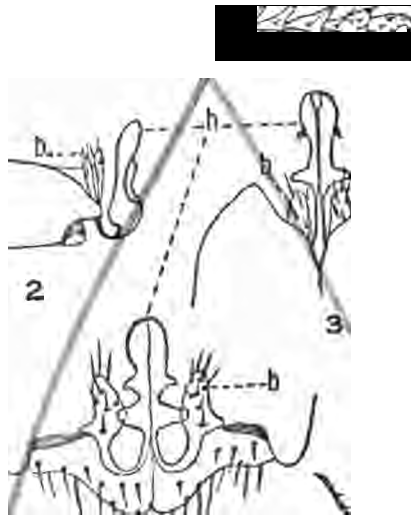


this structure is blackish color except for a whitish strip on the inner margins of the apex. The tips of the elytra are rather flexible and bent down as in Fig. 5. The setae are above and extend beyond the posterior segments of the abdomen. The female is similar to the elytra in color, covered with fine black setae. The legs are blackish with short thick whitish setae. The anterior tibiae of five segments are simple, the claws short and almost concealed in the whitish setae of the distal segment. Length 4.2 mm.

Type No. 40 in the author's collection at the Brigham Young University. Type locality: This species was collected by the writer, in the Raft River Mountains near the Utah-Idaho State Line, about two miles from the Herford Ranger Station, June 7, 1928.

Professor Fernald (1917) pointed out that *Microlipis longicollis* (Mots.) and *M. macreus* (Lec) possessed appendiculate elytra in the males; specimens of these species have been studied, but the structures were found to be very different from *utahensis* as here described. Specimens of these species of *Pseudebarus* have been studied, but the prolonged elytral tibiae do not correspond as closely as species of *Microli* to the form in question. Most of the species of *Malachius* are before me and such species as *ornis* and *auritus* possess elytral structures that are nearest to those found in *utahensis*.

This species may be separated from closely related species as follows:
Elytra structures like, (Figs. 2, 3) body uniform, bluish black in color. *utahensis*



4

Explanation of Figures of *Malachius utahensis*

- Fig. 1. Antenna of Male.
- Fig. 2. Side view of elytra and the appendages. b—flaps. h—horn.
- Fig. 3. Anterior aspect of elytral structures.
- Fig. 4. Distal aspect of elytral structure.
- Fig. 5. Retracted ventral tips of elytra.

1936

A Study of the Fishes of Utah¹

By VASCO M. TANNER

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Introduction

It is the purpose of this paper to bring together, as far as possible, all that is known about the native fish fauna of Utah. Since so many people are becoming interested in fishing and the life of the outdoors, an attempt has been made to provide information about all the native species of fishes and make available as complete a bibliography on the subject as possible. It is hoped that a more detailed study will be made of the cultural problems in our state and that the investigations begun by the Federal Bureau of Fisheries and our State Department of Fish and Game will be continued. It is important that this be done since habitat and faunal changes have already brought about many unfavorable conditions for the development of our fisheries. The balance of nature as it was seventy-five years ago has been greatly modified, and will continue to be so in the future as man develops his irrigation projects, changes the watersheds by grazing of live-stock, lumbering, and with fires, and by the development of new lakes and the draining of the old ones. It is important that we have some of the facts, in this connection, as to the past and the present conditions in order that the problems of the future may be more adequately dealt with. Many of the most desirable native species which were so abundant when the Pioneers came are probably gone forever, likewise many of the streams and lakes have been completely changed in their production of fish food. This means that we must continue to make a scientific study of this entire situation.

A study of the bibliography in this paper shows that many students of the fishes have made contributions to our knowledge of the Utah fauna. A brief review of the early collectors and publications may be of interest as well as of value.

Father Escalante (1776) and Captain Fremont (1844) were probably the first white men to fish in Utah waters and note their findings. The first parties to collect fish for scientific purposes were those conducted by Lieut. G. Beckwith and Lieut. J. W. Gunnison (1859) and Captain J. H. Simpson (1876). These parties collected the fauna and the flora of this western

¹ Contribution No. 39 from the Zoological Laboratories of the Brigham Young University Provo, Utah.

country, providing material for papers on Utah fish by Professors Baird and Girard.

The untiring efforts of Campbell Carrington and C. M. Dawes, naturalists of the Hayden Surveys, brought to light many new species which were described by Professor E. D. Cope. Mr. A. P. Rockwell (1874) contributed a short paper on the native fish of Utah.

The most complete and noteworthy study on the fish of Utah now extant is the one by Professor E. D. Cope and Dr. H. C. Yarrow (1875). This report is based upon a collection made in central and southern Utah by Dr. Yarrow and Mr. H. V. Henshaw, naturalists of the Wheeler Survey. In this treatise 22 species are listed, many of which are described as new.

Dr. David Starr Jordan and his students. Dr. B. W. Evermann, and Professor J. O. Snyder have contributed to the knowledge of Utah ichthyology. Dr. Jordan's first visit was in 1880 and again in 1889, at which times several new species were found. In 1915 Professor Snyder visited Bear Lake and obtained specimens of three species of endemic white-fish which he later described (1919).

Practically all of the above-mentioned collections, in so far as they are in existence, are in the National Museum Collection, Washington, D. C. This paper is based upon a collection which is probably one of the largest of Utah fish, other than the one in the National Museum. The writer has collected Utah fish for many years, and this has been augmented by specimens obtained by the Zoological Expeditions sent out by the Brigham Young University during the past ten years.

I am indebted to the late Dr. David Starr Jordan for his suggestions and advice in connection with the study of Utah fishes, also for his assistance in procuring literature on the subject. It was through Dr. Jordan's kindness that the writer obtained many valuable books on ichthyology from the library of his son, Eric Knight Jordan. Dr. Carl L. Hubbs has also kindly studied many of the species of this report. Finally, many zoology students of the Brigham Young University have studied and collected the fishes of Utah which has contributed much to the knowledge of our fauna.

Classification of Utah Fishes

This systematic arrangement of the families, genera and species is presented for those who are not trained in ichthyology. The average individual knows nothing about the general classification of the fishes. This state of affairs may be improved if those who use this study will spend a little time with the keys to the families, genera and species.

The fishes belong to a major group of animals known as vertebrates because they possess a spinal column made up of bones called vertebrae. The fishes belong to the first of five classes of vertebrates, known as Pisces. All the Utah species are easily recognized if they are studied in connection with the cuts, keys and discussions. (See Plate I, Figs. 1 and 2.)

The various technical terms used in the keys have been greatly reduced in number and with the use of the outline drawings, used to illustrate the principal external features of a fish, all the terms should be understood.

The 25 native species of this state belong to 5 different families. Keys to only the native species are given in this study, and they have been arranged to follow Dr. Jordan's recent check list.

