

AN ANNOTATED CHECKLIST OF THE FRESHWATER FISHES OF TEXAS, WITH KEYS TO IDENTIFICATION OF SPECIES

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ABSTRACT.—Forty-five families and 247 species of fishes are known to inhabit the freshwaters of Texas. We report on the distribution and status of these fishes and provide a key to their identification. Of the native fishes originally found in Texas, five taxa, *Notropis orca* (phantom shiner), *Notropis simus simus* (Rio Grande bluntnose shiner), *Cyprinella lutrensis blairi* (Maravillas red shiner), *Gambusia amistadensis* (Amistad gambusia) and *Gambusia georgei* (San Marcos gambusia) are apparently extinct, and three, *Oncorhynchus clarki virginialis* (Rio Grande cutthroat trout), *Hybognathus amarus* (Rio Grande silvery minnow) and *Gambusia senilis* (blotched gambusia) appear to be extirpated from the state. More than 20 percent of the remaining primary freshwater species appear to be in some need of protection. *Key words*: Texas fishes; dichotomous keys; fish distribution; checklist.

The freshwater fish fauna of Texas is conspicuous in its diversity and high degree of endemism. Contributing factors include the large geographic area covered by the state, the number of discontinuous drainages, and the diversity of hydrographic features. Equally important, however, is the fact that Texas occupies a broad transition zone between several major physiographic provinces of North America and encompasses a large number of distinctive biotic zones (Hubbs, 1957b; Edwards et al., 1989). More than two-thirds of the 247 species we recognize are exclusively freshwater fishes. The remaining 78 species are estuarine or marine but may be found in low salinity habitats. A precise separation is quite subjective as many streams (the Pecos, Brazos, and Wichita rivers, for example) commonly have salinities higher than those in the tidally influenced Sabine Lake.

The number of fish species historically recognized as the Texas fauna ranged from 154 (Evermann and Kendall, 1894) through 190 (Knapp, 1953), 197 (Jurgens and Hubbs, 1953), 208 (Hubbs, 1957a), 209 (Hubbs, 1958), 211 (Hubbs, 1961), 215 (Hubbs, 1972), 217 (Hubbs, 1976), 226 (Hubbs, 1982) to the present 247. There have been a few cases of species being synonymized and removed from the list, as in the case of *Fundulus kansae* and *Fundulus zebrinus*. The senior synonym for these two conspecifics is *F. zebrinus*, but the common name of plains killifish was retained as more appropriate and familiar (Robins et al., 1980). Conversely, many species have been added because a once widespread taxon has been shown to represent two or more distinct species such as the recent separation of *Dionda serena* and *D. argentosa* from *D. episcopa* (Mayden et al., 1992). We propose as common names, Nueces

roundnose minnow for *D. serena* and manantial roundnose minnow for *D. argentosa*. Other additions result from the 18 exotic fishes that have established breeding populations. Still others have been added because of geographic range extensions, such as the discovery of *Heterandria formosa* (least killifish) in the Sabine River.

An unfortunately large number of freshwater fishes have been adversely impacted by human activities. Approximately 20 percent of Texas freshwater fishes are now of conservation concern (that is, they are either directly or potentially in danger of extinction or extirpation). In the Chihuahuan Desert region (west of the Pecos River), about half of the native fish species are threatened with extinction or already are extinct (Edwards et al., 1989; Hubbs, 1990). Five fishes that once inhabited Texas are now extinct, *Notropis orca* (phantom shiner), *Notropis simus simus* (Rio Grande bluntnose shiner), *Cyprinella lutrensis blairi* (Maravillas red shiner), *Gambusia amistadensis* (Amistad gambusia) and *Gambusia georgei* (San Marcos gambusia). Three more have been extirpated from the state. Presumably *Oncorhynchus clarki virginialis* (Rio Grande cutthroat trout) occurred in McKittrick and Limpia creeks in west Texas, but none have been caught (or seen) in recent times (Garrett and Matlock, 1991). *Hybognathus amarus* (Rio Grande silvery minnow) once inhabited the entire Rio Grande Basin, but now has a sharply limited range in the Rio Grande in New Mexico. *Gambusia senilis* (blotched gambusia) once lived in the Devils River but the species now occurs only in the Rio Conchos Basin in Chihuahua, Mexico.

