2.—A REPORT UPON INVESTIGATIONS MADE IN TEXAS IN 1891.

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This paper is a report upon the investigations made by the U. S. Fish Commission in the State of Texas in November and December, 1891, as contemplated in an act of Congress, approved March 3, 1891, providing "For investigating respecting the advisability of establishing a fish-hatchery station in the Rocky Mountain region in the State of Montana or Wyoming, and also in the Gulf States."

The character of the station which it is desired to establish in this region is indicated in the memorandum of instructions furnished me by Col. Marshall McDonald, the Commissioner of Fish and Fisheries, viz:

> It is desirable, if practicable, to unite in one station the facilities for fish-cultural work with the salt-water species, for the pond culture of fresh-water species, for the investigation and development of methods for the propagation and rearing of the oyster, and for the investigation of the marine life of this coast. This means, of course, a laboratory of marine biological research, not large or expensive, but thoroughly equipped in all respects for its work. It is not necessary that all these requirements should be found at one locality, but they should be so closely and conveniently associated as to be brought under one direction. The requirements for each of the above classes of work may be briefly indicated as follows: For marine research and for hatching there will be required a suitable site above the chance of damage by storm or tide, with available supply of salt water. For the study of methods of oyster-culture will be needed an area of 100 to 200 acres of low-lying marsh lands, on the coast line, easily convertible into storage and rearing ponds. If this lies on the banks of a landlocked bay, from which the salt water may be conducted by canals into the ponds and which is not subject to roiling by storms, this is of course desirable.

If the requisite conditions for such a composite station could not be found sufficiently closely associated, I was instructed to make investigations in the interior of the State looking toward the selection of a site suitable for the culture of fresh-water species alone.

The requirements for the culture of fresh-water species of fish for this region are, briefly:

1. A constant supply of about 1,000 gallons of pure water per minute.

2. Not less than 20 to 30 acres of land. This land should lie so that the water may be obtained from the source of supply by means of gravity if possible. The land should be of such a character as to render the construction of ponds upon it an easy matter, and the fall should be sufficient to permit the ready drainage of any one of the series of ponds whenever occasion requires. Furthermore, there should be no danger of contamination from freshets or other causes.

3. The location should afford good railroad facilities.

REPORT OF THE INVESTIGATIONS.

GALVESTON BAY.

Investigations were made at various places in the vicinity of Galveston for the purpose of determining whether the conditions necessary for the culture of fresh-water fishes, salt-water fishes, and oysters could be found combined in one place. This, of course, means a location on or near the bay where salt water can be gotten under control and where fresh water can also be obtained. With this object in view visits were made to Dickinson, Fairwood, Hitchcock, and Highland, all on the mainland across the West Bay from Galveston; to Swan Lake and Moses Lake, on the mainland northwest of Galveston; and to South Galveston on the island.

FRESH WATER.

The only possibility of obtaining fresh water at any of these places is by means of artesian wells. There are not fewer than sixteen artesian wells on the mainland in the vicinity of Dickinson, Highland, Hitchcock, and Fairwood. The deepest of these is 768 feet, and the most shallow about 80 feet.

One well at the Ramie experimental farm on the Nicholstone estate, having a 2-inch strainer, flows 40 gallons per minute. The temperature of the water is 78°.

Another well near Dickinson flows about 25 gallons per minute; temperature, 78°.

At Fairwood is a well 576 feet deep, with a 2-inch strainer, which flows not less than 52 gallons per minute. The temperature is 78.5°. No analysis of this water has been made, but it is palatable and seems approximately pure. There is some carbureted hydrogen and a trace of iron.

Judge Wheeler's well, near Hitchcock, is 768 feet deep, has a 2-inch strainer, and flows about 48 gallons per minute. The temperature is 78°.

The Tacquard well, near Hitchcock, is 710 feet deep, has a 2-inch strainer, and flows 100 gallons per minute. The temperature is 79°. The height to which the water will rise above the surface at this well was found to be about 20 feet.

The Gulf, Colorado and Santa Fé well at Hitchcock is 726 feet deep. It has a 5-inch strainer, 30 feet long, and flows 97,000 gallons per day, or 67 gallons per minute. An analysis made April 23, 1890, by W. D. Church, chemist for the Atchison, Topeka and Santa Fé Railroad, Topeka, gave the following results:

Organic matter	Trace.
Silica	.350
Alumina and oxide of iron	.250
Bicarbonate of calcium	3.499
Bicarbonate of magnesium	1.500
Bicarbonate of potassium and sodium	17.221
Sodium chloride	9.660
Total solids (grains) per United States gallon	32.480

The temperature at outlet of pipe was 79°; density, at 15° C., 1001.91.

The South Galveston well is 800 feet deep, and has a 3-inch pipe with a 2-inch strainer. It flows 37 gallons per minute, and the temperature of the water as it comes from the pipe is 79.5°. The density at this temperature was 1002, which, reduced to 15° C., gives 1004.24.

At Judge Wheeler's residence, near Hitchcock, a fish pond has been made which receives its water supply from the artesian well. Black bass and sunfish have been placed in this pond, where they seem to thrive very well. The water of the Wheeler well does not seem to differ materially from that of the other wells of this vicinity, and it is probable that such species of fresh-water fishes as would be cultivated at the station contemplated would do fairly well in ponds supplied from any of these wells.

I understand that water has been gotten in every place on the mainland where wells have been bored, so it is quite certain that water of this character could be obtained along the mainland in the vicinity of the bay. To obtain the requisite supply would probably require three or four wells sunk to a depth of over 700 feet, and each should have at least a 3-inch strainer.

