike reach the sensory organ somewhere and the resulting motion is converted into a nervous impulse. \*

The second part of the hearing apparatus in man is the middle ear or drum. This contains a membrane stretched tight across the tube above mentioned and closing it altogether. This membrane—the drumhead—forms the bottom of the tube and receives all the waves that pass down it from the external ear. In response to these it vibrates. Attached to the drumhead is a chain of three small bones through which the vibrations are transmitted onward to their destination. The drum being closed against the entrance of air through the external ear some other communication is necessary to keep the pressure equal on both sides of the drumhead. Pain and injury would otherwise result. This is accomplished by a tube leading from the drum to the mouth. The Eustachian tube—which can be heard

---

\* It is needless to discuss the question whether or not the wave is *heard* or *felt* by the fish, because the same quibble might be raised in regard to our own hearing. The ear is only a marvelously delicate and sensitive organ of touch, and whether the wave of condensation reaches it through the air, the water, or the bones of the head is a matter of little or no importance to our present subject. A blow violent enough to shake the objects around us would doubtless be felt by our ordinary sense of touch and perhaps in addition by our muscular sense, and the same would be true of fish. But no such violent commotion is now in question, and the slight tremors that we call sound beside differing somewhat in their nature from those that produce shocks are far too slight to be appreciated by any organ save the refined mechanism of the inner ear.

to open with a click at every swallow and which allows the passage of air. If closed by disease deafness is likely to follow as in catarrh and after scarlet fever.

Here again it will be observed we have nothing but a transmitter, though one whose presence is of great importance to the perfection of the sense of hearing in the higher animals. Yet it is not the essential part of the organ, nor does its absence destroy the sense or prevent the action of the other parts if present.

It will be observed that the air wave in reaching and striking the drum-head is changed into movement of the membrane, just as the movement of a drum stick is lost or converted into movement of the stretched parchment of the drum. This movement is passed on to the first bone of the series which is a bent lever. This transmits it to the second, thence it passes to the third, which from its shape is called the stirrup-bone. This lies against a membrane that closes an opening in the bone of the inner ear, and which consequently moves with every movement of the bone. Here for the present we leave this sound-wave.

The third and most intricate and yet by far the most important part of the human organ of hearing is the inner ear. This from its complexity is well named the labyrinth. The annexed figures will aid the reader in following the description, but the whole structure cannot be well understood without actual dissection. Some account of it is, however, necessary for the comprehension of what is to follow.

The labyrinth or inner ear is a chamber excavated in the ear-bone—the hardest in the body—filled with a watery liquid, adjoining the middle ear and having a hole in the bony wall that separates the two, which, however, is not open but closed with a delicate membrane. Against this lies the stirrup-bone already mentioned. The form of this chamber is exceedingly complicated, but speaking broadly, it consists of three parts. These are, first a central portion separated from the middle ear by the bony wall containing the opening already mentioned; second and freely communicating with this is a posterior portion in form like the shell of a snail and severed from the middle ear only by a second delicate membrane stretched across a second opening in the ear-bone. Third, there are three semicircular tubes communicating freely at both ends with the central chamber. These three canals are roughly speaking at right angles with each other and like the whole of the inner ear are full of liquid. All this mechanism, both the spiral portion and the canals is securely imbedded in cavities in the bone, which makes their study in the higher animals both tedious and difficult.

We have now reached the central portion of the organ—the part by which the motion of the small bones is converted into nerve motion—the part without which no hearing is possible.\* Inside the labyrinth lie the fine hair-like tips of the seventh nerve—the nerve of hearing—floating as

---

\*From the facts here stated it may be seen how many parts of the ear may be destroyed while the hearing yet remains in greater or less perfection. Indeed it appears as though the sense could never be entirely abolished so long as the liquid of the inner ear and the



it were in the liquid that fills the chamber. These are distributed on the walls of the semicircular canals, and of the spiral cavity, and are exceedingly numerous. Their ends are excited by the vibration of the liquid and the nerve currents thus produced are transmitted along the nerve trunk to the brain.

In addition to the curious and complex mechanism already described there is another very singular portion whose exact duty is but ill understood, but which appears to be all important if we may judge from the fact that it is constantly present even among animals very low in the scale. There is in the labyrinth a variable number of small masses of limestone resembling bone in appearance. These ear-stones or "otoliths" seem to produce or to increase the effect of the vibrations of the liquid on the nerve ends, and in this way perhaps enhance the keenness of the sense.

The reader will now be able to follow the application of the above description to the special case of the fish, and to appreciate the value of the evidence deduced therefrom in relation to the power of hearing possessed by these animals. We have already said that the complexity of the ear grows less and less as we descend in the animal scale. Part after part disappears. Important though non-essential accessory organs cease to be present, and the ear is reduced at length to its most rudimentary form, namely, a simple chamber filled with liquid and containing the ends of the auditory nerve and some otoliths. Such an ear is found in the fresh water mussel of our rivers and ponds.

In illustration of this statement I may here state that the external ear is found in all mammals, in most birds and in some reptiles. In the amphibians, as in the frog and toad, it is absent and the drum head of the middle ear is visible on the outside. In fishes a still lower grade is found. Here the middle ear or drum is also absent. There is no drum head, no chain of small bones, and therefore no Eustachian tube. The inner ear is now the only portion left.

The ear of the fish accordingly corresponds only to the inner portion or labyrinth of the human ear, and even this in an incomplete form, for the spiral portion—the cochlea—is absent. The drum and outer ear being both undeveloped, there are no membranous partitions, the two openings in the bone do not exist, and the whole organ is shut up close within the bony cavity of the skull. It has no direct channel of communication with the world outside. No trace of it can be seen on the surface, and some care and pains are necessary to demonstrate its existence. Yet every part that is essential to hearing is present and may be found. In the cavity of the skull and near the base on each side is a recess, and in this the ear is situated. It is in actual contact save for some delicate, separating membrane, with the brain itself. This recess, or alcove, as it may well be called, extends from the top of the skull to a point a little below its base and is lined with a layer of liquid called the lymph of the ear.

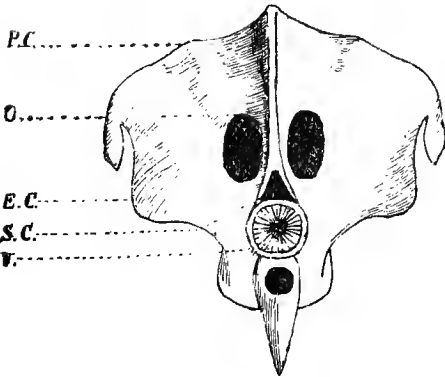
---

fine ends of the auditory nerve remain undamaged and in connection. These are the translators of the sound-waves into nerve vibrations, and where they are present hearing in some degree is possible.

Separated by this liquid from the bone, and suspended in it is the membranous ear. It consists of several parts. First and most readily seen is the sack containing the otoliths or ear-bones. This lies at the base and at the back of the brain, and contains a large otolith in front, behind which is another very small one. This peculiar bone of which a figure is given (figure c.) is loose in the sac and is of very irregular form. In a carp of twelve inches long it measures about one-fourth of an inch in length. To its carnelled edge are attached the ends of the fine branches of the auditory nerve which forms an intricate branching mass on the floor of the chamber. These may be easily seen.

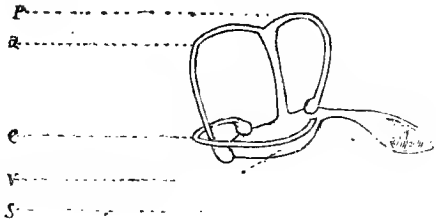
DESCRIPTION OF FIGURES ALL ARE TWICE THE NATURAL SIZE BUT D.

**A**



A. Hind view of head of carp.  
 P. C. Place of posterior semi-circular canal.  
 E. C. Place of exterior semi-circular canal.  
 S. C. Spinal chord.  
 V. First vertebra.  
 O. Opening at back of skull leading into the brain cavity.

**B**

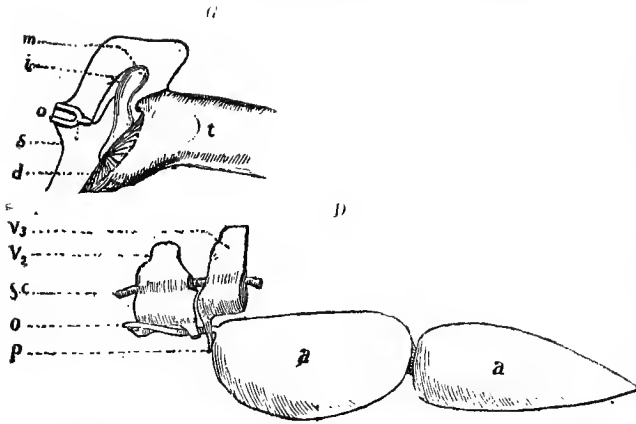


B. Left ear, seen from outside.  
 P. Posterior semicircular canal.  
 e. Anterior semicircular canal.  
 a. Exterior semicircular canal.  
 V. Vestibule containing small otolith.  
 S. Sac containing large otolith.

**C**



C. Otolith or earbone of right ear seen from outside. The notches on the edge are the points of attachment of the ends of the fibrils of the auditory nerve.



G. Figure of left drum or middle ear of man viewed from the front.

o. Opening in bone (closed by a membrane) leading to inner ear.

s. Stirrup-bone in place on the membrane.

i. Middle small bone, (*incus*)  
m. First small bone (*malleus*) in contact with drumhead.

d. Drumhead or membrane separating middle from outer ear.

t. Tube leading to outside.

D. Figure of the air bladder of a carp 10 inches long (life-size) with second and third vertebræ.

a. Air-bladder.

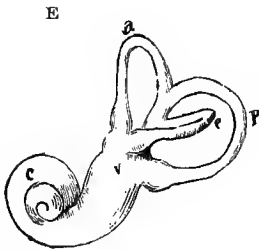
V2. Second vertebræ.

V3. Third vertebræ.

S. c. Spinal chord.

p. Process from third vertebræ supporting air-bladder.

o. Small bone connected with air-bladder and leading to back of skull.



E. Figure of the left labyrinth or inner ear of man as seen from the outside. (Sharpey & Quain.)

a. Anterior semicircular canal.

p. Posterior " " "

e. Exterior " " "

v. Vestibule.

c. Cochlea or spiral portion.

F. Section of the left labyrinth or inner ear of man as seen from the outside.

a. Anterior semicircular canal.

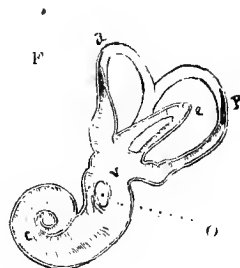
p. Posterior " " "

e. Exterior " " "

v. Vestibule.

C. Cochlea.

O. Opening to drum or middle ear.



Next there is another chamber lying slightly above and in the front of the sac of the otoliths and consisting like it of an exceedingly delicate transparent membrane. This is the central cavity or "vestibule," as it is called in man. It usually contains a third otolith to which other branches of the auditory nerve are attached and is filled, as is every part of the ear, with the liquid already mentioned. It occupies most of the alcove or recess above spoken of except what is taken up by the sac of the otolith. Connected with this vestibule are the three semicircular canals mentioned in the description of the human ear. The foremost of these, the anterior, rises from the front of the vestibule and in most fishes soon enters a tube larger than itself in the parietal bone of the skull in which it loosely lies. This tube curves backward and then downward and the canal within it of course does the same until it at last emerges into the alcove of the ear and reaches the membranous central cavity or vestibule at a point further back than that from which it started.

The second or posterior semicircular canal follows a similar course, but its bony tube lies in the occipital or hindmost bone of the skull. This is also vertical but in a "right-and-left," and not in a "fore-and-aft" plane. One end of this canal enters the alcove of the ear by the same tube which carries the hind end of the anterior canal.

The third or exterior canal leaves the vestibule near the front and winds *horizontally* backward in its bony tube to reenter it near its posterior end. There are therefore five openings in the bone and five openings in the vestibule for the passage of the six ends of the semicircular canals. Two of them, as said above, unite before reaching the point of entrance.

Each of these canals is expanded into a small bulb at one end. Two of these bulbs are situated at the front and the third at the back of the vestibule. All the above details can be seen represented in the figures accompanying this chapter.

Thus then we see that the ear of the fish is in all essential points a true ear, not a rudimentary ear, for the necessary portions might be still further reduced, and yet leave the organ in a condition capable of translating the vibrations of the outside medium into nerve vibrations. Any organ capable of doing this is a true ear. Its most striking character is that it is shut in and has no open channel of communication with the world outside.

But the bones of the head form a medium by which vibrations or undulations can be conducted inwards. It is, indeed, impossible to prevent this inward conduction of all vibrations in the watery medium in which the animal lives. Even some deaf men may be made to hear by putting a tuning-fork to the teeth and so forming a solid line of connection between the fork and the inner ear. In the same manner a sound-vibration in the water must be conducted through the skull-bones of a fish to its inner ear deep sunk as it is at the base of the skull.

Evidently the ear of a fish is not well adapted to receive the vibrations of the air. These are very feeble in consequence of the lightness of that medium. We ourselves do not hear sounds carried through the air when

our ears are stopped, and when the vibrations must pass through the bones of the head in order to reach the inner ear. But the ear of the fish is organically stopped and consequently has no opportunity of receiving such air-vibrations. But those of the heavier liquid, the water in which it lives are quite capable of penetrating the skull. There cannot be a shadow of doubt that fish can hear sounds under water, that is, can feel vibrations conducted through the water. Stamp on the ground by the side of a fish-pond and you may see them start. Explode a cracker under water and note the commotion that follows. But on the other hand many kinds of fish seem indifferent to the voices of persons talking near them though anglers usually maintain perfect silence "lest the fish should hear them." Many a time was I told when a boy by some patient sportsman to "keep quiet and not frighten the fish." Probably all fish are not equally sensitive in this respect. But it is also quite likely that the noise of an ordinary conversation is not loud enough to create a vibration in the water sufficiently strong to disturb them.

A writer in the November number of the "Journal of Carp Culture," (1887) after telling how he made a clock to deliver food to the carp in his pond says that on its striking a 30-pound bell once a day the fish assembled in great numbers at the feeding place. Here the loud sound is conducted down the sides of the building "which stands in the pond" and spread through the water. It is consequently a water wave and not the air-wave that the fish perceive. In this way we may I think account for the rather contradictory opinions that have been published regarding the hearing of fish.

The above is a general account of the structure of the ear among fishes, but it cannot be literally and exactly applied to every fish. In so large a class covering as it does so great a range of structure many differences must be expected. So we find it. The widest divergence from the type is in the semicircular canals. These are not equally developed in all fishes. Among our common fresh water species we find much variation in this respect. In the herring of Lake Erie, for example, the exterior and posterior canals are present and are embedded in bony tubes in the walls of the skull—the former in the parietal and the latter in the occipital bone. The anterior canal is also present but scarcely sunk in the bone at all, its tube being very short and for the most part cartilaginous. In the pickerel again the posterior and exterior canals are embedded in the bone but the anterior is only sunk in a groove formed by a projecting plate arising from the base of the chamber.

Numerous other departures from the typical ear of the fish could be cited to show how this organ can be traced from stage to stage in degree of complexity downward until it becomes almost rudimentary. But to do this would not come fairly within the proper domain of this chapter, and it must suffice to say that in the sea-lampreys we find an ear whose simplicity is almost as marvellous as is the complexity of the ear in man. In these lowly fish the ear-bones are not found at all, and consequently the membranous sac which usually contains them is absent. Further the

semicircular canals do not appear unless a slight fold of the enclosing membrane can be said to represent them in a rudimentary condition. Moreover the whole organ has no bony envelope as in most fishes, but is merely enclosed in a cartilaginous or gristly capsule connected with the brain-cavity. Sound-causing vibrations can therefore reach the centre by two channels either through the solid bone of the skull or more directly through the softer capsule of the ear.