Key to the Families

- A. Ventral fins inserted well back on the abdomen, their origins barely if at all reached by the tops of the pectoral fins, or ventral fins wanting.
 - B. Body more or less completely covered with scales.
 - C. Ventral fins present.
 - E. Adipose fin present.
 - F. Dorsal fin moderate, with 9 to 15 rays.
 - (1) Family Salmonidae, Trout and White-fish. p. 161
 - EE. No adipose fin.
 - G. Dorsal fin with ten or more rays without spines; no barbels; body usually cylindrical.
 - (2) Family Catostomidae, The Suckers p. 165
 - GG. Dorsal fin with 9 or more rays without a serrate spine (native species); or dorsal fin with 17 to 21 rays, and a serrate spine (introduced species); barbels present or absent; body often somewhat compressed.
 - (3) Family Cyprinidae, Minnows and Carp. p. 168
 - (4) Family Medidae, Desert Minnows p. 171
 - BB. Body without scales; adipose fin usually and barbels always present.
 - Family Siluridae, the Catfish. (Introduced).
- AA. Ventral fins inserted well forward, their origins quite near the origins of the pectoral fins; anterior portion of the dorsal fin always with spines.
 - H. Body well covered with scales, which are regularly arranged; anal fin with spines.
 - I. Dorsal fin single, the spinous and soft portions always united.
 - Family Centrarchidae, Sunfish and Bass. (Introduced).
 - II. Dorsal fins two, the spinous and soft dorsals completely separated or just touching the base.
 - Family Percidae, Perch. (Introduced).
 - HI-I. Body without scales, or at least not regularly and completely covered with scales; skin more or less covered with minute prickles; and fin without spines.
 - (5) Family Cottidae, The Sculpins or Bullheads, p. 172

Key to the Genera and Species of the above native families.

(1) SALMONIDAE

Three genera have been reported from Utah.

A. Mouth deeply cleft; dentation strong and complete; scales vary from large 140 to 150, to small 170 to 200.

(1) Genus **Salmo L., 1758.**

The two species may be separated as follows:

- a. Scales 140 to 150; spots sparse, pale color; Lake Bonneville Basin. *Salmo utah* Suckley p. 161
 aa. Scales 170 to 200; spots numerous, especially on posterior part; Colorado Basin. *Salmo pleuriticus* Cope p. 164

AA. Similar to *Prosopium* but mouth is larger and longer jaws; the pre-maxillaries are vertical in position.

(2) Genus **Leucichthys** Dybowski, 1874.

This genus is found only in Bear Lake in Utah and Idaho where it is represented by one species *L. gemmifer* Snyder. p. 164

AAA. Mouth not deeply cleft; dentation feeble or incomplete; scales 78 to 87.

(3) Genus **Prosopium** Milner, 1878.

Three Utah species are known.

- a. Scales 74 to 81; head long; maxillary 4.1. *P. spilonotus* (Snyder) (Bear Lake only) p. 164
 aa. Scales 69 to 78; head shorter; maxillary 3.2. *P. abyssicola* (Snyder) (Bear Lake only) p. 165
 aaa. Scales 83 to 90; head short, blunt; maxillary 2.8, broad. *P. williamsoni* Girard p. 164

(2) CATOSTOMIDAE

Four genera have been reported from Utah.

A. Dorsal fin with 9 to 18 rays.

B. Scales small, 50 or more in the lateral line; air bladder in two parts.

C. Small species in the Rocky Mountain region; hinder division of the air bladder slender.

(4) Genus **Notolepidomyzon** Fowler, 1913.

Only one species in this genus. *N. utahensis* Tanner p. 165

(5) Genus **Pantosteus** Cope, 1875.

Two species in this genus.

- a. Scales moderate, 80 to 90; mouth and lips moderate; dorsal rays usually 9. Lake Bonneville Basin. *P. platyrhynchus* (Cope) p. 165
 aa. Scales very small, 90 to 100 in lateral line, mouth large, with full lips; head short; tail slender; dorsal rays 9 to 12. Colorado River Basin. *P. virgatus* Cope p. 165

CC. Hinder division of air bladder broad.

D. No hump back of head.

E. Mouth inferior, with thick papillose lips; dorsal 11 or 12; scales 9-64-74-8.

(6) Genus **Catostomus** LeSueur, 1817.

We are able to recognize but one species in this genus in Utah; hence *C. ardens* Jordan and Gilbert; also *Chasmodon liorus* Jordan are considered as synonyms for the present. *Catostomus fecundus* Cope and Yarrow p. 166

DD. A high hump back of the head.

(7) Genus **Xyrauchen** Eigenmann and Kirsch, 1888.

Only one species. *X. texanus* (Abbott) p. 167

(3) CYPRINIDAE

Eight genera have been reported from Utah.

A. Dorsal fin short, without developed spine; no anal spine.

B. Maxillary without barbel; teeth 2-rowed, usually 2 teeth in the lesser row; teeth subconical, scarcely hooked, sharp-edged, wide apart, body elongate; mouth large; lateral line complete.

(8) Genus **Ptychocheilus** Agassiz, 1855.

This genus is represented by one species in the Green and Colorado Rivers. *P. luauis* Girard p. 168

C. Teeth compressed, close-set, strongly hooked, caudal peduncle slender and elongate, the caudal fin widely forked; scales very small; head compressed in the adult.

(9) Genus **Gila** Baird and Girard, 1853.

One species of this genus from Utah in the University collection.

a. Belly more or less fully scaled; caudal peduncle not very slender, its depth PA in maxillary; scales of back and belly moderately reduced. *G. robusta* Baird and Girard....p. 168

CC. Teeth 1 rowed, 4-5- or 5-5; mouth of moderate size; teeth entire; body not much compressed; anal fin short in American species.

(10) Genus *Hesperoleucus* Snyder, 1912.

H. symmetricus (Baird and Girard.) One species p. 170

D. Anal base long, or 9 to 22 rays; the fins all high; body more or less compressed; head bluntish, with large eyes; scales moderate, not closely imbricated, 55 to 65 in lateral line.

(11) Genus *Richardsonius* Girard, 1856.

The two species of this genus may be separated as follows:

- a. Scales very small, 80 in the lateral line; head not depressed; species of small size, from the Lake Bonneville Basin. *C. copei* (Jordan and Gilbert) p. 169
 aa. Scales moderate, 55 to 64 in lateral line; body moderately elongate; annal rays usually 11 to 12; one dark lateral stripe, forking anteriorly. *C. hydrophlox* (Cope) p. 168

DD. Scales in a longitudinal series about 36; no caudal spots; no trace of lateral line.

(12) Genus *Iotichthys* Jordan and Evermann, 1896.

I. phlegathontis (Cope) p. 170

DDD. Anal base short, its rays 7 or 8, rarely 9, fins low; caudal peduncle very deep and compressed, dorsal inserted above ventrals; scales comparatively large and well imbricated, about 56.

(13) Genus *Siboma* Girard, 1856.

S. atraria Girard. Single species p. 169

BB. Barbels present, scales small, 60 to 90 in lateral line.

E. Premaxillaries not protractile.

(14) Genus *Rhinichthys* Agassiz, 1842.

R. dulcis (Girard). Single species p. 170

EE. Premaxillaries protractile.

(15) Genus *Apocope* Cope, 1872.

Three species from this genus have been recorded from Utah.

- a. Scales small, usually more than 70 in lateral line; head 4; snout 4; scales about 89 in lateral line. *A. oscula oscula* (Girard) p. 171
 aa. Scales larger, fewer than 70 in lateral line; snout $2\frac{2}{3}$; eye 5 to $5\frac{1}{4}$. *A. adobe* (Jordan and Evermann) p. 171
 b. Scales large, usually 52 to 65; body more slender, depth $3\frac{1}{4}$ to 5 in length. *A. carringtonii* Cope p. 170

(4) MEDIDAE

The single genus in this family may be characterized as follows:

A. Dorsal fin short, posterior, with a strong spine, composed of 2, the posterior received into a longitudinal groove of the anterior; inner border of the ventral fins adherent to the body; teeth hooked, without grinding surface in 2 rows; body with small scales; teeth 2, 4-4, 2; no barbels.

(16) Genus *Lepidomeda* Cope, 1874.