SALT WATER.

Galveston Bay is shut off from the Gulf by Bolivar Peninsula and Galveston Island, between which is the Bolivar Channel. This channel is about 2 miles wide and is the entrance to the bay. The greatest length of the bay is from northeast to southwest, and is approximately 35 miles. The width between Bolivar Point and Swan Lake is about 7 miles. Above these points the bay widens out greatly, sending an arm known as East Bay to the eastward. Including East Bay, it is here not less than 27 miles wide. Above this it constricts again between Edwards and Smith Points, where it is less than 8 miles wide. Above Redfish Bar, lying between Edwards and Smith Points, is really the main part of the bay, the greatest width of which is about 14 miles, on a line running northwest from Smith Point to Morgan Point at San Jacinto Bay. Extending westward from the east end of Galveston Island, and separating it from the mainland, is West Bay. At the northeast end of the bay is a small bay known as Turtle Bay, shut off from the main bay by the delta of the Trinity River. At the northwest corner, lying above Morgan Point, is San Jacinto Bay, into which the San Jacinto River and Buffalo Bayou empty. About 10 miles down the west shore is the mouth of Clear Creek, the outlet of Clear Lake. Seven miles farther down is the mouth of Dickinson Bayou, just below which is Moses Lake; and 5 miles below this, or about 6 miles northwest from Galveston, is Swan Lake. Just north of Galveston, and between Swan Lake and Bolivar Point, are Pelican Spit and Pelican Island.

Through the greater part of the bay the depth of water is given as from 1 foot to 11 fathoms. According to the U. S. Coast Survey Chart (No. 204) of Galveston Bay—

There is usually one high and one low water here in each lunar day. The highest tides occur when the moon's declination is greatest, either north or south, and they are slightly increased when the greatest declination falls near the time of new or full moon. When the moon's declination is near zero, small tides usually appear twice a day for two or three days. The following table is made from average values:

Place.	Rise and fall of tides.		
	Mean.	At moon's greatest declination.	At moon's zero declination.
	Feet.	*Feet.*	*Feet.*
Galveston entrance	1.1	1.6	0.8
Pelican Spit	1.1	.....	.....
Redfish Bar	0.5	.....	.....

It is high water about seven or eight hours after the moon's meridian passage when the moon's declination is greatest south, and nearly twenty hours after when it is greatest north; but these intervals are uncertain by several hours. The effects of the winds are often greater than the real tides, and the time and the height of the apparent tides are greatly dependent on them.

The waters of Galveston Bay seem well adapted to the oyster. Oysters of good size and quality were seen about the wharves at Galveston, at Swan Lake, Moses Lake, Dickinson Bayou, Virginia Point, and other places.

The Galveston Packing Company was organized two or three years ago at Galveston for the purpose of developing the oyster industry at that place. This company has located 6,000 acres in the bay, principally in the vicinity of Pelican Island, of which they have planted 440 acres. Three thousand bushels of shells were planted upon one tract of 10 acres. Upon these shells a good set was obtained. These oysters were about eighteen months old at the time of our visit, and were very abundant and of excellent quality.

The density of the water here was 1021.66;* the temperature at surface, 72.5°, November 9, at noon.

Just off the outlet of Swan Lake the density was 1018.30; temperature at the surface at 10 a. m., November 10, 62°. Just inside of Swan Lake the density was 1017.30. Swan Lake is a shallow body of salt water, covering 600 or 700 acres. It has two outlets into the bay, one about 100 feet wide, the other about half as wide. Between these two narrow outlets is a low mud island which no doubt is flooded frequently at high tide. Oysters are quite abundant in this little lake, and we noticed two or three boats tonging oysters here. I paid special attention to this lake, as it seemed to present many of the conditions required for the station under consideration.

Swan Lake is quite shallow and, according to Mr. Parr, who lives upon the shore, is rapidly filling up. He says the lake is less than half as large as it was eighty years ago, when his father first settled upon it, and that it has decreased much in size during the last forty years, or within his own memory. The shores are, in the main, very low, particularly at the north end and on the east and southeast, where they are marshy. At the north end one or two small creeks flow into the lake, but I do not imagine the amount of water they carry in can be very great. At Mr. Parr's place, on the west side of the lake near the south end, the shore is several feet high, and apparently never subject to overflow. The greater part of the shore, however, is certainly flooded occasionally.

The low-lying land just north of Mr. Parr's, near the upper end of the west side of the lake, could be easily converted into ponds suitable for the study of methods of oyster-culture. Whether the water often becomes roiled I was not able to learn, nor do I know how injurious occasional flooding of the ponds would prove. Flood-gates could be constructed at the outlet of the lake by means of which the water coming in with the tide could be stored and fed out to the ponds between tides.

The tide is so little at this place that it could scarcely be depended upon for giving a gravity supply, consequently pumping would have to be resorted to. It is probable that water for the fresh-water ponds could be obtained by sinking artesian wells. These ponds could be constructed on the higher land near the south end of the lake.

*The density, as given in this report, is that of the water reduced to 15° C.

This location is about 3 miles from the railroad station at Virginia Point. It would seem to me that such a composite station as is contemplated could, with reasonable safety, be established in the vicinity of Swan Lake. The cost of getting sufficient water, salt and fresh, the doubt as to whether the artesian water would prove satisfactory, and the danger of flooding and roiling from storms, are questions that would have to be carefully considered.

The country in the vicinity of Moses Lake, Clear Creek, and Highland Bayou was also examined, but in no one of these places could the desired conditions be found, the danger of fresh-water flooding in each case being too great.