It is, however, perfectly relevant to the purpose of this chapter to dwell at rather more length on the ear of the carp which presents some peculiarities deserving notice. In this fish and others more or less nearly allied to it, there is a very singular apparatus seemingly adapted to assist the hearing. The air-bladder of the carp consists of two parts only slightly connected. The fore part is a short cylinder with rounded ends and supported by a projecting process from the third vertebra. Attached to the front of this part of the bladder are two small bones that point forward and upward toward the back of the skull. These communicate with two small chambers in the occipital or hindmost bone of the head which are in direct connection with the cavity of the ear. By means of these bones a line of communication is maintained between the air-bladder and the ear. This apparatus can be traced out by careful dissection. Moreover in the carp the back of the skull is completely open or at least contains two large passages that occupy a great part of its area, whereas in most other fishes it is shut in by a bony wall. These details are shown in figure A or figure D.

The carp therefore has two means of receiving waves of sound—one through the bones of the skull and the other through the air-bladder. It is not possible at present to say if these two supplement one another—each doing a different kind of work—or reinforce one another—each conveying similar vibrations so as to produce a stronger impression on the conscious centre.

In the carp it is moreover worthy of notice that the extent of the semicircular canals is very great. The bony tubes in which they lie are not excavated in the immediate wall of the skull as is usually the case, but the cranial bone is extended into broad wings two of which are vertical and the third horizontal. The three together form a sinus or chamber outside of the cavity of the skull which is open below but closed above, behind and outside. This structure gives a great apparent width to the head when viewed from behind without at all increasing the actual brain capacity. But at the same time it gives an opportunity for much expansion of the semicircular canals so that these bony wings with their enormous enclosed sinus may be regarded as a special development of the ear. It must not hence be inferred that this anatomical structure is peculiar to the carp. It may be found in other nearly related fishes but it is in strong contrast with the contracted limits of the bony canals in the herring, the pickerel, &c.

The sac of the otolith in the carp is also much depressed and is situ-

ated not only below but almost under the brain in a cavity excavated in the first vertebra.

All the various details here given regarding the ear of the fish and especially of the carp are illustrated in the diagrams accompanying this chapter and the general facts connected with the anatomy of the organ deprived of all unnecessary detail have been explained as fully as the limits allow. It may be as well to state that the article has been drawn up for the use of the general reader and not for the professional anatomist and is consequently as free from technical language as it was desirable to make it. This will I hope serve as an apology, if apology is needed, in case these pages should fall into the hands of any student of anatomy and he should be disappointed by the absence of the familiar and time honored, and in the technical treatise useful and indispensable, phraseology.

In conclusion the writer only desires to express the hope that he has succeeded in presenting the case clearly enough to remove from the mind of his reader any lurking doubt regarding the ability of fish to hear. Such an organ as has been here described can certainly not be without its function and though fish may be comparatively indifferent to sounds in the atmosphere yet they certainly hear vibrations passing through the denser fluid in which they live.

## CHAPTER XI.

### WATER PLANTS FOR CARP PONDS.

A luxuriant growth of plants in portions of the pond, adapted to their production, not only beautify the sheet of water but serve several important purposes, and is an important factor in successful pond culture. They are remedial agents in imbibing carbon and throwing off oxygen, thus greatly contributing to a healthy condition of the water. They are almost indispensable to the spawning pond and if not present artificial methods of catching the eggs, such as using the branches of trees, must be resorted to. They are the legitimate accessories of all ponds, as on their stalks and leaves multitudes of bugs and insects, throughout the entire season; deposit their eggs and hatch their young, which become the natural food of the carp. It is thus that these portions of the ponds, where the vegetation grows, become the natural feeding grounds of the carp.

Gravel and stone bottom ponds are almost barren of vegetation, therefore produce but little insect life, and hence such ponds are desirable for carp culture, only when artificial feeding is resorted to.

The measure of life in the water as out of it, is the fertility of the soil. In this will be found the reason why carp do much better, in some ponds, than in others in the same neighborhood, the ponds being similar in everything but the fertility of bottom, and the vegetation produced.

There are several *families* of water plants and a number of varieties of other families, that are abundant and common in nearly all portions of the United States, while others are confined naturally to certain sections. The manna grass mentioned in another chapter is specially adapted to the spawning pond, and the fish eat its seeds, but it cannot compare in beauty with the pond lilly. So that in stocking a pond with plants it is well to keep in view, both the ornamental and the useful. The water lilly family, is great in the variety, beauty and fragrance of its flowers, and perhaps no other one family combines the beautiful and useful to so great an extent. But tastes differ, and every culturist must select for himself. Some must put up with what they can get, while others can get just what they want.

To aid culturists in getting plants that are native to the waters nearest their homes, we furnish the accompanying list taken from the Bulletin of the United States Fish Commission:

### WATER PLANTS FOR CARP PONDS.

By Lester F. Ward.

The following list embraces only such plants as were named in a list furnished by Mr. Rudolph Hessel, superintendent of the carp ponds. The



names given in that list where obsolete are placed in parenthesis, the modern ones standing before them. The vernacular name of each is added wherever it is known, and the localities of the American species are given according to the best authorities. When found in the vicinity of Washington the particular locality is mentioned. In the case of exotics the general region of the globe is stated.

#### RANUNCULACEÆ—CROWFOOT FAMILY.

*Ranunculus aquatilis*, L.—White Water-Crowfoot.—The type is rare, but the var. *trichophyllus*, Gray, is common in the United States. The var. *heterophyllus*, DC. (*R. heterophyllus*, Weber), is chiefly a European form. *Ranunculus multifidus*, Pursh. (*Ranunculus fluviatilis*, Bigel)—Yellow Water-Crowfoot—East New England to South Pennsylvania, Illinois and Northwest. *Caltha palustris*, L.—Marsh Marigold, Cowslips.—Common North and West.

#### NYMPHÆACEÆ.—WATER LILLY FAMILY.

*Cabomba caroliniana*, Gray.—Florida to North Carolina and westward. *Nymphaea odorata*, Ait.—Sweet-scented white Water Lilly.—Found at Great Falls and below Long Bridge. Common in the Northern States. *Nymphaea tuberosa*, Paine.—Tube-bearing Water Lilly.—Western New York to Michigan, Illinois, and probably in the Southern States. *Nuphar luteum*, Smith.—Smaller yellow Pond Lily.—Chiefly European; the var. *pumilum*, Gray (*N. pumilum*, Smith), is not rare northward in the United States.

#### HALORAGACEÆ—WATER MILFOIL FAMILY.

*Myriophyllum*.—Water Milfoil.—Six species are found in the Northern United States, of which *M. spicatum* is the most common, and occurs sparingly near Washington. *Hippuris Vulgaris*, L.—Mare's Tail.—New York to Kentucky and northward; rare in the United States; more common in Europe.

#### ONAGRACEÆ—EVENING PRIMROSE FAMILY.

*Trapa natans*, L.—Europe, Siberia.

#### UMBELLIFERÆ—PARSLEY FAMILY.

*Oenanthe sarmentosa*, Presl. (*Phellandrium aquaticum*, L.)—Oregon and Washington Territory.

#### PRIMULACEÆ—PRIMROSE FAMILY.

*Hottonia inflata*, Ell. (*H. palustris*, Pursh.)—Featherfoil.—Massachusetts to Louisiana.

#### POLYGONACEÆ—BUCKWHEAT FAMILY

*Polygonum (amphibium, L. ?)*—Water Persicaria.—Common. Has been sparingly found near Georgetown, D. C.

#### CERATOPHYLLACEÆ—HORNWORT FAMILY.

*Ceratophyllum demersum*, L.—Hornwort.—Abundant.

## PRACTICAL CARP CULTURE.

## ARACEÆ—ARUM FAMILY.

*Acorus calamus*, L.—Sweet Flag, Calamus.—Common.

## LEMNACEÆ—DUCKWEED FAMILY.

*Lemna trisulca*, L.—Duckweed, Duck's meat.—Widely diffused.  
*Lemna minor*, L.—America and Europe. *Lemna gibba*, L.—Chiefly in Europe, but has been found in Arizona.

## TYPHACEÆ—CAT-TAIL FAMILY

*Typha latifolia*, L.—Cat-Tail Flag.—Very Common. *Typha angustifolia*, L.—Narrow-leaved Cat-Tail.—Less common, but found in this district and notably in a pond near the foot of Eighteenth street.

## NAIADACEÆ—POND-WEED FAMILY.

*Potamogeton natans*, L.—Pond-weed.—Common.

## ALISMACEÆ—WATER-PLANTAIN FAMILY.

*Alisma natans*, L.—Water-plantain.—Europe, Siberia, *Sagittaria variabilis*, var. *latifolia*, Eng. (*Sagittaria latifolia*, Willd.)—Arrowhead.—Common. *Butomus umbellatus*, L.—Europe, Northern Asia.

## HYDROCHARIDACEÆ—FROG'S BIT FAMILY.

*Anacharis canadensis*, Planchon. (*Elodea canadensis*, Michx.)—Waterweed.—Common. *Valisneria spiralis*, L.—Tape-grass, Eel-grass.—Common.

## IRIDACEÆ—IRIS FAMILY.

*Iris pseudacorus*, L.—Europe; Siberia.

## JUNCACEÆ—RUSH FAMILY.

*Juncus effusus*, L. (= *J. conglomeratus*, L.)—Common Rush.

## CYPERACEÆ—SEDGE FAMILY.

*Scirpus lacustris*, L.—Bulrush, Tule.—Common.

## GRAMINEÆ—GRASS FAMILY.

*Zizania aquatica*, L.—Indian Rice, Water Oats.—Potomac Flats, etc. *Glyceria aquatica*, Smith—Reed Meadow Grass.—Common northward. *Glyceria fluitans*, R. Br.—Common, but has not been found nearer Washington than Great Falls. *Festuca fluitans*, Leeds—Europe. *Phragmites communis*, Trin. (*Arunda phragmites*, L.)—Reed, Cane.

## CRYPTOGAMIA.

*Azolla caroliniana*, Willd.—New York to Illinois and southward.

We omitted from this list the *Utricularia vulgaris*, or Bladderwort, because of its fish-eating character, as shown in a former chapter.

Culturists wishing any of these plants can be supplied by addressing Hugo Mulertt, 64 Calhoun street, Cincinnati, Ohio, or W. S. Ritchie, Hudson, Ohio.

## CHAPTER XII.

### FISH AS FOOD.

The following valuable article on this subject was published in the *Farm & Fireside* in 1884, signed E. T. N.:

"The International Fisheries' Exhibition at London, has just closed, after a session of several months. It brought together a large number of persons engaged in this industry, and perhaps a still larger number of those who are studying the questions which the industry involves. It must follow that the papers read in the conferences are of great and permanent value. Sir Henry Thompson, who was introduced as "one of the most eminent surgeons in the world," spoke on the topic which stands at the head of this article. The United States commissioner, who rose to move a vote of thanks to Sir Henry, pronounced the paper the most important which had been read, and added the hope that it might be translated into many languages and be widely distributed. It is our purpose to review the paper in order to make public its wealth of facts. With these statements we shall feel free to use the exact language of the report when it best suits our purpose, and that without marks of quotation.

The author first attempts to show the value of fish by comparing it with other well-known forms of food. In every hundred pounds' weight of healthy flesh not artificially fattened, whether beef, mutton or poultry, and from which the bone has been removed, about seventy-five to seventy-eight pounds of water are present, and are separated as such from the solid matter in the processes of cooking and digestion. Perhaps twenty-five pounds are solid matter and alone contains the nutritive material. Of this nutritive material about sixteen or seventeen pounds consist of the essential elements of flesh, and of the solid parts of the blood. These are variously named by authors—the flesh-forming, the nitrogenous, or the albuminoid elements. Of gelatine, with some allied compounds, about one to two pounds are present. These are also nitrogenous, but are quite distinct from the former class, and possess less nutritive value. The fat is very variable in quantity, but may be estimated at from two to four pounds per hundred. The remainder of the twenty-five pounds of solid matter consists of salts, mineral, and even metallic substances, all of which are essential parts of the body.

In one hundred pounds of fish without bone, from seventy-five to eighty-five are water, leaving as an average about twenty pounds of the solid or nutritive. (The carp has 20.2 per cent.) The nitrogenous may amount to eighteen pounds, but it is more frequently from twelve to fourteen. The gelatine-forming portion is in excess as compared with the flesh of land animals. The fat varies with the season and with the species

—is less than one pound per hundred in most of the common fish, but rises to seven pounds in the herring, to twelve in the salmon, and to thirty in the eel. In the land animals, as well as fish, a portion of the fat accumulates at the expense of the nitrogenous elements, but much the greater portion simply replaces the water. Since fat is a true food, it is evident that, pound per pound, the flesh from well-fattened animals has a greater nutritive value than that from poorly-fattened animals.

With these data before us, which have been worked out by Sir Henry Thompson, we are able to judge of fish as an article of food. The human stomach is often like a balky horse—it needs a new sensation to make it go. The relish with which we greet the various productions of the farm and the garden, *in their season*, proves that the law is almost universal. Leaving out the question of variety upon our tables, the flesh of fish ranks next to that of the domesticated animals in its nutritive elements, and surpasses all the productions of the farm in this respect, as well as also in the ease by which it is digested. The solid elements of the flesh of fish are rather more soluble than are those of the flesh of the domesticated animals, as the following experiments clearly show:

A pound of rump-steak, one pound of fish, each without skin and bone, were thus separately treated. The flesh was passed twice through a sausage machine, and one pint of cold water added to each. After standing one hour, the mass was heated to boiling point, and allowed to simmer ten minutes, then strained through muslin cloth. A very careful analysis proved that the solid or nutritive portion of the beef-tea weighed 276 grains, while that of the fish-tea weighed 396 grains. After making full allowance for the gelatine which is in excess in the fish product, it appears that fish-broth contains twenty per cent. more nutritive material than beef-broth. But we must not overlook the fact, as the author shows, that there is an indescribable something in beef-tea which gives it great value as a nutritive agent.

The complaint is sometimes urged that a fish diet does not satisfy the cravings of the system, and that the desire for food soon returns. The reason for this is obvious. No one article of food is perfect in containing all the elements required by the human body. Some are rich in nitrogen, but poor in starch and fat; others may contain the latter elements and lack the former. Hence the absolute necessity for a mixed diet. Fish, as a rule, contain but little fat—much less than beef, and far less than pork. It should accompany, rather than take the place entirely of these other meats.

The author, while engaged in his investigations, observed that the hard-laboring fishermen on the coasts of Cornwall have a very appropriate diet. Portions of any fresh fish are cut up and placed in a large pie-dish, and among them some thick morsels of fat pork; the whole is covered with a substantial crust, and baked. Those of our readers who live in New England know that one cannot make a good "chowder" without using at least a few slices of fat, salt pork. There are many persons to whom fish, cooked in an appetizing manner would be a thankful relief

from the salted meats which are so universally found upon the tables of the farmer, especially during the summer months. The young, the infirm and the aged would find their digestion improved and their sleep more refreshing if they were to substitute an occasional dish of fish in the place of the ham and the corned beef.