L. vittata Cope. Single species in Virgin River drainage, p. 171

(5) COTTIDAE

In this family we have one genus in which we find:

a. Preopercle with a spine at its angle and 2 or 3 spines below it; ventral fins with 4 soft rays.

(17) Genus *Cottus* Linn., 1758.

The two species may be separated by:

a. Western, intermountain species.

b. Skin smooth; snout blunt; caudal peduncle slender; anal rays 11 to 13. *C. punctulatus* (Gill) p. 172

bb. Skin with prickles, especially about the pectorals; caudal peduncle deep. *C. semiscaber* (Cope) p. 172

Illustrations

Drawings and photographs are included for the purpose of assisting in the determination of the Utah species. If the Figures 1 and 2, Plate I, are studied in connection with the use of the keys, much time may be saved and most of the terms used in the keys will be explained.

All species in Plate III have been introduced, all others are native species.

Distributional List of the Native Species of Utah Fishes.

In this list of species I have attempted to include many of the synonyms in order that the species may be followed in the older reports. The Jordan check list number is given, as this publication is indispensable in dealing with the fishes. The locality records are drawn only from the Brigham Young University collection. Various comments concerning taxonomic questions and interesting points relating to the species are included under remarks.

FAMILY SALMONIDAE

I. Genus *Salmo* Linnaeus (Trout)(1) (341) *Salmo utah* Suckley. Utah Lake Trout.

Plate I, Fig. 3.

Salmo utah Suckley, Monogr. Salmo. 1861 (1874), 136, Utah Lake; "Pale specimen from the Lake."

Type Locality: Utah Lake.

Salmo mykiss virginalis (Girard), Jordan and Evermann. Fishes of North and Middle America, 1896, 495. Utah Lake.

Salmo mykiss virginalis (Girard), Jordan. Report of Explorations in Colorado and Utah during the summer of 1889, with an account of the fishes found in each of the river basins examined. 1891 Bulletin, U. S. Fish Commission, Vol. IX, pp. 14-15.

Salmo purpuratus pallasi Jordan and Gilbert. Notes on a Collection of Fishes from Utah Lake; Proc. U. S. National Museum. p. 460, 1881.

Salmo virginalis (Girard), Cope and Yarrow. Report Upon the Collection of Fishes Made in Portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona during the years 1871-2-3 and 4. Report Geography and Geology—Explorations and Surveys, West of the One Hundredth Meridian, Vol. V.—Zoology. pp. 687-693. 1875.

Salmo clarki Richardson. Goode. The Salmon Tribe. U. S. Fishery Industries. Sec. I, p. 468. 1884.

Salmo clarki utah Suckley. Jordan, the Distribution of Fresh-water Fishes. Annual Report Smithsonian Institution. 1927. p. 373.

Salmo utah Suckley. Jordan, Evermann and Clark, Check list of the Fishes etc. Rept. Commissioner of Fishes, 1928, part 2, p. 56, 1930.

Distribution: Utah Lake, Jan. Apr. Oct. 1927 and 1929.—Tanner. Headwaters of Provo River (Tryol Lake), Utah, July, 1920.—Tanner and Hansey. Bear Lake, Sept. 4, 1930.—Tanner and Fehser. Panguitch Lake. July, 1922.—Tanner.

Remarks: In 1933² Mr. Sheldon P. Hayes and the writer reported the progress of a study of the native trout of Utah. In this report we pointed out that there is very little reason for separating *S. utah* from *S. mykiss*. Until a more detailed study of a larger number of specimens (which it is practically impossible to obtain now) of native trout can be made it may be advisable to list the trout from the Great Salt Lake Basin and Colorado Plateaus under the species of this paper. There is no doubt but that there has been some color changes at least, which have been induced by the geographical isolation of the Salt Lake Basin.

Father Escalante (1776) and Captain Fremont (1844) found the trout abundant in Utah Lake. The Indians were fond of the trout as the suckers, using them fresh and dried. In Escalante's Journal we find the following: "The lake of the Timpanogotizis has great quantities of various kinds of fish, geese, beaver, and other amphibious animals which we had no opportunity to see. Round about it are a great number of these Indians who live on the abundant supply of fish in the Lake. For this reason the Vutas Sabnaganas call them "Fish eaters." Besides the

² 1933. The Genus *Salmo* in Utah. Proc. Ut. Acad. Sci., Arts and Letters. Vol. 1, pp. 163-164.

fish, they gather grass seeds on the plain and make atolls. They also hunt hares, rabbits, and wild fowl of which there is a great abundance here."

Captain Fremont (1845) has the following to say of the Utah Lake trout, page 273: "A few miles below us was another village of Indians, from which we obtained some fish, among them a few salmon trout, which were very much inferior in size to those along the California mountains. May 1844."

The Mormon pioneers found the lake teeming with trout. In December, 1847, a survey of the north end of the lake was made by Parley P. Pratt and associates who reported the presence of good food fish. From that year until about 1880 tons of trout were seined and sold to the people from Salt Lake City on the north to settlements in Sanpete County on the south, and to many of the mining camps.

In July, 1872, when Dr. C. H. Yarrow and Mr. H. W. Henshaw visited Utah Lake they made the following observations:

"In comparison with the other fishes of Utah, the Lake Trout is undoubtedly the most numerous and the most easily captured; how long, however, this condition of affairs will last it is impossible to say, the supply having greatly diminished during the past few years, owing to the reckless methods of fishing and increase in the number of fishermen; moreover, a larger demand is now made for this fish, owing to increase in the number of settlers. The decrease in the yield may be roughly estimated at about one-third, but this percentage is slowly but surely increasing. The greatest size this fish attains, as far as could be learned on inquiry and from personal observation, is three feet; weight about fifteen and a half pounds. The average length, however, is about fourteen inches, and average weight one and a half pounds.

"No steps have as yet been taken to increase the supply of this valuable fish by artificial means, the yield still being large enough to meet the wants of the settlers and miners; but, in the course of a few years, artificial propagation must be resorted to, for although certain laws have been passed regulating the size of the meshes of nets, no attention is paid to them by some greedy individuals, who think only of filling their own pockets at the expense of future generations.

"The trout of Utah Lake may be taken at nearly all seasons by both hook and net at all times, but in Panguitch Lake by hook only, since fishing in any other way is prohibited by common consent.

"Mr. Madsen, who lives on the lake, mentions that, in 1864, such was the abundance of this fish, that in one haul of the seine, discarding all other kinds, he secured between thirty-five and thirty-seven hundred weight of trout, while at the present time five hundred pounds is considered an enormous haul."

At the present time the Utah Trout is rarely taken in any of the above mentioned bodies of water. Many things have militated against its continuance in this region, some of which are upset in spawning, introduction of other species of fish which have changed the food conditions, and fishing methods.

In Bear Lake where this species is at present most abundant, its increase is being interfered with by diverting of the streams that served for spawning and by improper fishing of the streams at spawning season.

Several local names have been applied to this native trout. The early Utah Lake fishermen called it the "Lake Trout," "spotted trout," and "River Trout." At Panguitch it was known as the "Speckled trout," and at Bear Lake as the "Blue Nose." This probably because of the blue nose surrounded by the greenish color of the head.

- (2) (348)
- Salmo pleuriticus*
- Cope. Colorado River Trout.

Salmo pleuriticus Cope. Hayden's *Geol. Surv. Mont.* 1872, p. 47.
Salmo pleuriticus Cope. *Wheeler Survey*, 1875, page 693. Vol. 5.
Zoology.