All extinctions and extirpations are from the 169 native species that rarely, if ever, enter estuaries. This equates to a loss of more than five percent of the strictly freshwater species native to Texas. An additional six species are listed as threatened or endangered by the U. S. Department of the Interior (1989) and 21 more by the Texas Parks and Wildlife Department. The Texas Organization for Endangered Species (1988) list includes 35 species that are or should be listed by governmental agencies. Our listing of 47 species (Table 1) reflects the problems outlined by Williams et al. (1989) for North American freshwater fishes in general. We agree with their conclusion that water quantity (either too much in the case of reservoirs or too little in the case of dewatering), habitat quality, and the addition of introduced species (Table 2) are major components of the problem.

We herein present dichotomous keys to the families and species of Texas fishes and a brief description of range and status, and comments for each species. The list is modified from that of Hubbs (1982) and the keys are modified from those originally developed by Hubbs for ichthyology students at the University of Texas. This list of species and the keys to their identification are preliminary in an endeavor to prepare a much fuller accounting of the species in a separate volume. Families are

TABLE 1. Conservation status of fishes of Texas we consider to be extinct, extirpated from the state, endangered, threatened, or of special concern. Shown for each category is the status given to each species by the Texas Organization for Endangered Species (TOES), the Texas Parks and Wildlife Department (TPWD), and the U.S. Fish and Wildlife Service (USFWS). Abbreviations used are: E, Endangered; T, Threatened; NL, Not Listed; WL, Watch List (equivalent to our Special Concern); P, Peripheral (a wider ranging species that has a limited number of populations within the boundaries of Texas).

Species	TOES	TPWD	USFWS
Extinct			
<i>Cyprinella l. blairi</i>	E	NL	NL
<i>Notropis orca</i>	E	E	NL
<i>Notropis simus</i>	E	E	NL
<i>Gambusia amistadensis</i>	Extinct	Extinct	NL
<i>Gambusia georgei</i>	E	E	E
Extirpated			
<i>Hybognathus amarus</i>	E	NL	NL
<i>Oncorhynchus clarki</i>	NL	NL	NL
<i>Gambusia senilis</i>	E	E	NL
Endangered			
<i>Polyodon spathula</i>	T	E	NL
<i>Satan eurystomus</i>	T	T	NL
<i>Trogloglanis pattersoni</i>	T	T	NL
<i>Cyprinodon bovinus</i>	E	E	E
<i>Cyprinodon elegans</i>	E	E	E
<i>Cyprinodon pecosensis</i>	E	T	NL
<i>Gambusia gaigei</i>	E	E	E
<i>Gambusia heterochir</i>	E	E	E
<i>Etheostoma fonticola</i>	E	E	E
<i>Gobionellus atripinnis</i>	NL	E	NL
Threatened			
<i>Camptostoma ornatum</i>	WL	T	NL
<i>Cyprinella proserpina</i>	WL	T	NL
<i>Dionda diaboli</i>	T	T	NL
<i>Gila pandora</i>	T	T	NL
<i>Notropis buccula</i>	WL	NL	NL
<i>Notropis chihuahua</i>	WL	T	NL
<i>Notropis hubbsi</i>	T	T	NL
<i>Notropis jemezianus</i>	WL	NL	NL
<i>Notropis maculatus</i>	T	NL	NL
<i>Notropis oxyrhynchus</i>	WL	NL	NL
<i>Cyprinodon eximius</i>	T	T	NL
<i>Gambusia nobilis</i>	T	E	E
<i>Etheostoma grahami</i>	WL	T	NL
<i>Percina maculata</i>	T	T	NL

TABLE I. Continued.

Special Concern			
<i>Scaphirhynchus platyrhynchus</i> (P)	T	E	NL
<i>Hiodon alosoides</i> (T/P)	WL	NL	NL
<i>Notropis chalybaeus</i> (T)	WL	NL	NL
<i>Cycleptus elongatus</i> (T)	WL	T	NL
<i>Erimyzon oblongus</i> (T)	NL	T	NL
<i>Ictalurus lupus</i> (T)	WL	NL	NL
<i>Ictalurus</i> sp. (E)	NL	NL	NL
<i>Microphis brachyurus</i> (P)	NL	T	NL
<i>Centropomus parallelus</i> (T/P)	WL	NL	NL
<i>Centropomus undecimalis</i> (T)	NL	NL	NL
<i>Micropterus treculi</i> (T)	WL	NL	NL
<i>Ammocrypta clara</i> (T)	T	NL	NL
<i>Etheostoma radiosum</i> (T)	T	NL	NL
<i>Percina caprodes</i> (P)	NL	NL	NL
<i>Awaous tajasica</i> (P)	WL	T	NL

arranged phylogenetically, genera and species are listed alphabetically. Scientific and common names follow Robins et al. (1991) unless otherwise noted.