St. Paul tells us that strong meat belongeth to them that are of full age, even those who by reason of use have their senses exercised to discern both good and evil. Taken in a physiological sense, that seems to teach clearly that only those who have reached their full strength, and are doing manual labor of the severest kind, can with safety load their stomachs as so many of us are constantly doing. We no longer wonder that farmers grow old prematurely, and that so many of them are dyspeptic, and that so frequently they are compelled to end their lives within the walls of an asylum for the insane, when we learn how they live what they eat, and the lack of true business principles in their daily work. Let them, therefore, eat fish, and avoid all these ills."

#### THE CARP AS A FOOD FISH.

It is no longer necessary to speed over to Europe for testimony upon the table qualities of the carp. There are a half a million people in the United States who will testify to the excellent flavor and character of their flesh. Seeking the very best of our native fishes with which to compare them. In fact the criticisms and complaints are so few as to deserve no attention. All men do not like roast pork, roast beef, nor even roast turkey with cranberry sauce, while there are others who decline the delicious bivalve, in any form it may be prepared, and there are thousands who turn away from frogs quarters. It is true that tastes differ, and that prejudice often governs taste, and that excellent people will differ in their opinions and judgment. It is not saying too much to claim that there is less difference of opinion on the good eating qualities of carp by those who have partaken of their flesh, than there is in the same number of persons on the edible qualities of a goose or a hog. The testimony on this point is all on one side. Out of nearly 1,000 letters relating to this one subject, only 13 or about 1½ per centum have any criticisms to make. The other 98½ per centum speak in their praise. Space will not permit the publication of these opinions, nor does it seem necessary. Those seeking such information are referred to the back numbers of "American Carp Culture." Every farmer can raise his own fish food, as well and more easily than he can raise poultry or pork, and contribute greatly to his own and his family's health, prosperity and happiness.

The flesh of animals used for stock-getting purposes is not fit for the table during the season of service and breeding. The same is true of poultry, and applies with equal force to fish, especially the summer spawning classes, to which the carp belong. At such seasons the flesh of all animals is unpalatable. In the females it is soft and flabby and in the males strong. In this fact lies the secret of most of the criticisms made on the edible qualities of the carp. They have been eaten during the

spawning season, or perchance taken from some mudhole, where the wonder is they continued to live, and from which nothing healthy or toothsome could come. Then it is to be remembered that cooking has much to do with the taste of any food, and that poor cooking will spoil the best of food. Those critics whose judgment was not affected by any of these causes, simply differ in their taste from the great majority of mankind.

The larger the fish the firmer the flesh, is a principle that holds good with all kinds of fish. Carp from a weight of two pounds and upward are best for table use. Many, however, weighing from one-half pound upwards have been fried, and pronounced excellent.

The larger the pond, and the more vegetation there is in it, the clearer will be the water, and the better the fish.

Large fish are best adapted to baking and boiling, smaller ones to frying.

Upon taking the carp from the water kill it immediately, and let it bleed freely; scale it and remove the intestines. It is then

#### READY FOR THE COOK,

with whom the responsibility of a savory dish will rest.

Many elaborate methods of boiling, baking, frying and pickling and otherwise preparing the carp for the table, have come to us from the centuries of experience with this fish in Europe. While experience is not to be discarded, we do not feel like setting forth those methods here. In some receipts the many condiments, pickles, jellies, etc., used seem designed to cover up the very excellent taste of the carp.

Cook a carp the same as you would any other fish of the same size, and if you like the other fish thus prepared, you will be more than satisfied with the carp.

## CHAPTER XIII.

### POT POURI.

In spreading the table for our guests some of the bounties prepared were untouched, overlooked—so we gather them up for an after feast, where they will stand out more prominently, because isolated.

### GERMAN CARP

In this country are few and far between. The only real German carp in America are those that were imported, either by Capt. Robinson about 1830, and which escaped into the Hudson river, and so are not available, and the five tiny ones that reached alive, the ponds of Mr. Poppe at Sanoma, California, in August, 1872, and the 345 imported by the United States Fish Commission, in 1877. Allowing that all of these are now alive, there are only 350 German carp in America. The millions of other carp in this country, are just as good, and many of them much better than the original stock, but they are not German carp, and to call them so is a misnomer, and an injustice, that has in it no advantage for the culturists. They are the offspring, the progeny of the German carp, raised in American water, on American food from birth and are *American carp*, just as much as a child of German parentage, born in this country is at manhood an American citizen.

We have no other carp in this country than those mentioned.

In buying carp then do not be misled by the name given them. Determine which variety you want, then buy the largest growth, for the age, that you can get. The large growth being evidence that they are not stunted, and buy of a responsible culturist, who either raises but the one variety, or keeps the varieties strictly separate, in different ponds. You will then have good stock to start with, and can produce the best type of the variety selected.

### HYBRIDIZATION.

The varieties if grown together will cross, and lose their characteristics. If raised for home consumption, this will not be so serious a matter. If raised to sell for stocking purposes, it will be more serious, as beginners should start out with a pure blood of either of the varieties, and by care breed that variety to the highest possible type.

The crossing of the varieties is to be deprecated, but cannot be compared in seriousness with the crossing with other summer spawning fish, which are comparatively worthless as food. These latter crossings deteriorate from the high standard of the carp, and give it an inferior place among food fishes. The wonderful crossings, and hybridization we

find in the native fishes, warn us to fix no limit to the hybridization of the carp. We simply raise our voice to urge the keeping of the carp by themselves.

#### HOW TO DISTINGUISH THE SEX OF CARP.

This is a very important matter, either in the selection of breeders for sale, or for stocking the spawning or hatching pond.

One of our early American writers on carp culture, declared that the sexes could not be distinguished, unless at the spawning season when the female was very large. But then it was the same author that linked the hearing of fish and marines in the same breath, and taught that carp were vegetarians and slept in the mud all winter. His next volume should be entitled, "*What I don't Know About Carp Culture*," then if he gets somebody else to write it, the book with his egotism left out will be readable.

The following article, written for *American Carp Culture*, Nov., 1886, by Chas. W. Smiley, Washington, D. C., Ed. *Bulletin of the United States Fish Commission*, covers the subject completely. From many experiments under it we know it to be correct:

"When the adult is nearing the spawning time, the ripening of the ova produces a broadened appearance in the female, which is sufficient to enable most any one to distinguish the sex. It is necessary, however, to be able to distinguish them at a much earlier age, and this, although not generally understood, is declared by experienced fish culturists to present but little difficulty. Dr. Hessel, superintendent of the United States Government ponds, scarcely ever fails to identify the sexes, although he declares his inability to describe in words, the manner in which he does it. The German carp culturists, however, have distinctly stated their method.

Horak, in a work published 1869, and entitled *Die Teichwirthschaft mit besonderer Ruecksicht auf das suedliche Boehmen. Ein populares Handbuch fuer Teichwirthe, Fischereibedienstete und Freunde der Fischzucht*, by Wenzel Horak, says: "Fishermen who are not able to determine the sexes of the fish at once, are in the habit of squeezing the genital parts until they yield either milt or roe. This method is very injurious to the production of young fish. An experienced pond culturist will, at the first glance, distinguish a male from a female carp, even when they are only one year old. The milter or male fish, has a depression or concave place in its genital parts, while the spawner, or female fish, has a protuberance or convex place."

Carl Nicklas, perhaps the most skilled carp culturist at present living in Germany, indorses the above quotation from Horak, and adds: "The aperture of the genital orifice also seems to be somewhat larger and redder in the female than in the male. It is not very difficult to distinguish the male from the female carp; still it may require a little practice." Prof. B. Benecke, of Konigsberg, says: "As a general rule the belly of the spawner is broader and rounder; the genital aperture is larger and



reddish, and has thick lips, while in the male it forms a narrow slit.

Apparently without any knowledge of these German authorities, Geo. M. Ramsey, M. D., of Clockey, Pa., writing under date of November 22, 1883, says: "I have discovered how to distinguish the sex of German carp at all seasons of the year. By the inspection of the female carp a small fleshy protuberance, that pouts a very little, will be seen in front of the vent, whereas, in the male carp the same is slightly depressed or sunken rather than protuberant. On examination each fish should be held up to the light in the same position, back downward." Evidently Dr. Ramsey has made an independent discovery of what was already known in Germany."

#### SPAWNING.

Some culturists state that their carp have spawned twice in one season. The time between these spawnings being from three weeks to four months. We do not doubt the truthfulness of the persons making these statements, but we do doubt that the same female carp develops and ripens two sets of eggs the same season. In our opinion the facts are these: The deposition of the eggs when once begun may be delayed, by a change of weather, or a change of temperature in the water, even after the carp have been thus engaged for a part of several days, they usually begin early in the morning and continue until about noon, but when thus interrupted they very rarely run over three weeks, until their work is finished. Thus the same carp might be observed at their work a half a dozen of times in that time, but it is all one set of ova. The longer time of four months may be explained by the fact that it was a different set of carp that engaged in the work. The different ages of the carp, and the opportunities of growth and development the former season, would reconcile the difference of time in the ripening of the ova, and explain the statement that carp spawn twice. The fact being that different sets of carp in the same pond spawned in parts of the season widely separated.

We have often been asked, how to tell when carp are spawning? You can't make any mistake about it, as you will know when you have once seen it. The female, closely pursued by the male or males, rushes up among the grass and water-plants at the edge of the pond, their backs well out of water, and tails and fins a flashing, and the water boiling around about them, turning and doubling, twisting and retreating, only to come back again to the edge with another rush. If everything is favorable this is continued for hours, more or less eggs being deposited with every rush among the vegetation. As the eggs are dropped by the female the following male rushing in the same course milts them. The eggs are whitish and about the size of a No. 6 shot, are adhesive and stick to floating objects, such as the leaves of water plants, etc., until they are hatched, which takes from three to ten days, according to temperature.

#### HOW TO CATCH CARP.

They are good biters at a hook and are very gamey when hooked. We have lived within two miles of Lake Erie for 20 years, and have taken

nearly all kinds of fish from its water, as well as from the waters of Lakes Huron, Michigan, and Superior, and we have had as much real genuine sport in taking carp with a hook, as in taking any other fish. We have had them straighten a hook and break a line many a time. It requires good equipment and skill to land carp that weighs six pounds and upward.

For bait we have used worms, grubs, minnows, crusts of bread, etc. Where bread is used it must be kneaded into a pasty mass about the hook. A small piece of bloody meat makes a good bait. One of the correspondents in American Carp Culture says: "To catch large carp take grains of corn and place on the hook." We have never tried this, and cannot speak from experience.

Where larger numbers are wanted than could be conveniently taken by the hook, many traps and devices have been resorted to, but the seine is the standby.

#### DIFFICULT TO SEINE.

They are, however, very cunning and difficult to seine. This is particularly true of the larger sized fish. Never be discouraged with the first haul, for while the water is clear enough for them to see the seine, great numbers will avoid it. If they don't succeed in passing around it or jumping over it, they will stick their heads in the mud until it drags over them. When the water is once roiled, however, the hauls of the seine will be more successful.

#### FEEDING TIME.

The part of the day when carp feed naturally is at night and early morning. It is therefore the best time to take them with a hook, and the evening is the best time to give them food.

#### CONCUSSION.

Giant powder and dynamite have been frequently used by the lawless in our public streams and fishing places to secure in short order a big haul of fish. Its use for such purposes in many of the states has been made a misdemeanor and crime. The effect of the concussion of the discharge of such a missile under the water kills the fish, and many of them float on the surface of the water, and are then gathered up by the miscreants. This has even happened to the carp pond of one of our correspondents.

We make mention of this simply to get at the deadly effect of concussion. In cutting an air hole in the ice, another correspondent killed two fine carp with the blows of his ax on the ice. It is an old trick of hunters to strike the ice above water animals and so kill them.

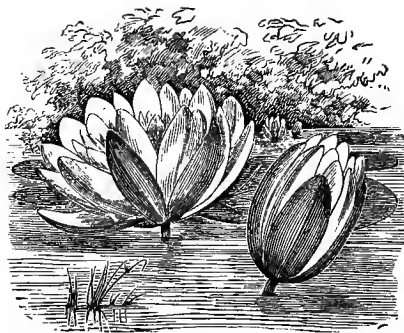
Concussion then, in our opinion, will explain some of the losses of carp in winter time, that are otherwise unexplainable. The raising or lowering of the water in a pond that is ice-bound will frequently cause a heaving or settling of the ice, either of which will result in a concussion of greater or less force, which cannot but affect the fish. The falling of trees on the ice, the throwing of heavy bodies on it, is to be avoided. The

cutting of holes in the ice should be done carefully. The taking of ice from the pond is not necessarily injurious, after the first hole is cut, as in sawing the ice, there is little or no jar and little or no concussion as a consequence, and this loses its force where there is open water.

#### WAVES ON PONDS.

Where ponds lie exposed to the action of the wind, waves of considerable size and force are frequently formed, even on ponds containing only two or three acres, and on larger sheets of water the waves are proportionately large. If left to work their own way they wash the banks, and unless the banks are exceptionally strong there is a possibility of a leak being sprung, when you are not thinking of it.

A simple and inexpensive protection against the action of the waves is made of poles, from 4 to 7 inches in diameter at the butt. These poles are trimmed of the branches and laid on the water next the embankments, the top of one pole being withed or bolted to the butt of another, until the poles extend along the entire line of embankments, then stakes are driven just beyond the poles to prevent their being carried out in the pond. The action of the waves is then on the poles instead of on the embankments.



NYMPHÆA ODORATA—SWEET SCENTED WHITE WATER LILLY.

MISCELLANEOUS APPENDIX.



## MISCELLANEOUS APPENDIX.

The purpose of this appendix is to place the reader in direct communion with some of the persons who have succeeded in carp culture, and many of them beyond their highest expectations. Their inexpensive ponds, and the simple methods by which they attained success, cannot but be interesting, instructive, and encouraging to others. Our difficulty in compiling this portion of our work arose from the superabundance of material. In selecting from it our sole desire has been to serve the very best interests of our readers. From many letters then we have taken only a brief extract, touching some particular phase of the subject, while others we present in almost their entirety. Because of several subjects touched in the same letter, it was very hard to classify them. But each one will speak for itself and all are worthy of reading.

It is but just to say that the writers of these letters are all of them subscribers to our monthly publication, "American Carp Culture," and all of them acknowledge the great aid they have received from it. Where not otherwise specially stated each of the following communications was addressed to us:

---

### INCREASE OF CARP—PRICES—HARDIHOOD, ETC.

MT. MORRIS, Pa., May 27, 1885.

My fish are doing fine. Drained Nos. 2 and 3; No. 2 contained eighteen three years old. No. 3 had twenty-four two years old in it. We took from these two ponds of last year's spawn 3,634 fish by actual count. I did not drain my large pond, No. 1; in this pond I have my four and five years old fish. We are cooking them pretty freely now. Some say that carp is unfit to eat; (sour grapes); they are too lazy to build a pond. I am well pleased with the taste of my fish and all that eat them are delighted.

J. W. LONG.

---

BEDFORD, Ohio, June 13, 1885.

Nearly every one in constructing ponds finds he lacks something or has made some mistake; I have three ponds and have sold 2,000 fish this spring.

J. C. ALEXANDER.

---

MARTINSBURG, O., October 20, 1885.

I drained one of my ponds the 16th, and had, actual count, 4,323 young fish, besides several hundred that got through strainer box. We had for

dinner three two-pound fish, and all said they never ate better fish. They have all grown beyond expectation. Young fish were from three to eight inches long.

IRA H. EWART.

---

BLAKESBURG, Iowa, March 25, 1886.