A visit was also made to South Galveston, on the island 10 miles southwest from the city of Galveston. At this point the South Galveston Land Company has recently struck water that seems fairly fresh. The depth of the well is 800 feet. With a 2-inch strainer the flow is 37 gallons per minute. The temperature of the water was 79.5°, and the density was 1004.24.

There is but little, if any, saline taste to the water, and it might prove suited to fresh-water fishes. There is considerable gas (probably CH_4) dissolved in this water, as was evidenced by the fact that a slight explosion was obtained upon applying a burning match at the end of the horizontal pipe through which the water was led from the well. Upon issuing from the pipe the water is quite murky, but very soon clears by the escaping of the contained gas or gases.

On the West Bay side of the island, a short distance from this well, are two narrow bays extending obliquely into the island. Each of these contains approximately 40 acres. The land adjacent to each is low, but probably high enough to prevent flooding, except during very heavy storms. Either of these small bays could be quite easily supplied with gates at the mouth and its water thus brought under control. Ponds could be constructed near them that would probably answer fairly well for oyster-culture. Higher ground can be found near by, suitable for the fresh-water ponds. Mr. Gray, the president of the South Galveston Land Company, says the company will give the Commission one of these bays and all the land it may need. This location does not seem as desirable, however, as the one at Swan Lake—the land not lying so satisfactorily and the water being less fresh than that which could probably be gotten at Swan Lake.

Mr. Fred Nichols offers a site near the mouth of Dickinson Bayou. The land there seems safe from overflow, and salt water could be gotten by pumping from the bayou. It is quite certain, however, that this bayou at times becomes too fresh for salt-water culture. Fresh water could be secured here, as elsewhere upon the mainland, by means of artesian wells. Mr. Nichols would no doubt donate all the land needed.

Dickinson Bayou.—This bayou is about 18 miles long and empties into Galveston Bay about 15 miles north of Galveston. In its lower portion its waters are salt except at the time of heavy rains, and the water is more or less brackish nearly throughout the course of the stream. The depth probably ranges from 4 to 18 feet. The water is rather warm and is stained more or less by vegetable matter in the stream. The current is sluggish and the banks and bottom are of mud in most places. The shores are low and are well covered with vegetation. There is a heavy growth of timber, the principal trees being several species of oak, elm, hackberry, ash, box elder, etc. The most characteristic and striking feature of the timber along Dickin-

lateral cleft; scales moderate, rather deeper than long, those in front of dorsal small; breast naked; lateral line complete, somewhat decurved. Origin of dorsal slightly behind that of ventrals, nearer snout than base of caudal, its height equal to length of head, pointed, the free margin nearly straight, inclined to be concave; anal small, its base one-half length of head, about equal to the dorsal in height.

Color of Neches River specimens pale, the upper parts of the body with numerous fine brown specks arranged chiefly along edge of scales so as to give a regular cross-hatching, this covering the caudal peduncle; middle of side with a plumbeous band about one scale wide, extending also across cheek and upon snout; two rows of small spots above and parallel with the plumbeous band and one below it, not distinct in some specimens; top of head dark, an indistinct line from nape to origin of dorsal fin; lower parts of body plain except on posterior portion where the cross-hatching extends to under side of caudal peduncle; no spot at base of caudal; fins plain or with a few scattered punctulations on dorsal and anal, no evidence of the large black area found on dorsal fin of *O. emiliæ*.

The specimens from Long Lake, Dickinson Bayou, Buffalo Bayou, and Kilper's Ponds agree in color with those from the Neches River, while all the specimens from Sims Bayou are nearly uniform pale yellowish throughout, there being no markings anywhere except a very faint lateral band and a few scattered punctulations discernible only under a lens; dorsal and anal wholly plain. The pale, bleached appearance of the specimens from Sims Bayou is quite certainly due to the peculiar character of the place in which they were found, it being a shallow, isolated, and stagnant pool with mud bottom, containing scarcely any vegetation and lying exposed on the open prairie. Thousands of cattle from the surrounding prairie come to this pool for water during the dry season, and, in consequence, the banks are much cut up and the water is more or less foul. These conditions, of course, have their effect upon the fishes found there, and all the species obtained there by us present the same faded appearance.

This species is quite close to *O. emiliæ* Hay, but may be distinguished from it by the less depth of the head, the more pointed dorsal and anal fins, and by the very different coloration. A specimen of *O. emiliæ* from Mayfield Creek, Kentucky, collected by Mr. A. J. Woolman, has the depth at the eye half length of head, and the free margin of the dorsal, as well as that of the anal, is convex, while in the Texas specimens it is straight or even concave, due to the greater length of the first three rays. These small differences, together with the entire absence of the large black spot on the dorsal fin which constitutes such a noticeable feature in the coloration of *O. emiliæ*, and the presence (except in the bleached specimens) of a much more distinct plumbeous lateral band than is found in any of the specimens of *O. emiliæ* that I have examined, do not permit me to believe that the two are specifically identical. To regard the Texas specimens as being *O. emiliæ* would require, it seems to me, either that the lateral band should be obsolete or that there should be some evidence of the presence of the black area on the dorsal fin; for it would seem that conditions which would result in *intensifying* one of these color markings would not *obliterate* the other.

This species differs from the other of the two known species of this genus (*O. bollmani*, recently described by Dr. Charles H. Gilbert, from Buckhead Creek, Georgia), in having the lateral line complete and in not having the black caudal spot so conspicuous in that species.