Ecological associations are listed with each species account (Freshwater, Estuarine, and Marine) as well as the conservation status of the species where appropriate (Introduced, Special Concern, Threatened, and Endangered). These terms are defined as follows: Freshwater—fishes that are nearly always restricted to inland freshwaters, although some of these environments possess substantial salinities. Estuarine—fishes that

TABLE 2. List of introduced fishes in Texas waters.

<i>Oncorhynchus mykiss</i> —rainbow trout
<i>Esox lucius</i> —northern pike
<i>Carassius auratus</i> —goldfish
<i>Ctenopharyngodon idella</i> —grass carp
<i>Cyprinus carpio</i> —common carp
<i>Scardinius erythrophthalmus</i> —rudd
<i>Hypostomus</i> sp.—armadillo del rio
<i>Poecilia reticulata</i> —guppy
<i>Morone saxatilis</i> —striped bass
<i>Ambloplites rupestris</i> —rock bass
<i>Lepomis auritus</i> —redbreast sunfish
<i>Micropterus dolomieu</i> —smallmouth bass
<i>Perca flavescens</i> —yellow perch
<i>Sitostedion canadense</i> —sauger
<i>Sitostedion vitreum</i> —walleye
<i>Tilapia aurea</i> —blue tilapia
<i>Tilapia mossambica</i> —Mozambique tilapia
<i>Tilapia zilli</i> —redbelly tilapia

commonly spend a substantial portion of their lives in brackish to marine coastal environments. Marine—fishes that are commonly dependent upon offshore, oceanic environments for a substantial period of their lives. Introduced—nonindigenous, transplanted by man. Special Concern—a taxon of which the abundance or range has been reduced to the degree that it may be threatened with extinction or the range of which only peripherally includes Texas and the species easily could be extirpated there. Some species for which up-to-date information concerning their status is unavailable or fragmentary are included in this category. Threatened—likely to become endangered in the near future. Endangered—species so imperiled that they require assistance to avoid extinction.

KEY TO FAMILIES OF FRESHWATER FISHES OF TEXAS

- 1a. Pelvic fins absent 2
- 1b. Pelvic fins present 6
- 2a. Jaws absent; pectoral fins absent; seven pairs of gill openings Petromyzontidae
- 2b. Jaws present; pectoral fins small; one pair of gill openings 3
- 3a. Dorsal fin attached to caudal fin; dorsal fin base goes less than two times in body length; upper jaw extends beyond eye 4
- 3b. Dorsal fin free from caudal fin base; dorsal fin base goes more than four times into body length; upper jaw does not reach vertical from eye 5
- 4a. Posterior nostril just above lower lip; scales absent; upper jaw projects farther than lower jaw Ophichthidae
- 4b. Posterior nostril well above level of lower lip, even with a horizontal line through lower margin of eye; scales present (they are small and embedded); lower jaw project farther than upper jaw Anguillidae
- 5a. Body with plates; snout long and tubular Syngnathidae
- 5b. Body without plates; snout blunt Tetraodontidae
- 6a. Five pairs of gill slits 7
- 6b. One pair of gill slits 9
- 7a. Gill slits dorsal to pectoral fins; body rounded Carcharhinidae
- 7b. Gill slits ventral to pectoral fins; body depressed 8
- 8a. Snout elongate, with sharp sawlike teeth; no spines on dorsal surface Pristidae
- 8b. Snout short and blunt; sharp spine on dorsal surface of tail; body much flattened Dasyatidae
- 9a. Caudal fin heterocercal (vertebral column noticeably bent upward into dorsal lobe) 10
- 9b. Caudal fin homocercal (vertebral column not bent upward into dorsal lobe) 13
- 10a. Caudal fin strongly heterocercal; mouth inferior 11
- 10b. Caudal fin abbreviated heterocercal; mouth terminal 12
- 11a. Body not armored; snout paddlelike with two small barbels Polyodontidae
- 11b. Body with several bony scutes; snout not more than two-thirds of head length; four elongate barbels Acipenseridae
- 12a. Scales ganoid; snout produced into an elongate beak; dorsal fin short, its origin posterior to origin of anal fin Lepisosteidae
- 12b. Scales cycloid; snout blunt; dorsal fin long, its origin anterior to origin of pelvic fin Amiidae