Complaint has been made of carp not living through our long, cold winters, and that they are a tender fish, difficult to winter, but I know them to be as hardy as we have in this part of Iowa. I have two ponds stocked with carp, and last fall I planted 450 young carp in those ponds, that had been shipped 500 miles in November, and they wintered all right. I have the same old spawners that came safe through the winter, while the native fish, grown by farmers in ponds along the creek, are dead—such as bullheads, sunfish, suckers, red horse, chubs—all our native kinds of fish. Further, I have not heard of a single carp dying this winter that was not hurt in handling in the fall. The carp is just the fish for the farmers to grow.

W. A. DAY.

---

UTOPIA, Texas, May 24, 1886.

I built me a pond in February which covers two acres. I cleaned the small brush off and broke the land with turn plow, then harrowed it and leveled the dam. Not a living thing in pond except a few trees. On the 9th day of April I put three German carp in. I saw no more of them till lately. There were hogs, cattle, 34 ducks, 23 geese, and turtles, snakes, crawfish, and frogs; all went in all the time. On the 22d day of May, by accident we found a young carp in a little neck of the main pond; we then began taking out, as I intended turning the water off, to stop some holes that leaked water; we picked with our hands 324 carp three inches long; don't know what is in the main pond; will drain pond to-morrow. Those fish had been laid, hatched and raised to that size in forty-three days. I am 600 miles west from mouth of Mississippi river, 1,500 feet above sea level, in the mountains.

B. F. BIGGS.

---

PULASKI, Tenn., April, 1887.

I have four fish ponds with 2,800 carp that will spawn next season. Started eighteen months ago with five carp—three male and two female; have from them handled and counted 4,000.

THOMAS S. PITTARD.

---

MCPHERSON, Kans., April, 1887.

Got twenty carp from Washington in November, 1882; they have never been fed; have multiplied wonderfully. There are many six-pounders among them, and small fry too numerous to mention.

E. C. WELLS.

---

WEST RICHFIELD, O., September 20, 1887.

In December, 1882, I received my first carp; lost all but eight. In Oc-



tober, 1884, I drew off my pond; found four of the original stock and thirty about six inches long. In October, 1885, drew the pond again; found four of the original plant, one of which weighed eight pounds, and twenty-six others eighteen inches long and bushels of small fry from two to three inches long. My four-year-olds spawned in May this year, my three-years in June. They come and eat like a lot of hogs when fed.

J. W. THORP.

---

WOODRUFF, S. C., October 29, 1887.

I this year raised 1,100 fry in a pond about 35x40 feet. I also lost by a breaking dam 137 yearlings and I suppose 1,000 fry. My experience inclines me to the opinion that one should have ponds enough to alternate winter and summer, leaving each pond exposed to sun and air and to take on vegetation half the season. Fish raising is a success if given the attention that pigs and chickens are given.

L. C. EZELL.

---

ONOVILLE, N. Y., November, 1887.

This is my first season in carp culture. The muskrats let the water out of my pond and cost me 2,000 or 3,000 fish. I lost 2,000 in transportation, sold 2,500 more, and have about 3,000 stored in winter quarters. The Kingfishers fished my pond all summer. From twelve two-year old breeders I have raised between 10,000 and 12,000 fish.

E. L. VALENTINE.

---

CORSICANA, Mo., November 23, 1887.

I have just drained out one of my ponds, (I have five of them) and taken out fish 23 inches in length, that weigh 3½ pounds; they are only one year old. I have about ten acres in ponds. I have an hydraulic ram that furnishes one of my ponds; under a twelve-foot head it will throw water fifty feet high; it runs fifteen gallons per minute; I think the German carp is the best fish yet.

L. J. BLANKENSHIP.

---

PUEBLO, COL., Dec. 21, 1887.

I drew down my pond October 16, got everything ready, made a haul with the seine and caught about 3,000 fish; would have weighed about 1,500 pounds. They then had two years' growth. I took out about 300 pounds, turned the seine over and let them go. I peddled out what I had. They sold very readily and people called for more. I could have sold every fish in my pond. The fish should have been larger, but they were stunted the first year. The party of whom I bought the yearlings, told me they were stunted as he raised over 50,000 in a pond 100 feet square. I expect to turn out a fine lot of fish next fall. My last spring spawn are nearly as large as the two-summer fish. I cannot tell how many I have of them but have plenty. I am raising carp for money and intend to make a business of it and am well pleased and feel sure of success. I have now about 20 acres of water surface and eight acres will be from three to 12 inches deep and

will make great feeding ground. I do not think the Kingfisher does any harm. He thins out the top minnows which are always on top of the water. My carp do not come to the top of the water unless the sun shines bright and no wind.

J. J. THOMAS.

---

WAUSAN, WIS., Feb. 11, 1888.

I certainly should think many claims made for the carp "fishey," had I not had some experience with them, and will candidly say that the most extravagant claims made for them comes fairly within the limits of possibilities and truth. Last year I raised 1,250 young fry, from 2 to 4 inches, from 11 breeders in a ditch 4 feet wide and about 20 rods long with water from 1 inch to 18 inches deep, and cattle and hogs occupying fully one-third this length in common with the carp, which made the water so muddy that no fish could be seen. Don't think this is the home I intended for my carp; no, I was going to have a nice little pond of about an acre, but the dry season prevented anything but the ditch from filling. And now after drawing my pond (or rather my ditch) and finding all my old fish (more than double the size,) and the 1,250 young ones; I can take any carp yarn you can spin. One thing more that I have not seen in your paper. It was late in the fall when I drew off the water and it froze quite hard that night, and the next morning I found several fry frozen in the ice in a small hole back some distance from the collector. These I thought, of course, were dead, but I put them in a pail with water, and to my surprise, when the ice was thawed enough to release them they swam around as if nothing unusual had happened. A few were kept in water to see if they had received any injury by freezing; they are well and lively to-day, fully proving that carp can be frozen in solid ice without any injury.

R. E. PARCHER.

---

FRENCHTOWN, PA., Feb. 27, 1888.

I have a carp pond of  $1\frac{1}{2}$  acre. About 18 months ago I first put in 110 earp that were about 4 inches long, and 10 months ago I put in 7 spawners that were from 22 to 30 inches long. Last October I drained the water off and was surprised to find more than 50,000 little carp that were from  $1\frac{1}{2}$  to 7 inches long; and the 110 small carp that I put in 18 months ago measured 16 and 18 inches long. On the day I drew the water from my pond I sold \$95 worth of the small fish. I assorted them in sizes under 3 inches, over 3 and under  $4\frac{1}{2}$  inches, over  $4\frac{1}{2}$  inches and under 6 inches, and sold them at proportionate prices.

JOSEPH BRUNOT.

---

#### SALE OF CARP FOR TABLE USE.

EDINBURG, Ind., December 12, 1886.

I am selling carp for food fish. This last fall and winter, and up to the present time, I have disposed of about 2,000 pounds and have yet about

5,000 pounds on hand, which I am holding for the Lenten season, when I expect a readier sale and higher price for them. What I have sold have given good satisfaction, except a few that were small, not weighing more than one pound each. I would recommend no one to offer carp in market under two pounds in weight; three pounds and upwards would be better. I sell at from 12½ to 15 cents per pound.

V. STILLABOWER.

---

DORRANCE, Kans., March 6, 1887.

My pond is only 250x25 feet, with a spring, which is very rare in this part. I sold a good many fish for table use, last October, for fifteen cents a pound, and folks come to my place to get more; they say they never ate any fish that were as good. In January last, when the mercury was about 20 degrees below zero my under drain got damaged and let the water out, clear to the bottom. I could not get to the fish as there was eighteen inches of ice; and I never expected to see any of them alive again, as there was very little water coming and I could not stop the leak for three days. But when the ice broke up I found all alive, with the exceptions of one, a four-pounder. The rest were all half that size.

W. BUNKER.

---

WAVERLY, Ohio, Jan, 7, 1888.

Last March (1887) I sold an express load of carp in the rough for 12½ cents per pound. They sold like hot cakes. I had but one complaint and that man said they were too fat.

W. B. LEE.

---

### CATCHING CARP.

CLAYTON, Mo., November 8, 1885.

Make a thick mush of corn meal, put plenty of salt in beforehand, cook it well, take pieces of cheese cloth 1½ to 3 inches square (which is as large as can go in the fishes mouth) tie the mush up in this, pass the hook through the cloth to the inside, being careful not to let it come out on the opposite side of the ball, fasten lines to your hook about 2½ feet long, take a small wire long enough to reach along the dam of the pond or along the deepest and straightest edge of the pond. Tie your lines to this wire at about four feet apart, and stretch your wire so that the bait on the hooks will just touch the sloping side of the dam or bank. I have found this place mostly frequented by carp in search of food, and the bait being on the ground and not suspended in the water, they can better find and take hold of it, or in feeding they get it in their mouth. I use the bass hook for this purpose; care must be taken in landing them, as they are very tender and will tear out their mouth. I have caught several that weighed from 2½ to 3 pounds in this way.

E. B. BROUSTER.

---

MOUNT UNION, July 19, 1886.

To catch carp take an old bone-dust or coffee sack, a hoop from a bar-

rel, fasten it inside of the sack at the bottom and another one at the top of the sack, with a short pole for a handle; put some corn, wheat or bread in the sack and sink it under water. You can catch fish of any size in it. I took four in this manner to-day; had one for dinner; weight  $2\frac{1}{2}$  pounds; very good fish.

CHAS. F. JOHNSON.

---

BROOKLYN VILLAGE, O., August 22, 1886.

To catch carp in small ponds have a box (of size to suit) with bottom fixed to feed the carp upon, and have six or eight inches open at the bottom of the sides for them to enter, and the top to come out of the water with pulley and rope to raise and lower the box, and on the inside have another box to let down and close up the opening for the entrance of the carp and if they are in, and when the water passes out you take out those you want and put boxes and fish back again.

JAMES GAY.

---

BROWN'S VALLEY, Ind., February 21, 1888.

To catch large carp and not small ones, bait with corn after being soaked in water for ten or twelve hours; put the hook through the point of the grain and throw out along the edge of the pond at sundown; line tied to limber switchs stuck in the bank; go for your fish in the morning.

PETER JAMES.

---

## CARP IN MINERAL, SULPHUR AND SALT WATER.

### IN SULPHUR WATER.

WOODS CROSS, Utah, June 30, 1885.

I have a carp pond containing one and-a-half acres. December 8, 1884, I received twenty German carp from Washington. Eighteen I placed in the pond for the winter, and two I put in a tank holding about 150 gallons, fed by an artesian well. The water contains a little sulphur and iron, with a temperature of 54 degrees Fahr. They wintered all right, although the prevalent idea is that water containing mineral is injurious to the carp.

JACOB GIERISCH.

---

### IN SALT WATER.

BLUE, Utah, March 31, 1886.

December, 1884, I received twenty-one minnow carp, mirror variety, of United States Fish Commission. Kept them in a pond 10x15 feet the remainder of the winter. Early in the spring I found that they had grown but very little, and removed them to a pond of about two acres, made by draining a swampy piece of slough land and turning a mountain spring into it. Late last fall I drained this pond and got thirteen (muskrats and snakes got the other eight) carp measuring about fifteen inches in length, and weighing from two to three pounds each. There was a thin scale of

ice on this pond when I drained it, and as the water lowered about half of the fish tore more or less of their scales off running through this scale ice. I then placed them in a deep pond which I had made for them to winter in and fed them some. They did *not* "hole up," but were feeding all winter whenever the pond was open. This spring the thirteen are all alive, but the ones that were hurt in the ice have fungus growth bad. The others look fine. None of them have grown much this winter. I have made a good hatching pond and placed them in it, hoping to get some young this season. During the winter I bought fifty young and three spawners, scale variety, shipped from Ohio. The express on the lot was about twelve dollars. They all arrived in good order, and I kept them by themselves. I have on my place a large, deep pond of very clear, *very salt* water, with lots of rushes around the sides, is fed by large salt spring, and is full of small wild fish and snails. As an experiment I placed one of my small carp in a small pail of this clear salt water, and changing the water daily kept him in it until I was satisfied that he would live and do well in this salt pond. I intend, with giant powder, to kill the small wild fish of this pond, and after my mirror carp spawn shall rub the fungus off the affected fish and place them in the salt pond. Will it kill or cure them? And will not fish be firmer and finer-flavored in the salt water than in a sluggish fresh water pond? My salt pond never freezes.

---

 IN MINERAL WATER.

MORENCI, Mich., March 15, 1888.

My neighbor, Mr. T. T. Baker, has a pond supplied by what is known here and in Northwestern Ohio, as a fountain. That is a hole bored in the ground, a gaspipe with a strainer inserted, from which the water flows. The water appears to be impregnated with iron, or at least everything with which it comes in contact becomes the color of iron rust. His pond is made by excavating a ditch around a piece of land, leaving the center covered with the native sod, and raising a bank outside and letting the water in until the center is overflowed a foot or more and the water in the ditch is four or five feet deep. It covers about 100 square rods of ground. In the fall of 1885 he stocked it with a few spawners and 100 or more small fry. In the summer of 1886 they spawned in May, and again later, and by fall, 1887, the pond was full of fish. In 1887 he commenced to use them, catching all of the first large ones, and some besides. The ice has been off his pond for some time, while the ice on my pond, which is fed by a small brook, is a foot thick. Last week he caught a mirror carp, with a hook, weighing over four pounds and it must have been one of the small ones put in at first, as his spawners were all scale carp.

A. COMBS.

---

 GREAT VITALITY OF CARP.

EIGHT HOURS OUT OF WATER.

CHARLOTTESVILLE, Va., March 18, 1884.

On Saturday evening I caught with a hook a carp which would weigh

about four pounds. I put him in my bath-tub filled with water. On yesterday, about 8 o'clock a. m., I put the carp in a small box, surrounding it with wet moss, and forwarded to Lynchburg by express. It reached there about 4 p. m., and I learn this morning from my friend to whom it was sent that when taken out and placed in a tub it was as lively as could be. My family ate a small carp Sunday morning and thought it vey good.— [From a letter to C. W. Smiley.]

R. T. W. DUKE.

---

FIVE HOURS OUT OF WATER.

EDINBURG, Ind., December 12, 1886.

Sent eight beautiful carp for eating purposes to Enos B. Reed, Indianapolis, Ind., packed in dry excelsior. They were at least five hours out of water, and when received by Mr. Reed they were alive and kicking. Well, he did not eat them, but put them in his carp pond; where they are doing well. I merely state the above facts to show the tenacity of life in the carp.

V. STILLABOWER.

---

IN A PINT OF WATER.

A small lot of carp was sent to C. F. Jones, Carysbrook, Va., leaving Washington on the night of November 20, 1886, at 10 p. m. These carp were on the way over five days, they having been delayed in Columbia. Mr. Jones, who lives twelve miles from that point, on the Rivanna river, depended on the captain of a boat running between those points to bring the carp. The captain failed for several days to do so, and the carp lay over in the express room without a change of water. After this delay they were brought up the river in an open boat thirteen miles, with the thermometer at 23 degrees Fahrenheit. When Mr. Jones opened the bucket, December 4, he thought the fish were all dead, as there was no signs of life and only a pint of water, the rest having been turned to ice; but noticing a slight movement of the gills, he transferred the fish into tepid water and in thirty minutes they were all lively. He then kept them over Sunday in the house, during which time none died or showed any injurious effects. This display of vitality is doubtless due to the cold weather at the time the fish were shipped and during their stay in Columbia.—Bulletin U. S. F. C.

---

ROLLED UP IN A NEWSPAPER.

GATES MILLS, O., May 1, 1887.