18. Notemigonus chrysoleucus (Mitch.).

Numerous specimens of this widely distributed minnow were taken at each of the following places: Neches River, 14 miles east of Palestine; Long Lake and Trinity River, near Palestine; Sims Bayou, Kilper's Ponds, and Big White Oak Bayou, at Houston; and Dickinson Bayou, near Dickinson.

19. Cyprinodon variegatus (Lacépède).

Thirty specimens of this species were obtained at Galveston, 3 from Dickinson Bayou, and 10 from Corpus Christi. It is abundant both at Galveston and Corpus Christi. This is the form described by Baird and Girard as *C. gibbosus*, but our specimens do not seem to differ materially from northern ones.

In our study of this and related species we had occasion to compare specimens of *Cyprinodon carpio* Günther and *C. mydrus* Goode & Bean, and can not see any tangible differences.

20. Fundulus similis (B. & G.).

The collection contains 14 specimens from Galveston and 2 from Corpus Christi. It is an abundant species at each place.

21. Fundulus heteroclitus (L.).

A dozen specimens from Corpus Christi, 2 from Dickinson Bayou, and 14 from Galveston, at each of which places it is abundant.

22. Fundulus pallidus, sp. nov. (Pl. XXXV.)

One specimen, $1\frac{3}{4}$ inches in total length, taken in Galveston Bay, near Swan Lake, Texas, November 10, 1891. Head, $3\frac{1}{2}$; depth, 4; eye, $3\frac{1}{2}$; D. 12; A. 11; scales, 31–11, about 16 before the dorsal.

Body, stout; head, heavy; caudal peduncle long and much compressed; snout, short and blunt, shorter than eye, which is two-thirds the width of the interorbital space; humeral scale not enlarged, two rows of scales on the cheek; mouth rather small, little oblique, teeth pointed, in more than one series, the outer enlarged. Dorsal fin over the anal, its origin midway between base of caudal and posterior edge of opercle, or midway of total length, its ray short, about $1\frac{1}{3}$ in head; anal rays about equal in length to those of dorsal.

Scales medium, not firmly attached, 31 in longitudinal series, 11 in transverse from dorsal to anal, about 16 before the dorsal.

Color, pale yellowish; sides with about 13 narrow, dark, vertical bars, much narrower than the pale interspaces, not extending on the back or belly; scales sparsely covered with fine dark punctulations, few on the vertical fins and head; a large oblong black spot on the back immediately in front of dorsal fin.

This species is allied to *Fundulus similis* Baird and Girard, but the head is less pointed, the snout very much shorter, it being shorter than the eye, while in *F. similis* it is $1\frac{1}{2}$ times the eye, the dorsal has one more ray and the anal two or three more, the color is paler, the bars less distinct, there is no dark dorsal line as in the other, while the pronounced black spot in front of the dorsal is not found on *F. similis*.

23. Fundulus xenicus Jordan and Gilbert.

Fundulus xenicus Jordan and Gilbert, Proc. U. S. N. M. 1882, 255 (Pensacola); Synopsis, 1882. 892.
Adinia multifasciata Girard, Proc. Acad. Nat. Sci. Phila. 1859, 117.

Four specimens of this interesting little species were taken in Galveston Bay. Head, 3; depth, 2½; eye, 3; snout, 3; D. 12; A. 12.

Body greatly compressed, the back elevated, profile from snout to dorsal nearly straight, this forming an acute angle with the ventral line from snout to anal fin; caudal peduncle very deep, its greatest depth 1¼ in head; dorsal large, its origin in front of anal, the longest rays nearly as long as head. The dusky blotch said to be below and behind the eye is not evident.

24. Zygonectes funduloides, sp. nov. (Pl. XXXV.)

This species is described from two specimens, each 1½ inches long, from Dickinson Bayou, Dickinson, Texas, November 13, 1891. Head, 3⅓; depth, 4½; eye, 3¼; D. 9 or 10; A. 9; scales, 35–11, 24 before the dorsal.

Body moderately robust, width at pectorals a little greater than greatest depth of head; snout rather blunt, equal to eye; interorbital width 1⅔ times diameter of eye; caudal peduncle deep and compressed; mouth not large nor greatly oblique; teeth pointed, the outer series being somewhat enlarged; peritoneum pale. General color in spirits, dark olivaceous, sides with 10 to 14 dark vertical bars which are usually two to three times as wide as the intervening silvery ones; in one specimen the bars extending from the dorsal to the anal are about equal in width to the silvery interspaces; whole body, including all the fins, profusely dusted over with minute brownish spots which are very numerous on back and top of head; a narrow, dark line extending from nape to origin of dorsal.

Dorsal fin small, slightly in front of anal, its origin midway between posterior edge of opercle and base of caudal fin, the longest rays about equal to base of fin, or half length of head.

If the characters which are used to distinguish the genus *Fundulus* from *Zygonectes* are really of generic value, the small size of the dorsal fin would put this species in *Zygonectes*, though the position of the fin is rather that of *Fundulus*. I have compared these specimens with numerous young individuals of *F. heteroclitus* collected by Dr. H. M. Smith at St. George Island, Maryland, and find them very similar in general appearance; in *Z. funduloides*, however, the dorsal is placed further back, and has fewer rays (9 or 10 instead of 12), the anal is smaller (9 instead of 11); the pattern or coloration is the same, but the contrasts are more marked, and instead of the dark dorsal band found in this species the young of *F. heteroclitus* have a small dusky area at base of dorsal in front; the young have an ocellus upon last rays of dorsal, which is not found in the other species.