Distribution: In lakes at the headwaters of the Duchesne River, August, 1930.—Tanner. Vernal, July, 1926.—Tanner.

Remarks: This trout was named in 1872 by Professor Cope from specimens obtained at the headwaters of the Green River. It is the common "native" in all the Uintah mountain waters which drain into the Green River.³

II. Genus *Leucichthys* Dybowski, 1874.

- (3) (396)
- Leucichthys gemmifer*
- Snyder. Cisco.

Plate I, Fig. 4.

Leucichthys gemmifer Snyder. Bull. U. S. Bur. Fish XXXVI, 1919.

Type Locality: Bear Lake, Idaho and Utah.

Distribution: Found only in Bear Lake, Utah and Idaho.

Remarks: This is the common white-fish of Bear Lake, where it is called "Peaknose." It is a good food fish, free from "bones." It was taken with the gill net at depths of 100 to 110 feet in September, 1930. The digestive tracts of 30 specimens were studied and it was found that over 95 per cent of the food consisted of *Diaptomus*. From this study it would seem that the food at this time of the year consists mainly of plankton species.⁴

III. Genus *Prosopium* Milner (Whitefish)

- (4) (420)
- Prosopium williamsoni*
- (Girard)

Plate I, Fig. 5

Prosopium williamsoni (Girard) Jordan, Evermann, and Clark, Check List of Fishes, U. S. Bureau of Fisheries, 1930.

Coregonus williamsoni Girard, Jordan and Evermann. Fishes of North America. Bull. 47. U. S. Nat. Mus. 1896, p. 463.

Distribution: Provo, Weber, Spanish Fork, Logan and Sevier Rivers, Utah Lake, near mouth of Provo River.

Remarks: This species is not so common now as it was thirty to forty years ago. It is oftentimes taken with a hook in the above mountain streams. A few specimens were taken with the seine in Utah Lake in March, 1927, near the mouth of Provo River. The Mountain herring is considered a very choice food fish.

- (5) (424)
- Prosopium spilonotus*
- (Snyder.) Bonneville Whitefish.

Coregonus spilonotus Snyder. Bull. U. S. Bureau of Fish, XXXVI, 1919.

Type Locality: At Bear Lake, Utah and Idaho.

Distribution: Found only in Bear Lake, Utah and Idaho.

Remarks: This species is common, as it is taken in large numbers along with *L. gemmifer*. In September, 1930, 113 specimens were taken with

³ 1933. The Genus *Salmo* in Utah. Proc. Ut. Acad. Sci., Arts and Letters, Vol. 10. This species and *S. utah* are discussed in more detail.

⁴ A detailed study of the food of all native Utah fishes is being made by the writer.

the gill nets in water from 100 to 110 feet deep. This whitefish never exceeds 6 to 8 inches in length, yet it is a very good food fish. The study of the stomachs of five specimens shows that they feed upon plankton as well as food taken on the lake bottom. Professor Snyder reports that specimens taken in January had eaten the eggs of *L. gemmifer*.

- (6) (425)
- Prosopium abyssicola*
- (Snyder). Bear Lake Whitefish

Coregonus abyssicola Snyder. Bull. U. S. Bur. Fish, XXXVI, 1919.

Type Locality: Bear Lake, Utah and Idaho.

Distribution: Found only in Bear Lake, Utah and Idaho.

Remarks: This is the large whitefish of Bear Lake. It attains a length of about 12 to 14 inches. It is not very common now and is found mainly in deep water. This species and the Utah trout have been taken in considerable numbers with the gill nets and shipped. The lowering of the lake level has reduced the food supply as well as destroyed the spawning areas of several species of the Bear Lake fish.

It has been suggested that fishing in Bear Lake may be improved by introducing the Mackinaw trout. The peak-nose would probably be a source of food for this species.

FAMILY CATOSTOMIDAE

IV. Genus *Notolepidomyzon* Fowler.

Plate II, Fig. 1

- (7) —
- Notolepidomyzon utahensis*
- Tanner. Utah Sucker.

Notolepidomyzon utahensis Tanner. Copeia, 1932, No. 3, pp. 135-36.

Type Locality: Santa Clara Creek, near Veyo, Wash. Co., Utah.

Distribution: Tributaries to the Virgin River, Washington Co., Utah.

Remarks: A common species and one that helps relate the species such as *as. clarkii* of the Colorado River Basin with *P. santa-anae* of Southern California.

V. Genus *Pantosteus* Cope.

- (8) (731)
- Pantosteus platyrhynchus*
- (Cope). Mountain Sucker.

Minomus platyrhynchus Cope. Proc. Am. Phil. Soc., Phila., 1874, p. 134.

Type Locality: Utah Lake, Utah.

Pantosteus platyrhynchus (Cope), Cope and Yarrow, Rept. upon Coll. of Fishes. 1871-2-3-4. Wheeler Survey Rept. Vol. V. Zool pp. 673-4, 1875.

Distribution: Provo, Jordan, Weber, Spanish Fork and Sevier Rivers.

Remarks: This species is common in the majority of large streams of the Bonneville Basin. It is known as the "Mud Sucker" in some parts of the state. Professor Snyder (1925) discusses the specimens of *P. platyrhynchus* which he collected in Utah in 1917.

- (9) (734)
- Pantosteus virescens*
- Cope. Blueheaded Sucker.

Pantosteus virescens Cope. Wheeler's Surv. Zool. Vol. V, 1875, p. 675.

Distribution: Virgin River at St. George and LaVerkin; San Juan River at Bluff; and Dirty Devil or Fremont River, Utah.

Remarks: In Wheeler's Survey (1875) *P. virgatus* was reported from the Arkansas River by Cope. This was probably erroneous since no specimen has been taken there since. Prof. Snyder (1925) found that a mountain sucker from the Weber and Bear rivers agreed with Cope's type and he has established these rivers as the probable locality where the fish was collected. It differs from *P. platyrhynchus* in having more numerous scales. Snyder observed that even where the two are in the same locality they are not associated.

VI. Genus *Catostomus* LeSueur (Fine-scaled Suckers)

(10) — *Catostomus fecundus* Cope and Yarrow. Utah Lake Sucker.⁵
Plate II, Fig. 2.

Catostomus fecundus Cope and Yarrow. Wheeler's Survey, Zoology Vol. 5, 1875, p. 678.

Type Locality: Utah Lake, Utah.

Catostomus ardens Jordan and Gilbert. Proc. U. S. Nat. Mus. III, 1880, p. 464.

Type Locality: Utah Lake, Utah.

Chasmistes liorus Jordan. Bull. U. S. Nat. Mus. XII, 1878, 249. June Sucker.

Chasmistes fecundus (Cope and Yarrow). Jordan, Evermann and Clark. 1930. Check List of Fishes, U. S. Bureau of Fisheries, p. 108.

Distribution: Utah Lake, Bear Lake; Provo, Weber and Sevier Rivers; Utah Snake River, Idaho.

Remarks: Many hundreds of specimens of suckers have been studied, but so far as we have been able to determine, we have only the one species present in Utah Lake today, *Catostomus fecundus* Cope and Yarrow. We are unable to distinguish the difference between *ardens* and *fecundus*, as the scale count shows there is a rather wide variation, ranging from sixty-two to seventy-four scales on the lateral line. The supposed difference in the mouth and shape of the head cannot be observed in the specimens we have studied. Specimens of these species in the Stanford University Fish collection have been studied by the writer, but I am unable to clearly distinguish the species. We have, therefore, been forced to conclude, for the present, that *ardens* is a synonymy of *fecundus*. We have recently been informed by Dr. Carl L. Hubbs⁶ that he is also in accord with this. He reports that after studying the types of *fecundus* and *ardens*, he is unable to separate the species. As to *Chasmistes liorus* Jordan, we have been unable to find any specimens of this species in the lake. The cause for this is indeed a puzzle. The only explanation we have to offer at this time is that it has been so greatly reduced by environmental conditions and seining as to be practically exterminated. It may be a seasonal species as in other cases in this region.