The tenacity of life in the carp is wonderful. Thomas Baxter, a neighbor of mine, recently took a carp from his pond and laid it on the grass for an hour, it was then rolled in a newspaper and carried a journey of ten miles, which occupied two hours more. When taken out of the paper it

appeared to be alive and when placed in a dish of water splashed the water over the floor and swam about apparently little worse for its journey.

---

### DO NOT HIBERNATE.

#### CATCHING CARP THROUGH THE ICE.

SHELBY, O., January 25, 1886.

I constructed a pond of about an acre late in the fall of 1884, put in 125 young carp. They did no good. Again in April last I put in 200 more. They did splendidly. I caught some in the fall weighing from three to four pounds. I also put in the pond in the spring six brood fish. I now have plenty young fish six to eight inches long, being twice as large as those I got in the spring for stocking. Do carp burrow in the mud in winter? I say they do not, as the following will show. A few days after the cold wave we had in December last, I cut a hole through the ice, put down baited hook and caught six, some small and some large. Again on January 2 I caught with hook and line some more. Again on last Wednesday, January 20th, I cut through six inches of ice and soon caught a three-pound fish with hook. The bottom of my carp pond is composed of muck and sand, so carp could get down very readily. The water in my pond is chiefly surface water. My experience is that carp in mid winter lay still on the bottom and in the deepest part of the pond. My pond has six feet of water. I find I can only catch them in the deepest water and nowhere else. If carp burrow in mud in winter, how can they be caught with hook and line. If any doubt let them come and try themselves.

C. C. LOSER.

---

#### FISHING THROUGH THE ICE.

COLUMBIANA, O., February 19, 1886.

On February 12th I took two fifteen-inch carp in less than fifteen minutes out of four feet of water with bait hook and line, through a hole cut through six inches of ice; mercury 34 degrees. Again, on February 18; mercury 23 degrees. No hibernation here. As to the different types of carp, so far as edible quality is concerned, we consider there is just as much difference as there is difference in beef of red, white, black and spotted bullocks. But when it comes to the cleaning we prefer the full scale, they are so much easier cleaned, one great advantage in their favor. As to growth, there is a diversity of opinion; in my experience with the different types, should place it in favor of full scale carp.

JAC. KNOPP.

---

#### IS WARM WATER NECESSARY FOR CARP TO GROW WELL?

PRINCETON, Ills., January 17, 1887.

On Christmas day, 1884, I saw six large spawners swimming abreast in my pond, which was covered with heavy ice, except a small place ten feet in diameter at inlet. Again last week (January 13, 1886) I saw through

clear ice ten inches thick, and frozen within a few inches of the bottom, a large carp which darted away like an arrow at my approach. The old theory of universal hibernation being thus disproven, we must have some other to accommodate those fellows who see their sleepy (?) fish shooting around in the winter time. All animal life requires oxygen for support. If the supply of oxygen is scant the animal becomes torpid, sluggish. Precisely so with the carp. If a pond has a running stream supplying it, a given number of carp (depending on the amount of flow), will get enough oxygen to keep up a normal circulation, and, consequently, will not hibernate, and will probably take food. If a pond is pretty well stocked with carp and covered with ice, no doubt the fish will hibernate, unless the inflow of fresh water is very large. One other thing I have had my doubts about. Hessel, and in fact nearly all writers on carp, emphasize the statement that *warm* water is absolutely essential to carp culture. I suspect that this conclusion is empirical rather than logical. If so, it may mislead some who would like to raise a few carp for pleasure, or for the family table, but who have at hand only facilities for a cold water pond. Concede that warm water is essential to natural growth, it seems to me that it does not follow that carp fed liberally require it. Cold water would produce little or no food, warm water the greatest possible amount. As far as I am concerned this lacks proof. I simply set it up as a theory to be knocked down by those better informed than myself.

S. W. COLTON.

---

COME AT THE SOUND OF A BELL.

CHILLICOTHE, O., February 22, 1888.

My carp do not go into the mud. When filling my ice house I cut a hole at one corner of the pond, over the deep water. Then rang my bell as I did in the summer time, and they came by the hundreds. I have lost no fish this winter.

W. A. PURSEL.

---

GROWTH OF CARP.

FOURTEEN WEEKS OLD, MEASURES 10 $\frac{3}{4}$  INCHES.

St. JOSEPH, Mo., September 12, 1885.

Sir, I have read a great many items in your journal on the rapid growth of the carp, but the growth of the carp at the hatchery will exceed anything that I saw in the Journal. I took eight carp to the St. Joseph fair, three months and seven days old, averaging from seven to ten and three-fourths inches, and took a twenty-dollar premium. I find that clabbered milk is one of the best things for food for young carp. They will grow and thrive faster on it than anything else you can feed them.

ELIAS CATRILL,  
Sup't State Hatchery, St. Joseph, Mo.

---

CLARENDON, Tex., March 29, 1886.

In February, 1885, I put into my pond fourteen scale carp, from four



to six inches long, after conveying them 180 miles by wagon, nine days on the road. I have just drained my pond. Found the original fourteen all right and more than twice the size they were when put in. I also took out 125 young ones, ranging from one to three inches long, which I sold for a big price, and left a few more in the pond. I can only account for the small number of young from the fact that my pond was infested last summer with turtles and frogs, which I suppose destroyed many of the eggs and young fish.

J. G. MURDOCK.

AFTON, Iowa, August 12, 1886.

In November last I placed nineteen carp minnows in a small pond; commenced feeding them in July; they will average fifteen inches in length now and look as if they would weigh two pounds.

S. D. COMFORT.

BLAKESBURG, Ia., October 18, 1886.

On November 8, 1884, I planted 500 fry from  $2\frac{1}{2}$  to 3 inches long in a pond ten feet deep, filled with surface water. On the 21st of August, 1885, I took some with a sein that weighed  $2\frac{1}{2}$  to 3 pounds each. My neighbors who helped draw the sein could scarce believe it possible they had grown so. I gave them some to try, and they say they never tasted better fish.

W. A. DAY.

EDGAR, Ill., November 17, 1886.

I have a well constructed dam with drain pipe, overflow and screen, so put in that the water comes through from below. The pond, when full, covers about one acre and a quarter of ground. It is fed by tile and natural springs that never fail. I started my pond in October, 1885, with large and small scale and parti-scale carp. I drew my pond this month and found a few thousand of 1886 hatching from three to seven inches long; the hatch of 1886 weighing from three-quarters of a pound to a pound and a quarter. All of my fish are in a thrifty condition. I am selling some young fry to stock ponds with. One quickly passes the experimental stage and finds that carp culture pays. They are nice for breakfast, dinner or supper.

C. C. STANFIELD.

HOOVER, O., October 20, 1887.

My carp ponds have been very successful this year. I have four-year old fish that weigh 14 pounds, three year-olds that weigh 10 pounds, two-year olds 5 pounds, and thousands of this year's spawn from  $2\frac{1}{2}$  to 7 inches long. We have been using them freely this fall and find them to be of excellent quality. Can see no difference in the quality of the different varieties. I use the bottom drain overflow in my ponds and consider it superior to any other.

S. E. WILLIAMSON.

PALMETTO, Ga., January 4, 1887.

I drew my pond on the 29th day of December, and I found two of my

carp that I put in for breeders. One weighed 5 pounds and the other 6, and three different sizes too numerous to mention, and all were in fine condition. My pond was overstocked, I think. After three years my pond had enough carp from 1½ to 6 inches to stock three ponds of one-quarter of an acre each.

A. J. DENNIS.

---

A SIMPLE METHOD SUCCEEDS.

PINCKNEYVILLE, Ill., July 9, 1887.

My carp raising is done on the simplest and rudest principles. In 1882 I put twenty in a stock pond. In the fall of 1884 I caught twelve of them out and placed them in another pond, built the same fall, in another pasture near my house. Last season my new pond of an acre literally swarmed with young fish. To-day when we feed them I see some of the original ones, over thirty inches long, also some that I received from the government in the fall of 1884—former at least thirty inches long, latter from twenty to twenty-four inches; then thousands of last year's hatching from 4 to 12 inches in length. I tell our farmers they need not be experts to raise them. Build a good strong dam covering from one to as many acres as they desire, put a dozen carp in it, and inside of five years they will have all the fish of the finest quality that they want. When they doubt my word I take them to my plain country pond, covering an acre or so, call up the fish, throw in a few chunks of bread, and then let them stand speechless with amazement and gaze at the thousands of fish, from 30 inches in length down to the young ones, scrambling over each other for food. I then pick up some nice yearlings five to twelve inches long and show them what was hatched a year ago. Then they are convinced, but, like the doubting apostle, nothing but seeing and feeling will drive away their unbelief. They look at my pond with its grasses, lilies and shade trees around it; they can make one as good as mine, and they leave determined to have a pond as soon as they can build it, and they want to know if I can let them have some fish this fall that will lay eggs next spring. They haven't time for them to grow; they must have spawners, they want fish. I assure you that when a new industry is so convincing to the average farmer on first presentation under so rude and simple circumstances, it is a success.

E. H. LEMEN.

---

XENIA, Ind., July 15, 1887.

My fish are doing well. On the 14th day of last August I put in my pond 500 fish, averaging 1½ inches long. I seined my pond this week; they measure from five to eight inches in length.

D. M. DARBY.

---

SPALDING, Iowa, February 7, 1887.

I got my first carp August 22, 1885, 71 in number, the larger about four inches long. They spawned some last year. They have done better and

grown faster than I could have expected. Last fall I caught some 18 inches long that weighed  $3\frac{3}{4}$  pounds. I had three kinds of carp. The scale carp increased the most and made the biggest growth, and they are good enough fish for me to eat.

J. V. HOAKISON.

HUDSON, N. M., October 15, 1887.

My carp are a success, and are doing well. I think I have some that are three years old, and will weigh from 9 to 10 pounds.

R. H. HUDSON.

SHINERSVILLE, Pa., December 18, 1887.

My four-year old carp weigh ten pounds each, and my three-year-old ones weigh six pounds. I will fatten 1,500 for the market the coming summer and show the people how big a carp can be raised in one summer from three-inch long fry if put in a warm pond about April 1st.

D. N. KERN.

Much has been written and said upon the rapid growth of carp, their age, their measurement and their weight has been given, and while the figures have been readily accepted as correct by the great majority of carp growers, there are others who doubt the statements, because they do not tally with their experience. The parent stock, the character of the water, the food supplied and the climate, each make a great difference in the development of this rapid growing fish. The greatest divergence of difference will, of course, be found where all these conditions are on the one hand favorable, and on the other hand unfavorable, and as these conditions approach each other, so will the growth of the fish. From Vol. VI. of the Bulletin of the United States Fish Commission, page 457, we clip the following statement and measurements:

GROWTH OF CARP.

On December 2, 1885, the size and weight of two young carp which were just  $5\frac{1}{2}$  months old, and they were reared at the carp ponds in Washington, were as follows, as reported by Dr. Hessel:

Measurements.	No. 1 Mirror.	No. 2 Leather.
Length, inches.....	12	$12\frac{1}{2}$
Vertice height, inches.....	4	4
Circumference, inches.....	$7\frac{3}{4}$	8
Weight, ounces.....	17	18

The eggs were obtained by methods which fixed exactly the day of impregnation, which in this case took place on June 15, 1885.

This is an official statement, and is specific, and from an official and reliable source. It is well established that with equally favorable conditions, the second season's growth is in a constantly increasing ratio to that of the first season's. Had this pair of carp stopped growing for the

winter (?) before they were weighed, if so the test was not a fair one, as they should have been weighed just before they stopped for the winter. Did the weighing stop their growth? or did they continue to grow during December? Let us take them where we find them and leave them there until the 1st of April, 1886, when we start them out on their way at the old ratio of development, without an increase of the ratio, and on December "15," at 18 months' age, one of the fish weighs 46 ounces and the other 43 ounces. These will be the minimum weights, and they do not do the fish justice. And yet they cannot but be satisfactory to carp raisers.

---

#### SEASON OF SPAWNING, TEMPERATURE OF WATER, AND LENGTH OF TIME REQUIRED FOR EGGS TO HATCH IN DIFFERENT TEMPERATURES, ETC.

NEW PORT TRACEY, O., July 8, 1885.

I will give my mode of gathering eggs for the hatching lake. I first build the lake; I make it twelve feet by twelve feet, about 2½ feet deep in the center, and the shape of a basin; construct it near the large lake or some place where it can be fed by warm fresh water. I have no outlet or waste way. I only feed it with water just as fast as it soaks away. I plank it up on all sides tight, so that no snakes, frogs or turtles can get in. Now I set sods around the edge of the large lake, from ten to twelve inches square, the grass being from six to eight inches high. When the spawning season comes I watch early in the morning for the spawning; I gather the eggs in the evening, lifting the sods carefully with a fork and setting them in the hatching lake the same depth that they were in the large lake

W. H. WESTHAFFER.

---

PARK RIDGE, Ills., May 12, 1886.

Having just completed an experiment instituted to determine how long it takes carp eggs to hatch, I herewith send you the result. On Wednesday last, May 5th, my carp began spawning for the season. On Friday last, on my return to the ponds, I made search for eggs and found them in abundance on hornwort (*Ceratophyllum*). I selected sprays with eggs adhering—in all forty—and put them in an ordinary fruit jar, placing the jar in the pond so that the surrounding water would reach within an inch of the top. This I have examined morning and evening of each day since. It had been quite warm last week, and on Friday I found the temperature of the water to be 64 deg. Farh., while the atmosphere in the shade was 62 deg. Friday a northeast storm set in, and since then the weather has been cloudy or foggy most of the time, with but little sun shining. During most of this time the thermometer has varied from 50 to 56 deg. in the shade, while the water has fallen to 57 deg. Farh. This morning the first little fish made its appearance, just five days after the eggs were put in the jar, and seven days after they were cast. More unfavorable weather could

not well have existed for the hatching of carp eggs than that which has prevailed during the past week. Last June I carefully tested the same matter and found the eggs to hatch in four days, the weather being favorable. We may therefore conclude that in *this latitude*, carp eggs will hatch in from four to seven days, according as the weather is favorable or unfavorable. This is quite different from the time required for the same purpose in Germany, as we are informed on good authority, viz., from twelve to twenty days. I may add that my spawning pond consists of 1-56th of an acre, is favorably located, having on the west and northwest a wooded bluff. It is stocked with eleven carp received from the government, and now five years old, with fifteen of their progeny three years old.

J. H. BOURNES.

---

NEW LISBON, O., May 25, 1886.

My carp spawned on the 21st of May. On the 23d I took a small handful of the sea moss which I had put in the spawning pond to receive the eggs and put it into a two gallon glass globe, with about three quarts of rainwater, and kept it in the sun in the day time and in the house at night. On the 25th, just four days, or ninety-six hours from the time the eggs were laid, there were dozens of young carp to be seen in the globe. The young carp are quite small but very lively.

JAMES T. HAWKINS.

---

UNDERWOOD, Tenn., June 13, 1886.

I have two four-year-olds; they only spawned once last year. This year they spawned on April 19th and on Wednesday evening the eggs were hatching. The same fish is spawning this morning but don't seem to be depositing many eggs. I had one three-year-old that spawned June 7th. The eggs hatched in forty-eight hours. The thermometer stood at 80 degrees in the water at noon. While large fish lay more eggs, I believe we can get more fish from younger spawners. The old ones will eat their eggs unless they are protected. I took from a seven-pound carp last season a little over half a gallon of clean eggs. Did not count them. If some one will count half a gallon of cabbage seeds, they can tell about how many eggs to the pound of fish. My one-year-old have been spawning this spring; they also spawned last year.

E. P. UNDERWOOD.

---

SHIMERSVILLE, Pa., June 14, 1886.