25. Zygonectes pulvereus, sp. nov. (Pl. XXXVI.)

This species is based upon the following specimens:

Nine specimens, 1½ to 2 inches long, from Dickinson Bayou, Dickinson, Texas, November 13 and 14, 1891.

One specimen, 1½ inches long, from Buffalo Bayou, Houston, Texas, November 16, 1891.

One specimen, 1½ inches long, from the mouth of Oso Creek, Corpus Christi, Texas, November 28, 1891.

Head, 3½; depth, 4½; eye, 3½; D. 10 (11 in one specimen); A. 10 (occasionally 9); scales, 35–11, about 22 before the dorsal.

Body stout, heavy forward; head broad and flat, the snout short and blunt; caudal peduncle long, deep, and greatly compressed; eye moderate, 1½ in interorbital width, greater than snout; humeral scale not enlarged, four rows of scales on cheek; mouth rather small, but little oblique; teeth pointed, in more than one series, the outer enlarged and canine-like; peritoneum pale. Dorsal slightly in advance of anal, its origin midway between tip of caudal and anterior rim of orbit, or about midway between base of caudal and opercular opening; anal small, its longest rays 1½ in head.

Color in alcohol, olivaceous, profusely sprinkled or dusted all over except on breast with very fine brown punctulations, so abundant on back as to obscure the individual specks; median line of back with a black stripe from occiput to dorsal fin; sides with 10 to 12 or more brown spots of larger size, these sometimes arranged somewhat definitely in two longitudinal lines, in the upper one of which the spots are confluent in some examples, forming large, oblong blotches; all the fins except the ventrals with numerous very small brown specks.

This species resembles *Z. jenkinsi*, but differs from it in the larger dorsal, much smaller anal, smaller scales, the much shorter snout, the heavier or broader head, and in the coloration. The localities from which the types were obtained would indicate that it is an inhabitant of water that is but little brackish or almost fresh.

26. Zygonectes jenkinsi, sp. nov. (Pl. XXXVI.)

This species is based upon 21 specimens, ranging in length from 1½ to 2⅛ inches, collected in Dickinson Bayou, near Dickinson, Texas, November 14, 1891, and 11 examples from Galveston Bay, Galveston, Texas, collected a day or two earlier.

Head, 3½; depth, 4½ (4⅕ to 5); eye, 3½ (3⅓ to 3⅖); D. 8 or 9; A. 12 (11 to 13); scales, 33–10, 18 before the dorsal. Body moderately elongate, head depressed, wide between the eyes, pointed, the snout about one-fourth greater than eye, which is contained 1½ times in interorbital width; mouth rather large, little oblique; teeth in more than one series, the outer enlarged, pointed, and slightly curved inward; humeral scale small, three rows of scales on cheek. Fins medium, dorsal slightly behind anal, midway between tip of caudal and posterior rim of orbit, the distance from tip of snout to origin of dorsal being twice the distance from that point to base of caudal fin; dorsal and anal low, their longest rays half length of head; base of anal 2½ in head; pectorals 1¾ in head; ventrals short, 1½ in pectoral; caudal fin truncate, about as long as head; peritoneum black.

Color, pale olivaceous, covered except on breast with numerous minute dark-brown specks, arranged chiefly along the edges of the scales, thus giving the sides and back a checkered or cross-hatched appearance; in addition to these fine punctulations, there are usually 15 to 30 larger spots more or less definitely arranged in two rows lying along or above the axis of the body; in some examples these spots are absent or blended so as to form short, indistinct vertical bars; in most specimens there is a very obscure lateral band about one scale in width; fins plain or with few very minute punctulations; top of head dark.

Related to *Z. rubrifrons* Jordan, but differing from it in the following particulars: The body is more slender, the head is shorter, the dorsal and anal are larger, and the color markings are quite different. Compared with specimens of *Z. henshalli* Jordan,

it is more slender, the snout is longer and more pointed, and the color is not the same; from specimens of *Z. cingulatus* Cuv. and Val. from Pensacola, the differences are seen to be about the same as those which distinguish it from *Z. henshalli;* from the types of *Z. auroguttatus* Hay, it differs chiefly in the greater number of anal rays and the less distinct crossbars.

I name this species for Prof. O. P. Jenkins, of Leland Stanford Junior University, in recognition of his work upon the fishes of the Sandwich Islands.

27. Zygonectes notatus (Raf.).

Specimens of this widely distributed species were obtained at the following places:

Neches River, east of Palestine	27
Trinity River, at Magnolia Point	2
Long Lake, near Magnolia Point	15
Buffalo Bayou, Houston	7
Big White Oak Bayou, Houston	23
San Antonio Springs, San Antonio	5

These Texas specimens do not differ apparently from examples collected in Indiana.

28. Zygonectes escambiæ Bollman.

Zygonectes escambiæ Bollman, Proc. U. S. N. M. 1886, 463 (Escambia River, Flomaton, Ala.).

From a pond on the bank of the Trinity River, at Magnolia Point, we obtained 5 specimens that I refer to this species.

Head, 4; depth, 5; eye, $2\frac{3}{4}$, greater than snout; scales about 38–10, 20 before the dorsal; dorsal, 7 or 8, slightly behind the anal; anal, 9. Sides with about 10 brownish or chocolate lines made up of a spot on each scale; in two of the five examples these lines are more nearly continuous than in the others; between these are smaller spots hardly forming lines; the individuals with the spots most distinct are probably males.