Professor Cope and Yarrow found *C. fecundus* to be very abundant in Utah Lake when they made their collection in 1872. According to Dr.

⁵ The writer read a paper before the American Society of Ichthyologists and Herpetologists, Western Division, at University of California Berkeley, June, 1934, in which all the species of fishes of Utah Lake were discussed, along with the chemical and physical changes of the lake.
⁶ 1933. Personal Communication.

Jordan, however, *C. fecundus* was not common in 1880, but *C. ardens* was the common sucker of the Lake. In 1891 Dr. Jordan comments on this as follows: "In a single haul of the large seine made in a channel on the south side of the lake, fifty trout ranging from two to two and one-half pounds were taken. With these were taken six June suckers *Chasmistes liorus* weighing about three pounds each, two hundred "Mullet" *Catostomus ardens* weighing about two pounds each, one webbug *Catostomus fecundus* weighing one pound, and about two hundred chubs *Leuciscus atrarius*, the largest weighing one and one-fourth pounds. This list gives a fair index to the relative abundance of the larger fishes of the lake. The "Sucker," and "Webbug" are, however, at time proportionately more abundant."

Ten years earlier, however, in 1881, Drs. Jordan and Gilbert reported that *Catostomus fecundus* was the common species. On page 463 of their "Notes of a Collection of Fishes from Utah Lake,"⁸ they say: "This species occurs in Utah Lake in numbers which are simply enormous, justifying Mr. Madsen's assertion that the lake is the 'greatest sucker pond in the universe.' It is very destructive to the trout." In this same paper, *C. ardens* "is described from a large male nearly eighteen inches in length, besides which we have a single young specimen." The scales of *ardens* were reported as 9-65-9. Cope and Yarrow gave the lateral line series of *fecundus* as 60. Later Dr. Jordan and Evermann in their "Fishes of North and Middle America" report the scales for *ardens* as 12-70 to 72-12, and record it as "swarming in myriads in Utah Lake."

There seems to be some discrepancy in the scale counts as well as relative abundance of the two species.

C. liorus and *C. fecundus* have been reported only from Utah. If *ardens* is considered a synonymy of *C. fecundus* this will greatly extend the range of *fecundus* since *ardens* has been reported from Snake River of Idaho, Yellowstone Park, and in several places in northern Utah.

The following are lateral line scale counts of 493 specimens of *Catostomus fecundus*:

Scales lateral series: 60-61-62-63-64-65-66-67-68-69-70-71-72-73-74-
Number of specimens: 11-43-36-93-76-48-38-31-21-21-22-22-21- 7- 4

Scales before the dorsal are found to vary between 30 and 44 in about the same proportions as the lateral line series.

At this writing Jan. 1936 practically all the Suckers as well as other fish in Utah Lake have been killed by the severe drought of the past four years. The surface of Utah Lake has been reduced from a normal surface area of 93,000 acres to about 50,000 acres. During the winter of 1934-35 the water was so shallow that hundreds of tons of suckers and carp were killed due to freezing and crowding in the few deep holes. They are so completely depleted that the commercial fishermen have had to abandon all fishing. In the spring of 1935 there were no suckers to run up Provo River, something that has never happened before in the history of Utah Lake. Some fishermen have proposed bringing in suckers from Idaho and restock the lake. It is hoped that our State Game Department will not permit this.

VII. Genus *Xyrauchen* Eigenmann and Kirsch.

Razorback Suckers.

(11) (765) *Xyrauchen texanus* (Abbott). Humpback Sucker.

⁷ 1891. Bull. U. S. Fish Commission. Vol. 9. p. 34.

⁸ 1881. Proc. U. S. Nat. Mus. III. 459-465.

Catostomus texanus Abbott, Proc. Acad. Nat. Sci., Phila., XII, 1860, p. 473.

Catostomus cypho Lockington, Proc. Acad. Nat. Sci. Phila. 1880, p. 237.

Xyrauchen uncompahgre Jordan and Evermann, Bull. U. S. Fish. Com. 1889, p. 26.

Distribution: Colorado River at Moab, and Green River at Green River, Utah.
Remarks: Several specimens were taken with a hook and line.

FAMILY CYPRINIDAE

VIII. Genus *Ptychocheilus* Agassiz. Squawfish.

- (12) (808) *Ptychocheilus lucius* Girard.

Ptychocheilus lucius Girard, Proc. Acad. Nat. Sci. Phila. 1856, p. 209.

Distribution: Green River at Jensen and Green River City; Colorado River at Moab.

Remarks: This species known as the "Colorado Salmon" becomes one of the largest fish in the waters listed, weighing from 10 to 20 pounds, with a maximum weight of 80 pounds. It is a good food fish.

IX. Genus *Gila* Baird and Girard.

- (13) (811) *Gila robusta* Baird and Girard. Roundtail.

Gila robusta Baird and Girard, Proc. Acad. Nat. SO. Phila. VI, 1853, p. 368.

Gila gracilis Baird and Girard, loc. cit., 369, Zuni River; Girard, Pac. R. R. Surv., X. 1858, 287; and Jordan and Gilbert, Synopsis, 1883, 229.

Gila grahami Baird and Girard, loc. cit., 389 Rio San Pedro, tributary of the Rio Gila; Girard, U. S. and Mex. Bound. Surv., Ichth. 1859, 61; and Jordan and Gilbert, Synopsis, 1883, 228.

Gila seminuda Cope and Yarrow, Wheeler's Surv., Zool. V, 1875, p. 666.

Type Locality: Virgin River at Washington, Utah.

Distribution: At Green River City, and Moab, Utah, and Virgin River, St. George, Utah.

Remarks: We are in agreement with Prof. Snyder (1916)⁹ that *C. seminuda* is a synonym of *G. robusta*. We have been unable to find any specimens that agree with the Cope and Yarrow description. All our specimens are well covered with scales.

X. Genus *Richardsonius* Girard 1856.10

- (14) - *Richardsonius hydrophlox* (Cope). Silverside Minnow.
Plate II, Fig. 3.

Cheonda hydrophlox (Cope). Jordan, Evermann and Clark, Check List of Fishes; U. S. Bureau of Fisheries. 1930.

Type Locality: Blackfoot Creek, Idaho.

⁹ 1916. Proc. U. S. Nat. Mus., 49, pp. 573-586. A valuable report for students of Utah fishes.
¹⁰ 1930. Check List of Fishes; U. S. Bureau of Fisheries, p. 117.

Clinostomus hydrophlox Cope, Hayden's Geol. Surv. Mont., 1871, p. 475.

Clinostomus montanus Cope, Hayden's Geol. Surv. Mont. 1871.

Leuciscus hydrophlox (Cope). Jordan and Evermann, Fishes of N. A. Bull. 47, Nat. Mus. 1896, p. 238.

Clinostomus taenia Cope, Proc. Amer. Phil. Soc., XIV. 1874, p. 133.
Type Locality: Utah Lake.

Gila Hydrophlox (Cope). Wheeler's Surv. Zool. 1875, p. 658.

Distribution: Common in the streams of Utah and Salt Lake Valleys.