I have completed a five days' experiment in taking the temperature of water in my quarter-acre pond. June 9th, at 5 p. m., 76 deg. Farh., it commenced to rain at 3 p. m., rained all night, cleared off in the morning and at 6 a. m., June 10, the water was 78 deg. Farh., at 1 p. m.; 84 deg. Farh. at 6:30 p. m., after a heavy thunder shower of one hour duration the water was 82 deg. Farh., June 11, at 4 p. m., 86 deg. Farh.; June 12, 6 a. m., 72 deg.; 11 a. m. 82 deg.; 3 p. m. 90 deg.; 5:30 p. m. 88 deg.; 8 p. m. 82 deg.

All the above temperatures was taken six inches below the surface of the water. June 12, 8 p. m., thermometer was 65 deg. in open air; three feet below the surface of the water 72 deg.; June 13, three feet below the surface, at 6 a. m., 70 deg.; temperature in open air 60 deg.; at 4 p. m., four feet deep, 72 deg. The water was seven feet deep at this place. In my pond No. 1 the carp spawned April 21, May 11 and May 22. In my pond No. 2 they spawned May 22 and June 7. In pond No. 1 I have six and ten-pound heavy carp, and in pond No. 2 I have four and five-pound heavy carp. I have scale carp.

At our Eastern State hatchery they had to watch the old carp day and night so they would not destroy their spawn. I am sure that my scale carp did not eat a single egg. My scale carp always spawn a month earlier than the leather carp do in my neighborhood. A carp hatched in April will be much ahead of a carp hatched in May or June, not only in the first year but in all after years.

D. N. KERN.

---

TO PREVENT EGGS BLOWING OUT AND DRYING UP.

DRESDEN, Tex., July 7, 1886.

Let me tell you how to prevent the eggs from blowing out on the sand and drying up in the sun, for I am out on the high prairies and not a tree or shrub about my pond, and the wind has a fair sweep, as the water is about level with the prairie around. Take strips of old grain sacks or bagging a foot wide and six feet long, and nail to strips or sticks one inch square by two feet long; small round poles will do, sharp at lower end, and stick these down in the mud in the edge of the pond, so that six inches of the bagging or cloth will be above water. The eggs hang on to the rough cloth and the cloth will remain wet for two or more inches above water and the eggs will hatch if they should be above water.

B. F. CARROLL.

---

LAKESIDE, KAN., Feb. 3, '87.

This winter has been a hard one on Kansas carp, on account of ponds getting so low in the fall and freezing solid. The native fish in the creeks have fared no better. Some places, for long distances, nearly all are dead. I have watched with interest the results of cutting fish out of the ice, and have been able to hear of two carp, of about six pounds each, being caught that way out of the creek and river several miles from here. My carp went through January (ice was all out February 1st) without the loss of over one dozen, as I have between 50,000 and 100,000. I think that is doing very well. I have increased my ponds in number and size until I now have three ponds, covering nearly 25 acres of ground, stocked exclusively with carp. I shall make another pond this fall to cover 15 acres, thus giving me 40 acres in all. Carp raising is no longer an experiment. It is a reality. I can sell all I have for market for 15 cents per pound live weight. Have sold some, and the almost unanimous verdict was, "as good as I ever ate." What better do we want than

that? To those of my brother carp-raisers who have lost all in the ice this winter, I would say don't give up the carp. They are bound to be the coming fish. Get some more and try it again. For your benefit I would say that I wintered 11,000 in one of my ponds this winter, never cut the ice, fed nothing and, in short, paid no attention to them whatever, and have not lost one-half dozen. My secret was just this: Deep water and plenty of it. The balance of my fish were put in a small pond (there is between 50,000 and 100,000 in there), not containing over one-tenth of an acre, and not over five feet deep in the deepest place. I cut in the ice a hole 16 feet square, and kept it open all winter, feeding once a week. The result is—no dead fish, not one dozen in all.

Another point and I will close. In the past, when I have drained my pond, I have found bushels, I might say wagon loads, of those large-sized tadpoles. I suspicioned my carp of eating them during the past summer, and when I drew the water off in November there was not one tadpole in the pond. I infer from this that the smaller sizes do not eat them, but I know the larger sizes do.

W. C. ROSE.

---

EGGS THAT GO TO THE BOTTOM ARE NOT LOST.

CHATHAM CENTER, O., June 16, 1887.

It is said that eggs that go to the bottom will not hatch. This is not correct. I fixed my pond all up with grass and brush, but the very dry weather caused the water to settle, leaving my fixing high and dry and yet, in a single dip with a scoop I took out 556 minnows by actual count.

JOHN W. WHITE.

---

WINSLOW, Mo., October, 1887:

My carp spawned last year on May 18th, 19th and 28th, and on June 1st, 7th, 11th, 13th, 16th, 30th and on July 5th. I have two spawning ponds, two growing or stock ponds and a supply pond, covering in all about eight acres.

JAMES W. WALDO.

---

CORSICANA, Mo., April 23, 1888.

My fish commenced spawning April 2nd, and in five days after they hatched. We put the thermometer in the water and it stood at 65 deg. Now I think there are at least 100,000 young ones, which are growing nicely. I am feeding the large fish, which are becoming very gentle, almost gentle enough to eat out of my hand. I will soon have completed my fifth pond. Have a hydraulic ram running all the time. Am plowing and feeding hogs to firmly fix the bed. Will soon attach an elevator to the carding machine, which, together with the ram, will force from 80 to 100 gallons per minute. My fish are doing just as well as I want them to do, and ten times better than I expected.

L. J. BLANKENSHIP.

---

A SURPRISE.

BERTHOUD, COL., April 12, 1888.

Three years ago I bought twenty scale carp about sixteen inches

long and put them in my lake, for a trial; the lake is about 60 by 100 rods long. It is a natural basin without an outlet and in the deepest place is from 7 to 8 feet. Last year folks used to ask me about my carp; I told them that I thought they were all dead; but three weeks ago some one asked me if I would let them try a seine in it. I told them yes, for I wanted to know whether I had any carp left. The trial was made, the first haul we had nothing; the second haul we got a few carp and some suckers; the third haul we had 10 big washtubs full, of all sizes; the largest weighed over 10 pounds. Among this lot there were some 50 pounds of suckers. All the fish were of a fine quality.

C. G. BESTLE.

---

#### CARP SEEKING THEIR OLD HOME.

POTOMAC, ILL., May 31, 1888.

On the 12th day of May, 1886, we had a heavy rain storm. So much water fell at the time that the overflow of one of my carp ponds, or lakes, was inadequate to carry off the water, and as a consequence the levee burst. At the time there was in it 120 spawners twelve to twenty-four inches long and 6,000 young fish. The levee was repaired in the next few days, but I found at the next drawing that I had lost 60 of the large fish and a thousand or two of the small ones. Now the strange part of the story is that these large fish are now coming back for admittance, after an absence of more than two years. A few days ago while drawing this same pond I discovered three large carp (one spawner and two milters) in the ditch below the pond. They were returned to their old quarters. To-day we found the fourth one trying to make an entrance from the creek. Now the query in my mind is: are these fish trying from knowledge to gain an entrance to the pond they left so long ago? As there have been no carp planted in the streams near here, I feel sure they are the same fish that left me two years ago. Since their escape there has been several carp taken from the streams with hook and line.

JOHN GOODWINE, JR.

---

#### SOME GENERAL PHASES OF CARP CULTURE.

##### A FINE TABLE FISH.

CHAGRIN FALLS, O., March 24, 1885.

Carp culture has come to stay, and the more it is investigated the better it shows up. The vicinity of Chagrin Falls enjoys the notoriety of having more carp ponds than any other part of the United States of like area. There are within twelve miles of this place over 100 ponds, and I think the number will be doubled the coming summer. The first pond was constructed here by W. E. Watters three years ago and stocked by him in connection with the Chagrin Falls Fish Club. The result has proved so satisfactory that everybody is going into it. He has fish three years old which weigh ten pounds each, and in his pond, which covers only about



one-fourth of an acre, he has thousands of them from that weight down. They are so tame that they eat from the hand, and fairly crowd each other out of the water in their efforts to obtain the food.

As an evidence of the growth of carp I quote the following from the Chagrin Falls Exponent of September 4, 1884:

"The carp in Mr. J. M. Bullock's pond in Russel, now measure from six to ten inches long, the largest weighing fully one pound. This is a good growth for fish which were hatched in May of this year, and there is no possible doubt of the correctness of this report, for the pond was filled this year for the first time, and no fish over an inch long was put in it, besides the fish may be seen any day by those doubting the story, which, we confess sounds a little fishy."

I have eaten carp and consider them fully equal to black bass or white fish, if grown in water not too stagnant, and being a life-long angler, I consider myself a fair judge. In quality they equal anything we have ever eaten, excepting only brook trout. The texture is fine and firm, and there are no bones, excepting the backbone and the usual attachments, as in the case of a black bass or white fish. The flavor resembles that of a rock bass or perch more than any other fish with which we are acquainted. The slightest muddy taste was not discovered, although the pond in which they were grown had a muddy bottom. The late Dr. Theodatus Gorlick, of Bedford, "father of American fish culture," was of the same opinion, after giving the matter a fair test, and he was surely competent to judge.

Carp culture has much to recommend it. The lending of variety to the farm-table; the rendering of the farm more attractive to the young, and thereby keeping our boys on the farms, instead of sending them into the cities, or into the overcrowded professions; and above all the adding, with little expense, to the farm profits, are among the strong arguments in its favor.

There are few farms which do not afford some suitable place for a carp pond, and be it of only a few rods area it will supply the table with excellent fish, and pay many times its cost. I can show you within five miles of Chagrin Falls half a dozen ponds that you could not buy for a thousand dollars apiece, if the owner could not have another.

J. J. STRANAHAN.

---

#### ONE WAY OF COOKING THEM.

OWASCO, N. Y., October 16, 1887.

I live near Owaseo lake where we have trout, pickerel, perch, pike and suckers; none of them can beat a carp. I have carp all the year round. The way to cook fish is to cut them in pieces, salt and roll them in flour; have half lard and butter on a griddle, hot; lay your carp on, fry

slow; keep adding on butter, so they won't burn. They are good enough for me.

JOHN N. BROKAW.

---

TURNING OUT THE HOGS TO MAKE ROOM FOR CARP.

WASHINGTON, KAN., May 12, 1885.

I have been experimenting with carp ponds for the last three years. I first made them in small streams that drained my farm and stocked with U. S. fish, but so far the results have been pro bono publico, for an occasional very high freshet would permit the fish to go to other ponds, and, like the boy whose tea-kettle fell overboard into the sea, I know where they are and went to, though I can't put my finger on them. In Europe and in England, as a disciple of Walton, I have occasionally and rarely hooked a carp, in the Thames and its tributaries. They live in the streams with other fish, even the pike, but not in large numbers, having so many enemies to contend with. They attain a large size and are highly prized as a table fish, coming next to speckled trout. This year I am making my ponds in low places on the side of small streams or where the rainfall on the hills will fill my ponds without overflowing. I have no doubt of the success of carp culture in Northwestern Kansas. The French political economist counts fish raising a very important factor in furnishing food for the people. In fact I have turned the porker out of my lots and am substituting fish ponds in their place, and expect to reap a reward by a larger profit in money, and in improved-digestion by their use at the table, for when the Jews of old tabooed pork for centuries there was wisdom in it, for we are apt to become as gross as the diet we feed on.

CHAS. WILLIAMSON, M. D.

On April 15, 1886, Mr. Williamson writes: I shipped fish last year in June, of the new hatch, 125 miles, that were only three-fourths of an inch long. They survived the trip and have done well. I shall ship 1,000 in a can in the same way this season to stock other ponds, for I do not want to pay too dear for my hobby.

---

WATER SUPPLIED BY WIND MILL—BOTTOM PUDDLED BY HOGS.

TAYLOR, OGLE CO., ILL., April 13, 1886.

I wrote you last summer that I was going to sink a well and put up a wind mill and lay pipes to supply two ponds, the ponds being sink holes that the hogs had packed or puddled the bottom so they held water. I went 84 feet for water, put in a three inch cylinder and a ten foot wheel, and could raise the water in one pond three inches a week without any rain, the pond 100 feet across. The ponds are no deeper now than they were when the ground froze last fall. The edges freezing expanded the soil, and when thawed left them loose and the water soaked away. I got a few fish the 6th of July, and they grew so fast that I got 600 of their brothers and sisters the 19th of August out of spring water. My fish are all right this spring. The first ones that I got are 11 to 12 inches long and weigh 13 to 15 ounces, the last ones are nearly six inches long and weigh

one and one-half to two ounces. That is the difference of being in spring water and warm pond water with mud clay bottom for six weeks during the growing season. Where the pipes came out in the ponds about 18 inches under the water I put an elbow to throw the current up against the ice, and it kept an air hole most of the time. Toward spring I made a box three feet high on north side, and one foot high on south side, six feet square, covered with glass, and set over the hole. It helped very much. Would be better to put a shed roof on and close up west and east sides. I am getting some spawners the first of May. Last fall I plowed and scraped two days to make a little pond for them, fenced it, and am scattering shelled corn around the edges for the hogs. As the wind mill pumps the water in it is very muddy, but by letting it stand two weeks it will be fit to put the fish in, and won't rye straw be good to receive the eggs.

I kept two fish in the house this winter to watch their movements. They were in a glass box 14 by 28 inches, 6 inches deep of water. At first the water had to be changed every two days, but later in the season not so often, and once it was not changed for five weeks. They would stay in one corner with their heads together for days, unless disturbed, and hardly move a fin. When the water was changed they would be quite lively for a few days, and would eat a little but did not grow any.

H. P. EDMONDS.

---

#### CARP ARE CANNIBALS.

ROSEHILL, TENN., December 20, 1886.

I see in speaking of the draining of Mr. Ritchie's pond, on the 15th of November, you are at a loss to account for the greater percentage of scale over mirror carp. Precisely the same thing has occurred to me for two years past, and I account for the difference of increase in my water in this way. The scale carp is a more active fish than the mirror or leather, and in the spawning season the scale milter vivifies a much larger percentage of spawn than the others, which will account for the difference in part. But there is another reason for the difference, much more potent, in my judgment, than this. The pure scale carp in my water has upset all the received theories as to its non-flesh-eating habits, and demonstrated to my entire satisfaction that it is, in fact, as well as in theory, *a fish*. If that be so, it is not so different from other fish, as some men imagined, but may be a less ravenous cannibal than many other varieties. It is absolutely certain that my scale carp devour spawn very greedily, and I have seen them "in the very act" so often during the past three years, I do not expect much increase if the eggs are not removed. That they also eat the young fish when permitted to remain in the water among them is absolutely indisputable, for I have observed it too often to be mistaken. Closely concealed within a few feet of the fish, I have repeatedly observed three and four year old carp float to the top of the water, and hold their

mouths open as the buffalo fish does in "piping," while a very slight puff of air would drive many young fish into the trap set for them.