Compared with the types of *Z. escambiæ*, these specimens are more slender, the spots come nearer to forming continuous bands, and the fins are all plain, compared with the types of *Z. craticula* Goode and Bean, which are from Indian River, Florida; the snout is shorter and less pointed, the lower jaw projects less, and the longitudinal lines are less marked. Specimens of *Z. craticula* collected at Titusville, Florida, by Mr. R. E. Earll, show about 10 dark crossbars not developed on any of the other specimens examined except on one collected at Westville, Florida, by Dr. O. P. Hay, and identified by him as the *Z. nottii* of Agassiz. *Zygonectes escambiæ* Bollman closely resembles *Z. craticula* Goode and Bean, and it may be that they are both identical with *Z. nottii* Ag. The briefness of Agassiz's description of *Z. nottii* makes it very difficult to identify that species with certainty, and it is perhaps best to let the names stand as above.

29. Lucania parva (B. and G.).

Cyprinodon parvus Baird and Girard, 9th Smithsonian Report, for 1854, 345 (Greenport, Long Island).

One specimen of this interesting little fish was taken in Sims Bayou, at Houston, 3 in Dickinson Bayou, 4 in San Antonio Springs, and 4 at Corpus Christi.

This species at first glance much resembles *Gambusia patruelis*, and, in collecting, is apt to be mistaken for that species.

30. Gambusia patruelis (B. and G.).

Heterandria patruelis Baird and Girard, Proc. Acad. Nat. Sci. Phila. 1853, 390.
Gambusia gracilis Girard, Proc. Acad. Nat. Sci. Phila. 1859, 121 (Matamoras).
Gambusia humilis Günther, Cat. Fish., VI, 335, 1866 (Matamoras).
Haplochilus melanops Cope, Proc. Amer. Phil. Soc. 1870, 457 (Neuse River).
Zygonectes atrilatus Jordan and Brayton, Bull. U. S. N. M., XII, 84, 1878 (Neuse River, North Carolina.)
Zygonectes brachypterus Cope, Jordan and Gilbert's Synopsis, 341, 1882 (Trinity River and other streams of Texas).

This species is represented in the collection from Texas by the following specimens:

Neches River, east of Palestine	1
Trinity River at Magnolia Point	2
Long Lake, near Magnolia Point	2
Buffalo Bayou, Houston	8
Hunter Creek, Houston	10
Kilper's Ponds, Houston	38
Big White Oak Bayou, Houston	5
Sims Bayou, Houston	48
Dickinson Bayou, Dickinson	36
San Antonio Springs, San Antonio	15
Comal Creek, New Braunfels	127
Rio San Marcos, San Marcos	68

All the specimens from the first seven localities show the dark suborbital spot very distinctly. All the specimens from Sims Bayou are very pale and there is no suborbital spot in any of them, but all the fishes gotten from this place present a bleached appearance, due, no doubt, to the character of the water in which they were found, which was a muddy and foul pool left by the drying up of the greater part of the stream. Of the specimens obtained from Dickinson Bayou, 4 show the spot while the others are plain. All these specimens were also quite pale. The 15 specimens from San Antonio are quite dark, and the majority show the dark suborbital spot. The majority of the numerous specimens from New Braunfels show the spot, though in some it is quite faint and in others it is wholly absent. All these specimens are quite dark and resemble those from San Antonio. Those from San Marcos are rather pale and but few of them show the suborbital spot.

There do not seem to be any good reasons for separating *G. humilis* from *patruelis*, even as a geographical form.

In many of the female specimens from San Antonio and New Braunfels the embryos are quite large, fully ¼ inch in length, showing that the species produces its young in midwinter in southern Texas. Specimens collected by Dr. Hugh M. Smith, at St. George Island, Maryland, July 1, contained immature eggs, while others collected at the same place by him August 11 contained young apparently ready for extrusion.

31. Mollienesia latipinna Le Sueur.

One specimen of this attractive species was taken at Corpus Christi, 2 at Galveston, 42 at Dickinson Bayou, and 1 from Hunter Creek, near Houston.

LIST OF CRUSTACEA COLLECTED.

[By Mary J. Rathbun, Department of Marine Invertebrates, National Museum.]

The collection of Crustacea of which a list is given below was made by Prof. B. W. Evermann, of the U. S. Fish Commission, during the months of November and December, 1891, while engaged in an investigation of the fresh and salt waters of eastern Texas, with a view to the establishment of a hatchery. While the collection contains no new species, it is interesting from the fact that it extends the limits of many species and furnishes new localities for others. Those species which have not been hitherto recorded from a locality so far south, are as follows: *Panopeus depressus*, *Callinectes hastatus*, *Tozeuma carolinensis*, *Palæmonetes vulgaris*, *Palæmonetes exilipes*, *Palæmon ohionis*. *Hippa emerita* (not *talpoida* Say) has not been found further north than Cuba and Mexico. The species whose range includes Texas but which have not been previously recorded from there, are *Libinia dubia*, *Panopeus herbstii*, *Arenæus cribrarius*, *Petrolisthes armatus*, *Alpheus heterochælis*, and *Squilla empusa*.

BRACHYURA.

1. **Libinia dubia** Milne-Edwards.
   Corpus Christi; Shamrock Point, Corpus Christi.
2. **Panopeus herbstii** Milne-Edwards.
   Galveston Bay.
3. **Panopeus texanus** Stimpson.
   Shamrock Point, Corpus Christi.
4. **Panopeus depressus** Smith.
   Galveston Bay.
5. **Callinectes hastatus** (Say).
   Galveston Bay; jetty, Galveston; Swan Lake, Galveston; Corpus Christi; Shamrock Point, Corpus Christi; Dickinson Bayou. The specimens are all small, except one large male from Galveston Bay.
6. **Arenæus cribrarius** (Lamarck).
   Corpus Christi Bay.
7. **Sesarma cinerea** (Bosc).
   Swan Lake, Galveston.