- 13a. Both eyes on same side of head; dorsal and anal fins both with more than 25 soft fin rays 14
- 13b. Eyes on each side of head or absent; either dorsal or anal fin (or both) with fewer than 25 soft fin rays 15
- 14a. Edge of preopercle hidden by skin; no left pectoral fin Solidae
- 14b. Edge of preopercle not hidden by skin; both pectoral fins present Bothidae
- 15a. Pelvic fins without a spine, and with more than five soft fin rays; anal fin with no spines; one dorsal fin with fin rays 16
- 15b. Pelvic and anal fins with one or more spines; one or more dorsal fins with fin rays 30
- 16a. Adipose fin present 17
- 16b. No adipose fin 21
- 17a. Body scaled; head without barbels 18
- 17b. Body not scaled; head with four to eight barbels if naked, otherwise body with bony plates 19
- 18a. Fewer than 50 lateral line scales Characidae
- 18b. More than 60 lateral line scales Salmonidae
- 19a. Body covered with bony plates; no barbels Loricariidae
- 19b. Body naked; head with four to eight barbels 20
- 20a. Nostrils close together, posterior nostril without a barbel Ariidae
- 20b. Nostrils far apart, posterior nostril with a barbel Ictaluridae
- 21a. Head scaleless 22
- 21b. Head partly scaled 27
- 22a. Branchiostegal membranes free from isthmus; gill slits extent far forward below jaws 23
- 22b. Branchiostegal membranes united to isthmus; gill slits do not extend far forward below jaws; no teeth on jaws 26
- 23a. Mouth subinferior, below a tapering piglike snout; upper jaw long, reaching beyond posterior margin of preopercle Engraulidae
- 23b. Mouth variable, but if inferior, upper jaw not reaching behind eye 24
- 24a. Lateral line absent; scales along midline of belly modified to form a sawlike keel Clupeidae
- 24b. Lateral line present; scales along midline of belly undifferentiated 25
- 25a. Upper jaw not extending posterior to level of eye; dorsal fin above anal fin; gular plate absent Hiodontidae
- 25b. Upper jaw extending posterior to level of eye; dorsal fin above pelvic fin; gular plate present Elopidae
- 26a. Pharyngeal teeth numerous (more than nine) and comblike; distance from origin of anal fin to base of caudal fin less than one-half distance from origin of dorsal fin to base of caudal fin; mouth adapted for sucking Catostomidae
- 26b. Fewer than nine pharyngeal teeth on each side; distance from origin of anal fin to base of caudal fin more than one-half distance from origin of dorsal fin to base of caudal fin; mouth not adapted for sucking Cyprinidae
- 27a. Snout needle-shaped; lateral line low Belonidae
- 27b. Snout not needle-shaped; lateral line, if present, median in position 28
- 28a. Snout duck-billed or paddle-shaped; caudal fin forked; lateral line median in position Esocidae
- 28b. Snout blunt; caudal fin rounded, no lateral line 29
- 29a. Oviparous; adult males with a rounded anal fin, third soft ray in anal fin branched in both sexes Cyprinodontidae
- 29b. Viviparous; adult males with a modified anal fin forming a gonopodium; third soft ray in anal fin unbranched in both sexes Poeciliidae