My attention was first drawn to this habit by watching the old fish, and they invariably thrust their heads up, facing the wind. By a vane or a flag, indicating a change in the current of the wind, when not alarmed, the fish always changed position. Such is the exquisite sensibility of the tentacles, that the fish would often detect a change in the current of air as it swept over the water, and reverse its position before the flag indicated the change. For more than a year I use a United States flag for this purpose, but some "trooly loyal" thief came in the night and stole it off the flagstaff, and after that I resorted to other devices for noting a change in the wind. In view of these plainly manifested habits of three and four year old fish in devouring the young during all warm days in the early summer, I cannot entertain the slightest doubt of the cannibalism of scale carp until I first learn how to doubt the evidence of my own senses. But the other reason for the disparity of numbers observed in Mr. Ritchie's pond: During the growing season for carp, and while the younglings are still quite small, the water of the pond is always more or less muddy. The scale fish are so near the color of the water, any little leaf, or blade of grass, or moss in the pond furnishes them a secure hiding place from the larger ones; but it is quite different with the mirror, the golden-colored scales of which make it a "shining mark" and render escape much more difficult. Thus you see I am not a convert to the new-fangled theory that the Deity performed a miracle in the creation of the carp, but believe the "big fish" devour the little ones when man does not wisely exercise his God-given dominion over them, as he does with the "beasts of the field and the fowls of the air."

M. T. PEEPLES.

---

#### AN EASY WAY TO MULTIPLY PONDS—FISH KEPT IN THE CELLAR.

POMEROY, O., December 26, 1886.

One year ago last spring I put in two 2-year-old scale carp in one of my ponds. Last fall we drew off the water and found about one bushel of carp from one to ten inches long. This fall we drew off the water, and found I think an even wagon load, from one to sixteen inches long, the largest weighing two pounds. The two old fish weighed seven pounds each. I gathered out all the largest fish and placed them in a large box, which I will now undertake to describe. I first drew two feet of water out of pond, next I built a board fence across the upper end of pond; I now dug a hole large enough for a box 24 feet long, 4 feet wide and 5 feet deep, using the dirt to build a levee from end of box to the board fence. This makes a pond 40 feet square on each side of the box. The water is four feet deep in the box, and about sixteen inches deep in the small ponds. I should have said before that I banked up dirt against the upper side of the board fence higher than high water mark. I have the box so arranged as to let water from the small ponds to the large pond below. I put a partition in the large box by nailing slats across the box and filling

in with gravel. The space for gravel being four feet and ten inches thick. This I think is far better than wire screen. The water runs in near the end of the box. All the water that runs into the ponds must run through this box. When we drained our ponds this fall we put about fifty fish in the box, and I don't know how many buckets full in the small ponds. When we use all that is in the box, we will draw the water off from the small ponds (which are only about sixteen inches deep) and fill up the box for winter use.

We have a seine  $4 \times 4\frac{1}{2}$  feet to take them from the box. The lids of the box open back on a frame making a place to walk when seining. I intend to use these small ponds for spawning purposes in summer, and as above stated in fall and winter.

I dug a cistern last fall within a few feet of our cellar, made a hole from cistern to cellar, put in an inch gas pipe, dug a sink in cellar  $2\frac{1}{2} \times 6$  feet, and one foot deep. Now after the sink is filled with water a stream of water smaller than a straw will supply enough water for two dozen fish. Now when my wife wants a mess of fish she can get them as easy as getting a mess of potatoes out of the cellar. E. D. ASHWORTH.

In April, 1887, Mr. Ashworth wrote: "I would just say that my box arrangement that I described in the January number has proved a perfect success. We have had fish to eat ever since last fall, simply because they were where we could catch them. Also the arrangement in our cellar as described in the above number has been a success, we have kept them a month or more just to see if they would live, and they appeared as healthy as when first put in. Their table qualities are excellent as all that have eaten of them pronounce them so."

#### NATIVE FISH DELAY SUCCESS.

NORBORN, Mo., May 20, 1886.

About four years ago I made a fish pond and wrote to the Fish Commissioner for some carp to stock it with, was informed that I could not get any until fall. I was so anxious to have the fish in my pond that I went down in the Missouri river bottom, where the water was drying up along the railroad bottom, and caught a whole barrel of fish of all kinds and sizes and put them into the pond. The last of December the same year I received from Forest Park pond, St. Louis, a can containing twenty-two mirror carp, which I put into the pond. I had no information on the subject, until the winter of 1884-5, when I received a little book from the State Fish Commissioners on carp culture. In the fall of 1885 I made a new pond and drained the old pond by cutting through the bank, having no drain pipe. Out of the original twenty-two carp I had sixteen left. I found twenty one-year-old carp and only two young carp, and several thousand little sun perch, a few small catfish and plenty of frogs and crawfish. I put nine of my old fish in my new pond at the time I drained the old one, the balance I put in a box made by digging a hole  $8 \times 12$  feet square, three and a half feet deep in the ground, running spring

through it, (I should have stated before that my ponds are fed by springs, the ponds being about one hundred yards below them) in this box my fish wintered finely. After cleaning out and repairing my old pond this spring, I took my fish out of the box on the 9th of May, and put them in the old pond, and in two days after they were in they literally covered six cedar brush, which I had placed there, with eggs, and in just five days they hatched out. My carp in the new pond spawned a little on the 6th of May, the water being a temperature of 68 degrees. I have provided both of my ponds with the Cary plan for draining. The ponds cover about half an acre each, depth of water five and a half feet at the deepest points. In conclusion, I want to state that half day's labor that I spent in procuring and putting into my pond of that barrel of native fish has cost me two years benefits of my ponds. If I could have had that little book that I received afterward from the State Fish Commissioner, and your valuable paper to read at the time I made my first pond I would not have made that sad mistake.

DANIEL HEINEV.

---

50,000 CARP SOLD IN FIFTEEN DAYS.

EDINBURG, IND., October 24, 1887.

I have been very busy the last three weeks in fishing out and restocking my carp ponds. I had to build this year five additional store rooms in which to place my surplus carp, making eight in all. I thought these would be ample room for all I would have left after restocking my waters, but I found, to my surprise, that I did not have one-half the room I needed, so I had to use one of my regular spawning ponds in addition to the eight store rooms for the winter quarters of my surplus fish. I started to count all my carp, young and old, but the number of fry was so great that I gave it up, and counted only those that I put back in the ponds for another year. Of course I will be able to report the number of carp I used for stocking my own pond, as well as those that I sell in the future. Since October 8 I have sold and engaged 50,000, nearly all minnows, and I have used 30,000 for my own waters, making up to date 80,000 carp of all sizes. Two of my smallest store rooms furnished them and still they are not half emptied, so you may have some idea of the vast number. This may seem fishy to you, but if you will come out I will convince you that I have a good many carp.

V. STILLABOWER.

---

TRAP AND AUTOMATIC FEEDER.

EAST LYNN, Ill., October 26, 1886.

Let me tell you how I had a nice ten-acre pond with thousands of carp in but could catch none to eat. It is three-fourths of a mile from my house, so it was difficult to feed regularly in a trap to catch them. Last winter I built a cheap 10x12 feet building on the ice in the middle of the pond. To make the building I took four poles sixteen feet long and eight inches in diameter for the sills. I laid two of them on the ice side by side

ten feet apart; then I took the other two and laid them across the first two twelve feet apart and bolted them firmly together with four 1x14 inch bolts. Then for the ends of the building I set the boards up end ways and nailed them on the inside of the end sills; then eighteen inches above the end sills I put in another set of light sills 4x4, all around the *outside*, then nailed the sideboards on the *inside* like the ends but only let them come down to the upper sills—so there will be an open space eighteen inches high and twelve feet long on each side for the slide doors on the inside. All this rough frame work is always under water. After the building was complete, I sawed the ice all around about eighteen feet square and kept each side sawed about equal so when it broke it would go almost straight down with the block of ice. I was careful to hold the saw a little slanting so the block of ice was a little smaller on top than on the bottom, then it would not wedge fast. The block of ice would soon melt and leave the building firmly on the ground, and standing perpendicular, too. But if the bottom of the pond is not level then the sills could be raised on the ice before building to suit any slope of the pond bottom. That is, if the bottom slopes one foot in sixteen then raise the sills with blocks of ice on one side one foot high.

I made two slide doors eighteen inches high and twelve feet wide, one on each side. These slide doors are raised with ropes over pulleys and fastened to a wheel with a crank to it. The doors are weighted so they will sink easily. There is a moveable bottom 10x12 feet, made of common boards, with some grating near each side to let the water through. This floor is also weighted with about 500 pounds of old iron. It is raised with ropes at each corner and over pulleys to a windlass. The fish are fed on this floor until they learn to come there. I have a small rope hitched to the door-post and hitched to a post in the water about six rods away. A boat is rowed up to the rope and I slyly pull the boat up to the building and with a key the side doors are instantly dropped. Then the floors are lifted with windlass at leisure. It is fun to see the big fish make the water boil then. This six rod rope comes very handy on a windy day to make a landing at the house. I soon found it was too much of a chore to go so far to feed the fish on this floor regularly, so I took an old eight-day clock, took out the springs and in their place put spools large enough to hold cord enough to run the clock twenty or thirty days with weights. The trip that sets the clock to striking every hour I took off and put a moveable one on the wheel that revolves every twelve hours and then I filled up eleven of the twelve holes in the spacing wheel, leaving only one hole open, so the clock would only commence to strike every twelve hours and strike seventy-eight times—that is the full amount of twelve hours, striking—continuing to strike while the spacing wheel would make one complete revolution. I lengthened the main winding shaft and on the end I put a wheel something like a water wheel that would hold as much feed as I wanted to feed at once. This wheel is placed under a hopper that holds several bushels of feed. The clock is set to strike at any hour in the morning and evening. While the clock is striking seventy-eight

times the feed wheel revolves once and the feed drops on a block hung under the wheel and scatters itself over the water and sinks down on the floor. I use about an ounce hammer in the clock, on a thirty-pound bell. The fish come at the ringing of the bell and the regular time of feeding in great numbers.

HARVEY BOWEN.

AN EASY WAY OF KEEPING AN OPEN SPACE IN A POND IN WINTER.

ONOVILLE, N. Y., March 11, 1888.

My fish are wintering well; I don't think I have lost more than a dozen or so, as yet, out of nearly 300 small ones put in the winter pond last fall. I intend building two more small ponds this spring. Near the head of my winter pond I built a plank dam across from one bank to the other, and made a hole through it near the bottom, a foot or more under water so the water has to pass through that hole and boils up below the dam and keeps the water in commotion, so it will never freeze over at that point. At the outlet where the screen is, I placed two boards about three feet long with the out ends nailed together in the form of a letter V, as a boom, in front of the screen, catching all the leaves and trash; or nearly all that would otherwise come against the screen. It also acts as a boiler, the same as the dam at the head of pond; the water passes under the boards, which should be nearly a foot wide, and edgeways up and down; the water boils up on the inside next to the screen, so it don't freeze over. I learned this by accident, and it works well.

E. L. VOLENTINE.

NOTES FROM A CARP DIARY.

NATCHITOCHEs, LA., January 26, 1888.

I dammed a 6 $\frac{1}{2}$ -acre pond in the latter part of December, 1882, and on January 15, 1882, I placed therein 81 young carp received same day from the U. S. Fish Commission. They were from 1 $\frac{1}{2}$  to 4 inches long. On March 15, 1882, I caught three in a net, the largest one measuring 7 $\frac{1}{2}$  inches. That night a heavy rain flooded the pond and thousands of other fish entered it. On October 15, 1882, I caught one carp 18 inches long. On January 9, 1883, I received 140 more carp from same source and put them in same pond. On February 15, 1883, I caught one carp, measuring 24 $\frac{1}{2}$  inches, and weighing 7 pounds dressed. I saw no more of them until I drained the pond in January, 1886, when I opened it and found but 13 German carp in the pond, but I had tons of perch, trout, catfish, and in fact, of nearly every native variety. I placed my carp in wire trellis boxes in another pond and had mine thoroughly cleaned out, leaving only young cypress trees. On February 16, 1886, work being over and dam in order and sufficient water, I put my 13 carp (of which only one had scales) back into my pond.

Following is the measurement and weight of the 13 carp respectively, after having been in the boxes 56 days without a particle of food:

No. 1.....	24 inches—10 pounds
No. 2.....	20 " — 5 "



No. 3.....	19	“	— 4	“	8 ounces
No. 4.....	20	“	— 5	“	8 “
No. 5.....	20	“	— 4	“	12 “
No. 6.....	20	“	— 4	“	8 “
No. 7.....	19	“	— 4	“	4 “
No. 8.....	22	“	— 6	“	8 “
No. 9 (scale).....	20	“	— 5	“	4 “
No. 10.....	21	“	— 6	“	8 “
No. 11.....	22	“	— 6	“	12 “
No. 12.....	22	“	— 6	“	“
No. 13.....	20	“	— 5	“	8 “

Tuesday, June 22, I caught four mirror and two scale carp, measuring two inches each. Thursday, July 22, I caught carp measuring  $3\frac{1}{2}$  inches, and there are thousands in the pond. Wednesday, November 17, 1886, my dam broke, gophers having riddled it, causing the break. I lost many fish, for it ran four out of seven feet of water I had into the river. I again put it up, and I am, at this date, nearly overstocked with young carp. I have sold as many as 40 pounds in a day, at 10 cents, on the market, and they are a most excellent pan fish, and pronounced by true connoisseurs as equal to the celebrated croakers of Lake Ponchartraain, La. My task has not been a light one, I assure you, for I caught and killed with my own hands to December 31, 1887: Injurious water fowls, 152; alligators, 3; mink, 1; large frogs and lampney eels, 51; turtles, 198; snakes, 403; total, 808. My pond varies in depth from one inch to seven feet, which last depth covers fully four acres in area; the rest is gently sloping on the west and north sides and deep on the east and south. The bottom is muck, not boggy, and not a particle of vegetation in the pond this year. I have fed slaughter-house offal more than of anything else, and I find them fond of it.

I omitted to mention that during the freeze of the 15th and 18th insts. I lost about 1,000 young carp that happened to be on the shallow borders and the sudden change caught them and they perished in the ice, not one of them being over five inches long. The pond is only supplied by rainfall. The water is as good as from a cistern, being used by some neighbors for culinary purposes and for drinking.

These few extracts are taken from my diary on carp culture.

J. ERNEST BREDA.



---

# Seeds! Seeds!

## MOODY'S SEED STORE.

---

It is with pleasure that I introduce myself and business to the public through this medium. My seed trade is now thirteen years old, and I have met with such success that I am encouraged to put forth greater efforts to introduce my seeds into new territory. I am better prepared each succeeding year to know the wants of my patrons, and no pains or expense is spared to supply the very best and most reliable seeds that this country produces. I am supplied direct from the most reliable growers in the United States, and I am as choice of the seeds put out as I am of the quality that I sow in my own garden. I am trying honestly and legitimately to extend my seed business, and I bespeak at least one trial from all by whom this page is read.


I have a complete stock of everything in

## Garden, Field and Flower Seeds

And would be pleased to have your name and address, in order that I can mail to you free our fine Illustrated Catalogue and valuable hand book of information ; mailed post-paid upon application. Address

**J. H. MOODY, Seedsman,**  
**7 E. Federal St. and 47 Public Square, YOUNGSTOWN, O.**

---

 Mr. Moody is one of the most respected business men of our city, and is not only reliable but well and permanently established in the seed trade.

—The Author.

## CLEARANCE SALE

OF

**\$40,000** FISHING TACKLE **Shot Guns** **Revolvers, Rifles, Etc.** **\$40,000**

Send stamp for Price List. Address Great Western Gun Works, Pittsburgh, Pa.

WORTH OF FINE

## GUNS and REVOLVERS

Large Lot of Seines, Nets, Netting and Twines.

200 Old Kentucky Muzzle Loading Rifles, all sorts and sizes, \$8.50 to \$20.00.

700 Single Barrel Shot Guns, Muzzle and Breech Loading, for \$1.75 to \$14.50 each.

850 Double Barrel Muzzle Loading Shot Guns, all sizes, lengths, weight and bore, and some very fine ones among them, \$4.75 to \$35.00.