ANOMURA.

8. **Petrolisthes armatus** (Gibbes).
   Galveston Bay.
9. **Hippa emerita** (Linné ?) Fabricius.
   Galveston Bay; Swan Lake, Galveston. Easily distinguished from *talpoida* by the following characteristics: The median lobe of the front is more triangular; the lateral lobes much longer and narrower. Second joint of outer antennæ with the median spine very long, much exceeding the eyes, directed slightly outward; while in *talpoida* the spine is much shorter and directed inward. Third point of outer maxillipeds longer and narrower than in *talpoida*, the inner margin being straight or slightly concave for its anterior two-thirds instead of convex as in *talpoida*; the lobe

at the antero-internal angle much longer. In the specimens under discussion the terminal joint of the third pair of legs is lanceolate, but this is not characteristic of the species.

MACRURA.

10. Tozeuma carolinensis Kingsley.

Shamrock Point, Corpus Christi.

11. Alpheus heterochælis Say.

Galveston Bay; jetty, Galveston Bay.

12. Palæmonetes vulgaris (Say).

Galveston Bay; Swan Lake, Galveston; Corpus Christi; Dickinson Bayou. The specimens agree in having the tip of the rostrum devoid of spines.

13. Palæmonetes exilipes Stimpson.

Neches River, fourteen miles east of Palestine; Magnolia Point, Trinity River; Kilper's Pond, Houston; Big White Oak Bayou, two miles south of Houston; Corpus Christi. While as a rule the rostrum has seven or eight teeth above and two below, one specimen has nine above and three below, and several specimens with eight above have three below. The single specimen from Corpus Christi is the only one in which the rostrum exceeds the antennal scales.

14. Palæmon ohionis Smith.

Long Lake, Palestine; Magnolia Point, Trinity River; Big White Oak Bayou, two miles south of Houston.

15. Penæus setiferus (Linné).

Galveston Bay; jetty, Galveston Bay; Swan Lake, Galveston; Corpus Christi.

16. Penæus brasiliensis Latreille.

Galveston Bay; Swan Lake, Galveston; Corpus Christi Bay; Corpus Christi.

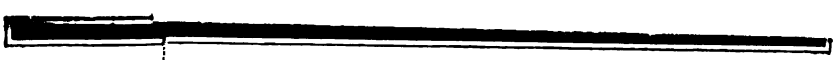
17. Cambarus clarkii Girard.

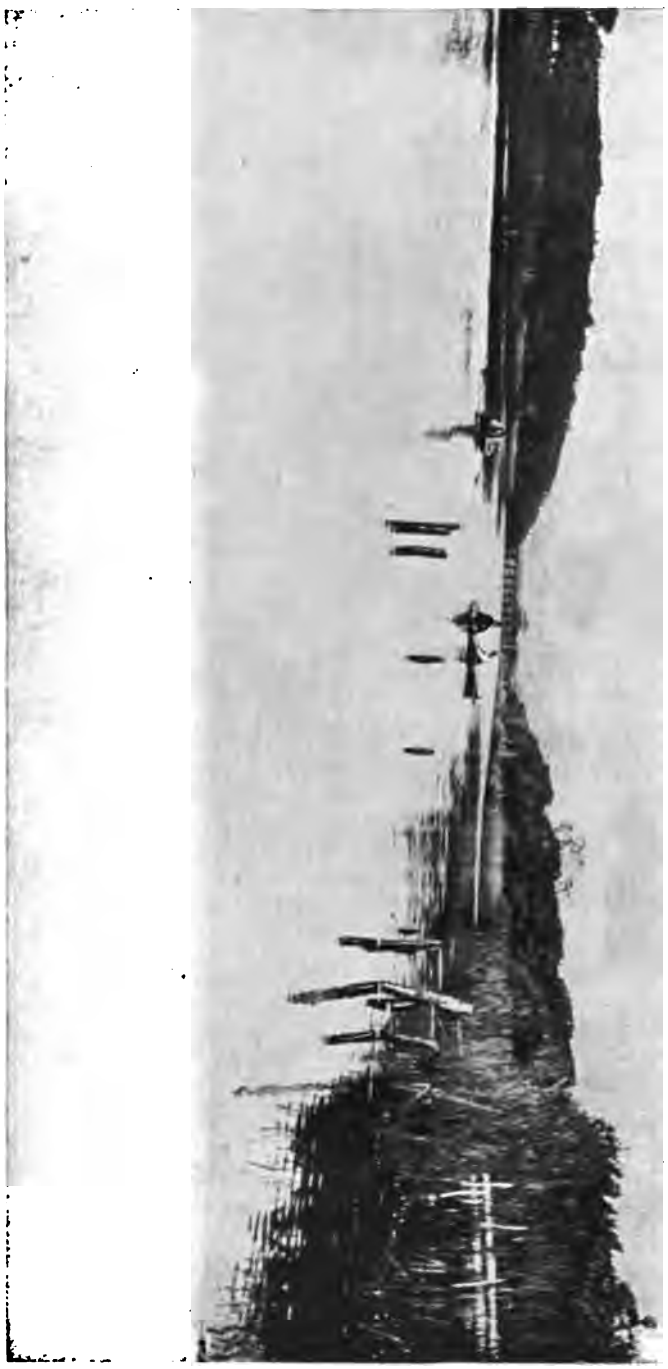
Swan Lake, Galveston. One young male.