Remarks: It would seem that the genus *Richardsonius* should be used for our Utah minnows since they seem to be more closely related to such species as *balteatus* of the Columbia River system. There seems to be no good reason for making genera out of many of Girard's sub-genera. Dr. Huhbs of Michigan has examined specimens of this species and believes they should be placed in this genus.

- (15) — *Richardsonius copei* (Jordan and Gilbert).

Leather-sided Minnow.

Cheonda copei Jordan, Evermann and Clark, Check List of Fishes; U. S. Bureau of Fisheries. 1930.

Squalius copei Jordan and Gilbert, Proc. U. S. Nat. Mus. III, 1880, p. 461.

Squalius aliciae Jouy. Proc. U. S. Nat. Mus. 1881, p. 19.

Type Locality: Provo River, near Utah Lake.

Distribution: Associated with *hydrophlox* in above localities, Weber and Logan Rivers.

XI. Genus *Siboma* Girard.

- (16) — *Siboma atraria* Girard. The Utah Lake Chub.
Plate II, Fig. 4.

Tigoma atraria (Girard) Jordan, Evermann and Clark, Check List of Fishes; U. S. Bureau of Fisheries. 1930.

Siboma atraria Girard. Proc. Acad. Nat. Sci. Phila. VIII. 1856, p. 206.

Type Locality: Fish Springs, Tooele Co., Utah.

Tigoma squamata Gill, Proc. Bost. Soc. Nat. Hist. VIII, 1861, p. 42.

Type Locality: Great Salt Lake Basin.

Hybopsis bivittatus Cope, Hayden's Geol. Surv. Mont. 1872, p. 474.

Type Locality: Warm Springs, Utah.

Hybopsis timpanogensis Cope, Proc. Amer. Phil. Soc. XIV, 1874, p. 134.

Type Locality: Timpanogos, Utah.

Squalius cruoreus Jordan and Gilbert, Proc. U. S. Nat. Mus. III, 1880, p. 460.

Type Locality: Provo River, Utah.

Squalius rhomaleus Jordan and Gilbert Loc. Cit. p. 461.

Type Locality: Utah Lake, Utah.

Distribution: Common in the Bonneville Basin.

Remarks: This species was described by Charles Girard in 1856 from a specimen collected by Mr. F. Krenzfeldt, botanist of the Gunnison, Beckwith Pacific Railroad Surveys. Professor Snyder who studied the types in comparison with the specimens he collected in Utah in 1917 expresses his belief that *S. atraria* is not a synonym of *Luciscus lineatus* (Girard) but that it is a valid species name for the chub of Utah Lake.¹¹ A careful study has been made of this species by Mr. Sheldon Hayes who studied specimens from various parts of the Bonneville Basin including the type locality, Fish Springs in western Tooele County.

XII. Genus Iotichthys Jordan and Evermann.

- (17) (862) Iotichthys *phlegethontis* (Cope).

Clinostomus *phlegethontis* Cope, Proc. Amer. Phil. Soc. XIV, 1874, p. 137.

Type Locality: Beaver River, Utah.

Distribution: Beaver River, Parowan Creek, and Clear Creek. It is abundant in Beaver River. Also found in Provo River and fresh water ponds around Great Salt Lake.

XIII. Genus Hesperoleucus Snyder.

- (18) (863) Hesperoleucus symmetricus (Baird and Girard)

Pogonichthys symmetricus Baird and Girard. Proc. Acad. Nat. Sci. Phil. VII, 1854, p. 36.

Myloleucus parovanus Cope. Proc. Am. Phil. Soc. XIV, 1874, p. 131.

Type Locality: Beaver River, Utah.

Distribution: Beaver Creek, and Santa Clara Creek.

XIV. Genus Rhinichthys Agassiz.

- (19) (1044) Rhinichthys dulcis (Girard)

Plate II, Fig. 5.

Argyreus dulcis Girard. Proc. Acad. Nat. Sci. Phila. VIII, 1856, p. 185.

Rhinichthys luteus Garman, Bull. Mus. Comparative Zool. VIII, 1881, p. 87.

Type Locality: Bear River, Ogden, Utah.

Distribution: Logan, Ogden, Weber and Bear Rivers, also Snake River, Idaho.

XV. Genus Apocope Cope.

- (20) (1053) Apocope carringtonii Cope.

Plate II, Fig. 6.

Apocope carringtonii Cope. Hayden's Geol. Surv. Mont. 1871, p. 472.

Type Locality: Warm Springs, Utah.

Apocope vulmerata Cope. Loc. cit. p. 473.

Type Locality: Logan, Utah.

¹¹ 1922. Proc. U. S. Nat. Mus. Vol. 59, pp. 21-28.

12 1935. Masters Thesis, Brigham Young University, Provo, Utah. pp. 40-54.

Tigoma rhinichthyoides Cope. Loc. cit. p. 473.

Type Locality: Logan, Utah.

Rhinichthys henshawi Cope. Proc. Amer. Phil. Soc. XIV, 1874, p. 133.

Type Locality: Provo, Utah.

Agosia novembradiata Cope. Proc. Acad. Nat. Sci. Phila. XXV, 1883, p. 141.

Type Locality: Weber River at Echo, Utah.

Distribution: Warm Springs, Salt Spring, Fish Springs, Candy Springs, and many other springs in the Bonneville desert. Provo, Logan and Weber rivers.

Remarks: This species was described by Professor Cope from specimens collected at Warm Springs near Salt Lake City by Campbell Carrington, naturalist of the Hayden Survey.

- (21) (1054) Apocope oscula oscula (Girard).

Argyreus osculus Girard. Proc. Acad. Nat. Sci. Phila. 1856, p. 186. Apocope oscula (Girard). Jordan, Evermann and Clark. Check List of Fishes; U. S. Bureau of Fisheries, 1930.

Apocope oscula oscula (Girard). Tanner, Copeia, No. 3, 1932, 135-136.

Distribution: Moab, small stream 30 miles south of Bluff, Zion National Park, Veyo, Utah. Common in the Colorado River Basin.

Remarks: The species *Apocope oscula* was described from specimens taken from the San Pedro River of Arizona. Specimens collected in the upper part of the Colorado River drainage seem to be rather closely related to *Apocope canisii* (Yarrow).

- (22) (1057) Apocope abode (Jordan and Evermann).

Apocope abode (Jordan and Evermann). Jordan, Evermann and Clark Check List of the Fishes; U. S. Bureau of Fisheries, 1930.

Type Locality: Sevier River, Utah.

Agosis adobe Jordan and Evermann. Bull. U. S. Fish Com. IX, 1889, (1891).

Distribution: Sevier River at Hatch, Richfield and Gunnison, Utah. This species seems to be confined to the Sevier River drainage.

FAMILY MEDIDAE

XVI. Genus Lepidomeda Cope.

- (23) (1102) Lepidomeda vittata Cope

Lepidomeda vittata Cope. Proc. Amer. Phil. Soc. Phila. XIV, 1874, p. 131

Lepidomeda vittata Cope. Tanner, Copeia, No. 3, 1932, 135-136.

Distribution: This species is common in the Santa Clara Creek. It seems to be associated with specimens from the Paharanagat Valley of Nevada through the drainage system of the region. This species was first reported as occurring in Utah by Tanner in Copeia, 1932.

13 1872. Hayden's fifth Annual Report of the United States Geol. Survey.