1150 Double Barrel Breech Loading Guns of the best American, English and German makes, at all prices from \$8.50 to \$100.00 each. Many rare bargains. All sizes from 16 to 8 bore, 28 to 40 in. barrel, 6 to 10 lb. and some 14 to 16 lb. weight.

380 Repeating and Breech Loading Hunting, 22 to 45 cal., from \$10.00 to \$25.00 each.

690 Flobert Rifles, at \$2.50, \$3.50, \$5.00 and \$6.50 each.

350 G. A. R. Guns, for Posts and Companies, also Equipments for the same at \$2.50 to \$10.00 a set.

240 Single Barrel Powder and Cartridge Pistols, 65c to \$2.75.

1400 Single Action Revolvers, 5, 6, 7 shooters, at \$1.00 to \$3.50.

780 Double Action, Central Fire, Self-Cocking Revolvers, at \$2.10 to \$7.50 each, 22, 32, 38, 44 cal.,

and a great many other goods of various kinds to be sold at Lower Prices than ever heard of. Don't order till you get our Illustrated Catalogue and Special Price List which we mail free to any one who writes and mentions **CARP CULTURE**. This is our Annual Clearance Sale. The Goods are an accumulation or over stock, and must be sold in less than 90 days. Send at once, don't delay, this is a chance of a lifetime. Address **J. H. JOHNSTON, GREAT WESTERN GUN WORKS, 621 Smithfield Street, Pittsburg, Pa.**

## POND SUPPLIES,


[The Great Depot of Pond Supplies, heretofore located at Hudson, O., and conducted by W. S. Ritchie, has been purchased by the undersigned and will be run in connection with the MONTHLY JOURNAL—AMERICAN CARP CULTURE.]

## NETS AND SEINES OF EVERY DESCRIPTION

Rods, Lines, Etc.

AQUATIC PLANTS, BULBS AND SEEDS,

FISH TRAPS AND SHIPPING CANS.

 Catalogue of Goods Sent for 2 Cent Stamp.

Address L. B. LOGAN, Youngstown, O.

---

## ARTESIAN LAKES

For pure German Carp, Short Horn Cattle, Poland China Hogs, Mammoth Bronze Turkeys, and Plymouth Rock Chickens. Call on or address

JOHN GOODWINE, JR.  
Potomac, Vermillion County, Ills.

---

## GENESSEE CARPERY.

BIOL O. COON, Proprietor, - - - Little Genesee, N. Y.

Breeders and Fry of all sizes and ages, at fair prices. Correspondence solicited. Orders promptly attended to. Address as above.

---

**Kansas.** LARGEST FISHERIES IN THE STATE. SEVEN PONDS.  
Forty Acres of Water. All sizes, Any amount, and Lowest Prices. Write for circular and price list.

LAKESIDE CARP FISHERIES, - - - Lakeside, Kans.

---

## LOUISVILLE CARP PONDS,

J. T. A. HOOVER, Proprietor, - - - Louisville, Nebraska

Breeder of the pure German Carp, as bred and raised in Germany.

Breeders and Fry of all sizes constantly on hand, and for sale at reasonable prices. Write for what you want. Address as above.

---

## GERMAN CARP FOR SALE.

I can furnish any quantity of pure, high-bred Scale, Mirror and Leather Carp for stocking Ponds. Spawners a specialty. For terms and low prices, address.

W. R. FRALEY, Salisbury, N. C.

---

## Parti Scale Carp

Of various ages and sizes, for sale at reasonable prices. Correspondence solicited and cheerfully and promptly answered.

JOHN F. MOORE,  
Fairchance, Fayette County, Pa.

---

IRA W. EWART, Martinsburg, Ohio,

Breeder of Merino Sheep, Full Scale German Carp, Shepherd Dogs, Bronze Turkeys and English Ferrets.

## BAVARIAN FISHERIES.

VALENTINE STILLABOWER, Proprietor. - Edinburg, Ind.

More than Twenty Acres under water cultivation.

The Largest Carp Hatchery in the West, Spawners and young Fry shipped to any part of the United States or Canadas. Send for circular and price list. Address as above.

## INDIAN HOLLOW

# Brook Trout Fishery

R. E. FOLLETT, PROP., WINDHAM, CONN.

Brook Trout of Superior Quality Furnished in Quantities  
to Suit Purchasers.

G. BROWN GOODE,  
Commissioner.

United States Commission of Fish and Fisheries,  
Washington, D. C., Sept. 19th, 1887.

Richard E. Follett, Esq., Windham, Conn.:

In reply to your inquiry as to the quality of the trout eggs purchased by me for the Virginia State Commission, I beg to say that they arrived in prime condition, hatched out good healthy fish, and with little loss. Twenty-five hundred were distributed just after beginning to feed, the rest retained until now, when we have about fifty thousand fish from three to four inches long for distribution from this lot.

Very truly yours, [Signed] M. McDONALD, Com. Fisheries, Va.

DR. E. W. HUMPHERYS, Salisbury, }  
G. W. DELAWDER, Oakland. }

Maryland Fish Commission,  
Oakland, Sept. 19th, 1887.

R. E. Follett, Esq.:

My Dear Sir: The trout eggs you sent me last winter were so well handled that our loss was nothing in transportation and the count was rather over than under. In hatching we obtained 97 per cent. I shall favor you with more orders this coming season.

Very truly yours,

[Signed]

G. W. DELAWDER, Commissioner.

Specialty made of Eggs, Young Fry and Yearlings in the Season,

## MUGO MULERTT.

M. C. Imp. Russian Soc. of Acclimation. Author of "The Goldfish and its Culture."

No. 64 Calhoun Street,

Opposite Ohio Avenue, - - - CINCINNATI, OHIO.

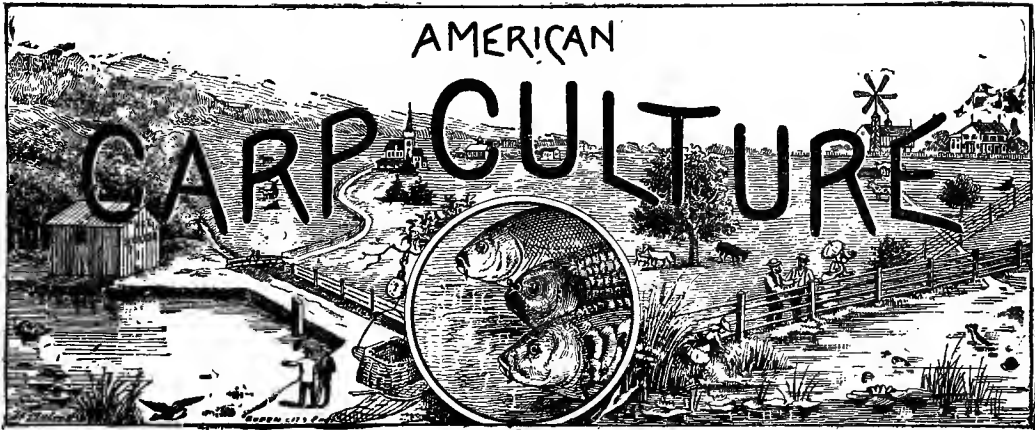
Telegram Address, Corryville.

LIVE FISH and WATER PLANTS

FOR STOCKING

## AQUARIUMS AND PONDS

Supplied in any quantity at lowest rates. Send for prices.



The only JOURNAL in the United States devoted to the interests of carp culture. It is a 16 page, 48 column illustrated paper, published monthly at 50 cents a year. It is now (July, 1888,) in the fourth year of its existence, and has subscribers in every State and Territory in the Union, in nearly all the Provinces of Canada, and in Germany, England and France. Its every edition is replete with the best experience of the carp culturists of the world. In its Question Department, all questions asked relative to ponds or fish are answered free of charge. It has a Natural History and an Aquarium Department. These two departments are conducted by Hugo Mulertt, M. C. Imperial Russian Society of Acclimation, Cincinnati, O.

It has also a Department of Natural Science, conducted by Prof. E. W. Claypole, of Buchtel College, Akron, O., author of the chapter on the hearing of fish, in this book. In this department all specimens of plants or animals sent for inspection are classified and named free of charge.

These departments make the JOURNAL valuable not only at the pond side, but also interesting in the home as an educator and instructor.

We append a few abstracts from letters of Fish Commissioners, giving unsolicited endorsement:

Your JOURNAL was recommended to us by Prof. Spencer F. Baird, United States Fish Commissioner.

LUNNENBURGH, VT., June 28, 1885.

I like your JOURNAL and commend it to those in our State interested in carp culture. Our 2-year-old fish weigh two pounds and over.

H. A. CUTTING,  
Fish Commissioner for Vermont.

NEBRASKA FISH COMMISSION, SOUTH BEND, March 8, 1886.

I am highly pleased with the JOURNAL OF CARP CULTURE, I find it both interesting and instructive to the reader, and in fact it is invaluable to any one who is interested in carp culture. I would be pleased to be the means of placing your valuable paper in the hands of every carp culturist in our State. Yours very truly,

M. E. O'BRIEN, Supt.  
ST. PAUL, July 29, 1886.

I have eaten carp, some of our own raising, and I know they are delicious. I shall take pleasure in naming your paper to those desiring such. Very respectfully,

ROBT. ORMSBY SWENEY,  
President Minnesota State Fish Commission.

St. Louis, Mo., April 2, 1887.

You will see by our fourth bi-ennial report that we have recommended all fish culturists to subscribe for your JOURNAL. It is most valuable to them, and would save a vast amount of correspondence to all Fish Commissions. I. G. W. STEEDMAN,  
Chairman Mo. Fish Commission.

Your monthly JOURNAL is invaluable to those persons engaged in carp culture, and it will be greatly to their interest to take it. S. FEE, Fish Commissioner, Wamego, Kan.

Your JOURNAL is of great service to those interested in carp culture. HENRY DOUGLAS, Sandusky, O., Supt. O. Fish Commission.

I appreciate your JOURNAL very highly, and wish every one of our carp culturists would take it. OTTO GRAMM, Fish Comr., Laramie, Wyo. Ter.

If carp culturists only knew that such a paper as yours was published and of its great value to them, every one of them would subscribe for it. JAS. NEVINS, Madison, Wis. Supt. Wis. Fisheries.

In condensing and compiling the experience of the carp growers of our country, your JOURNAL is invaluable to those interested in the culture. S. P. BARTLETT, Quincy, Ill., Secy. State Fish Commission.

We might add to these endorsements, others similar in character, from Fish Commissioners or Superintendents of Fisheries from every State and Territory in the Union. But space will not permit, and these are sufficient.

The price of AMERICAN CARP CULTURE is 50 cents a year.

Address L. B. LOGAN, Youngstown, O.

---

## VALUABLE BOOKS, For Farmers and Others, Sent by Mail Postage Prepaid on Receipt of Price by L. B. LOGAN, Youngstown, O.

---

### **The Gold Fish and Its Systematic Culture With a View to Profit.**

—A practical treatise on the fish, its propagation, enemies, diseases and care of the fish, in captivity, together with hints on the construction of ponds, etc., by Hugo Mulertt, propagator of ornamental fish and aquatic plants. Illustrated with colored frontispiece and 19 wood cuts drawn from nature. This work is so well thought of in Europe that it has been translated into German, and is now being translated into Russian. No lover of ornamental fish can afford to be without it. Price 60 cents.

**How to Cook Fish**, by HUGO MULERTT.—133 Recipes for preparing sea and fresh water fish for the table. Sixty pages: price 25 cents.

**How to Propagate and Grow Fruit**, by CHAS. A. GREEN.—It contains over 50 illustrations and two large, colored fruit plates. It tells how to propagate strawberries, raspberries, blackberries, currants, gooseberries, grapes, quinces, peaches, apricots, plums, cherries, pears and apples, with illustrations showing how to bud, graft and propagate from layers, etc., with full instructions for grafting the grape. Price, 25 cents.

**Grape Culture**, by H. TRYON.—A practical treatise, giving full instructions how to cultivate, prune and train the vine so as to insure the most perfect success. Price, 25 cents.

**A B C of Potato-culture**, by T. B. TERRY.—It tells how to grow potatoes in the largest quantity, and of the finest quality, with the least expenditure of time and labor. It is not only valuable to potato-growers, but a great part of it applies to the management of almost any crop on the farm, especially to the preparation of the soil, manures, etc. Price, 40 cents.

**A B C of Bee-culture**, by A. I. ROOT.—This is a cyclopædia of everything pertaining to the care of the honey-bee, and is valuable to the more advanced bee-keeper, as well as to the beginner. It contains facts gleaned from the experience of thousands of bee-keepers, all over America. Price, cloth binding, \$1.25; paper, \$1.

**Practical Turkey Rearing**, by FANNY FIELD, the most experienced turkey-rearer in America. Written expressly for those who are interested in making the business profitable. All turkey-rearers should get it. Price, 25 cents.

**Poulterer's Guide**, by C. J. WARD.—It tells how to treat diseases of poultry, etc. Every poultry-producer should have it. Price, 25 cents.

**Kendall's Horse Book**.—No book can be more useful to horse-owners. It has 35 engravings, illustrating positions of sick horses, and it treats all diseases in a plain and comprehensive manner. It has many good recipes, etc. Price, in either English or German, 25 cents.

**The Winter Care of Horses and Cattle**.—The most humane and profitable treatment, by T. B. TERRY. Price, 40 cents.

**Dr. Foote's Hand-Book of Health**.—It contains hints and information of the utmost importance concerning eating, drinking, dressing, sleeping, bathing, working, etc. It tells how to cure boils, burns, chilblains, corns, coughs, cholera, diarrhea, dysentery, diphtheria, dyspepsia, ear-ache, felons, headache, hiccough, hoarseness, itching, pimples, piles, rheumatism, ringworm, sore eyes, sore mouth, sore throat, sun-stroke, stings and insect bites, toothache, ulcers, whooping cough, worms, etc. Price, 25 cents.

**"The Sucker's Visit to the Mammoth Cave,"** by R. S. THOMPSON.—A real commonplace journey by a real lover of nature, whose discernment of everything rich, humorous and beautiful, and whose graphic power to describe them has made his book famous. This is, beyond doubt, the most realistic and exhaustive description of the wonders and scientific formation of Kentucky's modern marvel, that has yet been written. Price 25 cents.

**Food Adulteration**.—What we eat and what we should not eat. Price, 50 cents.

**Emperor William I. and the German Empire**, by JAS. P. BOYD, A. M.—Contents: The Dead Emperor. German Unity. Old Dreams. Glimpses of a Real Germany. Germany of the Crusades. The Hapsburgs. The Hohenzollerns. Political Earthquake. Dawn of a New Germany. The German Confederation. The Coming Deliverer, King William I. Birth of the Empire. Empire and Emperor. At Berlin—Bismarck. At Berlin—Von Moltke. This book is of special interest at this time. Price, 30 cents.

**Roscoe Conkling, the Distinguished American Statesman and Brilliant Advocate**, by JAMES P. BOYD, A. M.—The mental attainment, noble aim, pure official record, honorable political method and sterling character of Roscoe Conkling was surpassed by no man. Every American citizen should read the book. Price, 15 cents.

## RELIABLE BREEDERS OF CARP.

- J** J. THOMAS, Pueblo, Colorado.  
**O** TTO SCHISSEL, Indianapolis, Ind.  
**V**. STILLABOWER, Edinburg, Ind.  
**J** OHN GOODWINE, Jr., Potomac, Ills.  
**W**. R. FRALEY, Salisbury, N. C.  
**B** IOLO'COON, Little Genesee, N. Y.  
**W**. S. RITCHIE, Hudson, Ohio.