STOMATOPODA.

18. Squilla empusa Say.

Jetty, Galveston Bay.





DICKINSON BAYOU, UPSTREAM FROM NICHOLSTONE; DICKINSON, TEXAS

TRINITY RIVER NEAR MAGNOLIA POINT, TEXAS.

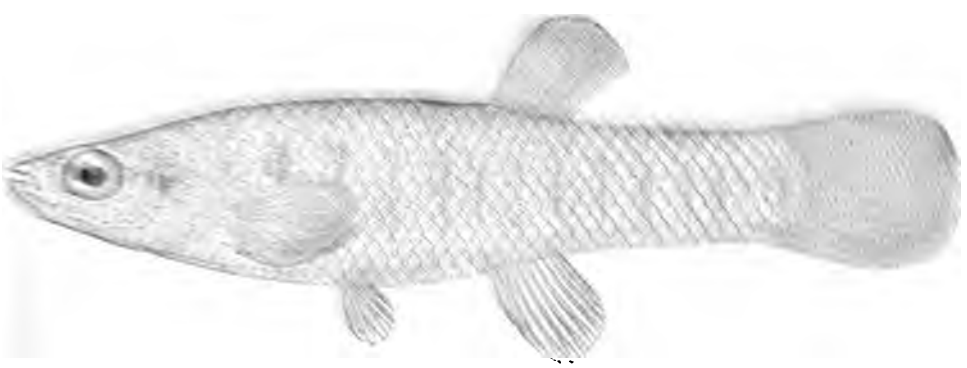
FISH POND AT SAN PEDRO SPRINGS, SAN ANTONIO, TEXAS.

SAN MARCOS RIVER AT THE MILL, SAN MARCOS, TEXAS.

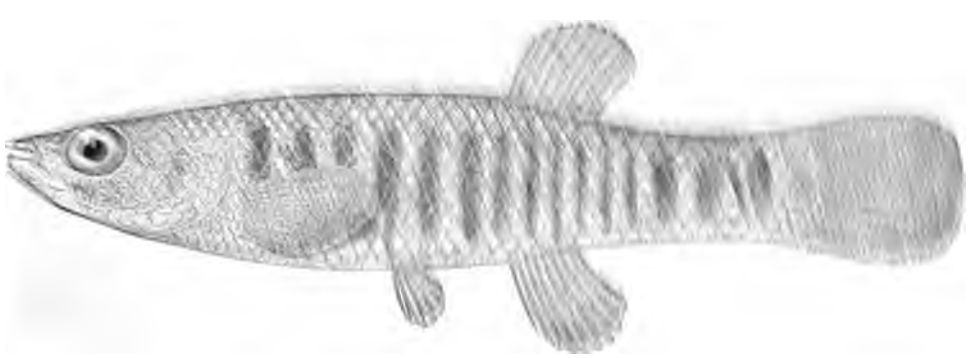
PLATE XXXIII.

SAN MARCOS SPRING, SAN MARCOS, TEXAS.

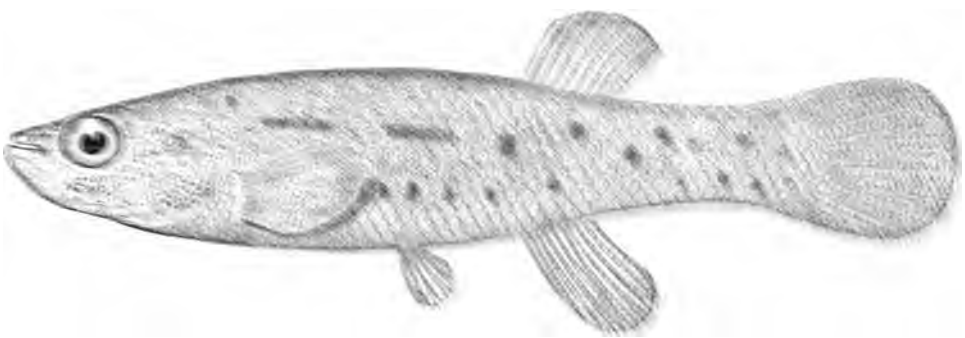
SAN MARCOS SPRING, SAN MARCOS, TEXAS.



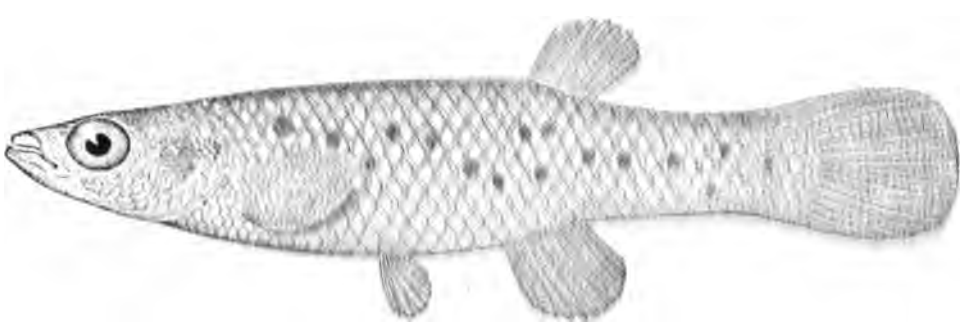
2. FUNDULUS PALLIDUS, sp. nov. About three and a half times natural size.



3. ZYGONECTES FUNDULOIDES, sp. nov. About three and a half times natural size.



1. ZYGONECTES PULVEREUS, sp. nov. About three times natural size.



2. ZYGONECTES JENKINSI, sp. nov. About three times natural size