FAMILY COTTIDAE (Scaleless aculifera)

XVII. Genus *Cottus* L.

- (24) (3001) *Cottus punctulatus* (Gill)
Plate II, Fig. 7.
Cottus punctulatus (Gill). Jordan, Evermann and Clark Check List of Fishes; U. S. Bureau of Fishers, 1930.
Potamocottus punctulatus Gill. Proc. Soc. Nat. Hist. VIII, 1861, p. 40.

Distribution: La Sal Creek, and Moab, Utah.

Remarks: Dr. Carl L. Hubbs is making a study of this genus, which may change the species as listed here. The species in the Colorado Basin is as indicated in the Keys, distinct from the G...-tat Basin form.

- (25) (3002) *Cottus semiscaber* (Cope) Rocky Mountain Bullhead.
Cottus semiscaber Cope. Jordan, Evermann and Clark Check List of Fishes U. S. Bureau of Fisheries, 1930.
Cottopis semiscaber Cope. Hayden's Surv. Mont. 1871, p. 476.
Uranidea wheeleri Cope. Proc. Amer. Phil. Soc. Phila. XIV, 1874, p. 138.

Type Locality: Beaver River, Utah.

Distribution: Bear, Utah, Fish and Panguitch lakes; Beaver, Sevier, Provo, Weber and Bear Rivers.

A List of Species that Have Been introduced into Utah Streams

Unfortunately the State Game Commissioners have never kept an accurate record of species that have been introduced into this state. I have therefore gathered my information from government reports, etc. Other species may have been introduced that are not included in this list.

- (329) *Oncorhynchus kisutch* (Walbaum). Silver Salmorn.
(331) *Oncorhynchus tshawytscha* Chinook salmon.
(334) *Salmo sebago* Girard. Landlocked salmon.
(339) *Salmo lewisii* (Girard). Yellowstone trout; Back-spotted trout.
(357) *Salmo irideus* Gibbons. Rainbow trout.
(358) *Salmo gairdnerii* Richardson. Steelhead trout.
(359) *Salmo shasta* (Jordan). Common Rainbow trout.
Salmo levenensis. Loch Leven trout.
Salmo fario. Brown or von Behr German Brown.
(369) *Cristivomer namaycush* (Walbaum). Mackinaw trout.
(371) *Salvelinus fontinalis* (Mitchill). Eastern Brook trout.
Cyprinus carpio Linn. European carp.

Plate III, Fig. Z

- (1152) *Ictalurus punctatus* (Rafinesque). Channel catfish.

Plate III, Fig. 4

- (1164) *Ameiurus nebulosus* (LeSueur). Evening pout; Small catfish.
(1169) *Ameiurus melas* (Rafinesque). Eum or mud catfish.

Plate III, Fig. 3

- (1423) *Gambusia pumilus* (Baird and Girard). Mosquito fish.

- (2180) *Perca flavescens* (Mitchill). Yellow Perch.
(2314) *Huro floridana* (LeSueur). Large-mouthed black bass.
(2315) *Micropterus dolomieu* Lacepede. Small-mouthed black bass.

Plate III, Fig. 1

- (2317) *Apomotis cyanellus* (Rafinesque). Blue-spotted sunfish.
(2324) *Lepomis auritus* (Linn.) Bream, sunfish.
(2351) *Pomoxis annularis* Rafinesque. Crappie.
Tinca tinca Boch. The Tench, a European species.

Summary

In this paper 25 native species and 23 introduced species are discussed. A systematic presentation of the families, genera and species is included. Illustrations of 10 native and 4 introduced species are included in this report.

A list of all the important papers on Utah ichthyology is presented. A bibliography is not only serviceable as a list of source material, but it gives the progress and historical aspects of the subject.

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Plate I

- Figure 1. Head of fish.
1. Nostrils; 2. premaxillary; 3. mandible; 4. Lateral portion of premaxillary; 5. Maxillary; 6. Supplementary maxillary; 7. Cheek; 8. interopercle; 9. preopercle; 10. branchiostegalis; 11. Subopercle; 12. opercle.
(From Pratt-Vertebrate Animals of the United States).
- Figure 2. The external parts of a fish, and the names by which they are referred to in the descriptions.
a. anal fin; b. barbels; c. caudal fin; d. dorsal fin; e. eye; f. depth; h. head; l. length; p. pectoral fin; v. ventral fin; l.l. lateral line.
(From Pratt-Vertebrate Animals of the United States).
- Figure 3. *Salmo utah* Suckley. Utah Trout.
(From Jordan's—Explorations in Colorado and Utah).
- Figure 4. *Leucichthys gemmifer* Snyder. Bonneville Cisco or "Peak-nose."
(From Snyder's Whitefishes from Bear Lake, Idaho and Utah).
- Figure 5. *Prosopium williamsoni* (Girard) Mountain Whitefish.
(From Jordan's—Explorations in Yellowstone National Park).

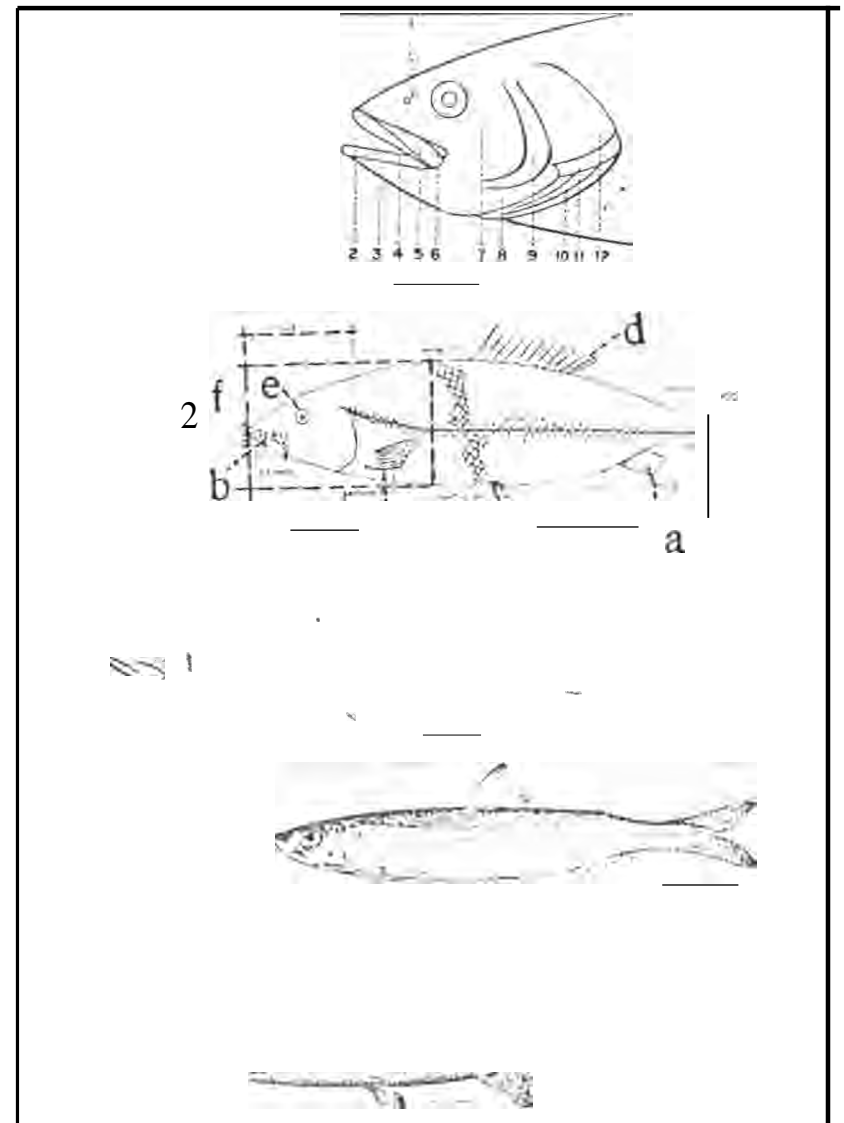


Plate I

Plate II

- Figure 1. **Notolepidomyzon utahensis** Tanner.
 Figure 2. **Catostomus fecundus** Cope and Yarrow.
 (From Jordan's—Explorations in Yellowstone National Park).
 Figure 3. **Richardsonius hydrophlox** (Cope).
 (From Jordan's—Explorations in Yellowstone National Park).
 Figure 4. **Siboma atraria** Girard.
 (From Jordan's—Explorations in Yellowstone National Park).
 Figure 5. **Rhinichthys dulcis** (Girard).
 (From Jordan's—Explorations in Yellowstone National Park).
 Figure 6. **Apocope carringtonii** Cope.
 (From Jordan's—Explorations in Yellowstone National Park).
 Figure 7. **Cottus punctulatus** (Gill).
 (From Jordan's—Explorations in Yellowstone National Park).

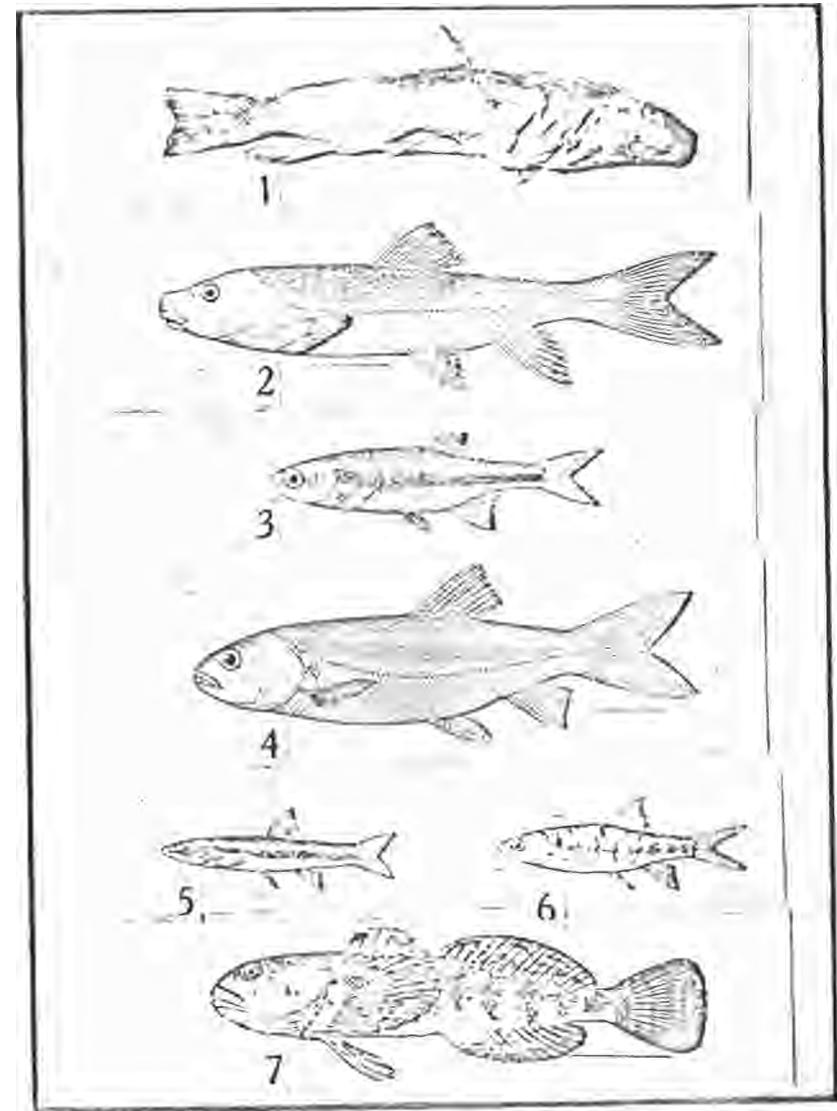


Plate II

Plate III

- Figure 1. *Micropterus dolomieu* (Lacépède), Small-mouth Black Bass.
 Figure 2. *Cyprinus carpio* Linnaeus, Common Carp.
 Figure 3. *Ameiurus melas* (Rafinesque), Mud Catfish or Black Bullhead.
 Figure 4. *Ictalurus punctatus* (Rafinesque), Channel Catfish.
 (All figures on this plate from Forbes and Richardson, The Fishes of Illinois).

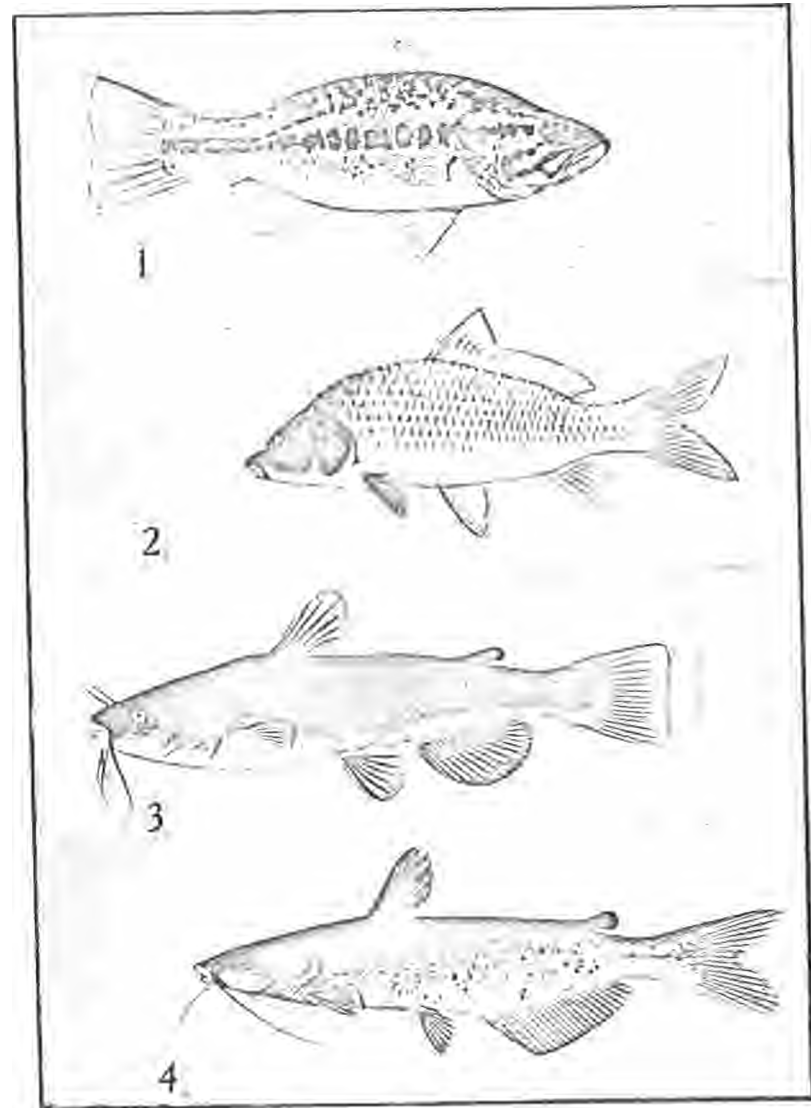


Plate III