- 30a. Anus anterior to pelvic fins; pelvic fins with more than five soft fin rays Aphredoderidae
- 30b. Anus posterior to pelvic fins; pelvic fins with five soft fin rays 31
- 31a. Pelvic fins abdominal or subthoracic (insertion underneath tips of pectoral fin rays); dorsal fins well separated 32
- 31b. Pelvic fins thoracic (insertion underneath front third of pectoral fin rays); dorsal fins separate or united 34
- 32a. Pectoral fin with five to eight lower fin rays detached and filamentous Polynemidae
- 32b. Pectoral fin entire 33
- 33a. Three anal fin spines; four stout dorsal fin spines Mugilidae
- 33b. One anal fin spine; four to eight slender dorsal fin spines Atherinidae
- 34a. Posterior part of lateral line with well developed spiny scutes; two anal fin spines separated Carangidae
- 34b. Posterior part of lateral line (if present) unarmored; one to eight anal fin spines, connected by membranes 35
- 35a. Nostrils single on each side; lateral line interrupted Cichlidae
- 35b. Nostrils double on each side; lateral line complete, incomplete or absent 36
- 36a. Lateral line extending onto tip of middle fin rays of caudal fin 37
- 36b. Lateral line, if present, not extending beyond base of caudal fin 39
- 37a. One or two anal fin spines; mouth inferior; dorsal fin single; caudal fin rounded Sciaenidae
- 37b. Three anal fin spines 38
- 38a. Two separate dorsal fins Centropomidae
- 38b. Dorsal fins continuous Haemulidae
- 39a. Gill membranes broadly joined to isthmus; lateral line absent 40
- 39b. Gill membranes free or nearly free from isthmus (may be joined to each other across isthmus); lateral line present or absent 41
- 40a. Pelvic fins separate Eleotridae
- 40b. Pelvic fins joined into a suction disc Gobiidae
- 41a. Premaxillaries excessively protractile, their basal processes long; a groove at top of cranium Gerreidae
- 41b. Premaxillaries moderately protractile or not protractile; no groove at top of cranium 42
- 42a. Jaw teeth prominent incisors; molar teeth on roof and floor of mouth Sparidae
- 42b. All teeth canines 43
- 43a. One or two anal fin spines, first usually distinctly longer than second (if present) Percidae
- 43b. Three or more anal fin spines, third distinctly longer than first 44
- 44a. Opercle with a spine; pseudobranchium (small gill-like structures on inner surface of gill cover) well developed and uncovered Percichthyidae
- 44b. Opercle without a spine; pseudobranchium absent or covered with a skin Centrarchidae

Family PETROMYZONTIDAE—lampreys

- 1a. Disc large; length of disc contained 14.3 times in total length; cusps in posterior field not degenerate; adults with well-developed intestine *Ichthyomyzon castaneus*
- 1b. Disc small; length of disc contained 17.2 to 26.3 times in total length; cusps in posterior field degenerate; intestine not developed *Ichthyomyzon gagei*

Ichthyomyzon castaneus Girard—chestnut lamprey. Chestnut lampreys range from west-central Manitoba along the Red River of the North, and

in the Mississippi River and Great Lakes and southward to Mobile Bay. In Texas, this parasitic species occurs in eastern Texas streams of the Red, Sabine, and Neches basins. Freshwater.

Ichthyomyzon gagei Hubbs and Trautman—southern brook lamprey. The southern brook lamprey ranges along the Gulf of Mexico drainages from western Florida to eastern Texas, north through eastern Oklahoma to Missouri, and east to Tennessee. In Texas, this nonparasitic species occurs in the Red, Sabine and Neches basins. Freshwater.

Family CARCHARHINIDAE—requiem sharks

- 1a. Teeth smooth; length of longest gill slit more than one-third height of dorsal fin; head triangular in front of nostrils *Carcharhinus isodon*
 1b. Teeth serrate; length of longest gill slit less than one-fourth height of dorsal fin; head bluntly rounded in front of nostrils *Carcharhinus leucas*

Carcharhinus isodon (Valenciennes)—finetooth shark. This Atlantic species commonly occurs along the coast in the surf zone and may enter coastal streams in their downstream stretches. Marine.

Carcharhinus leucas (Valenciennes)—bull shark. Bull sharks are found circumtropically in euryhaline and low salinity estuaries and river mouths. In Texas, this species occurs along the coast and may travel short distances upstream in coastal streams. Estuarine.

Family PRISTIDAE—sawfishes

Pristis pectinata Latham—smalltooth sawfish. This tropical Atlantic species occurs from New York to Bermuda, through the Gulf of Mexico and south to Brazil. Sawfish are primarily coastal inhabitants in Texas. Marine.

Family DASYATIDAE—stingrays

Dasyatis sabina (Lesueur)—Atlantic stingray. The Atlantic stingray occurs along shallow coastal waters from Chesapeake Bay to Mexico. The species occurs in all of the major bays of Texas and also may migrate considerable distances inland. Estuarine.

Family ACIPENSERIDAE—sturgeons

Scaphirhynchus platyrhynchus (Rafinesque)—shovelnose sturgeon. Shovelnose sturgeons once occurred throughout most of the Mississippi and Missouri river drainages, and two specimens were obtained by Dr. Oscar Loew from the Rio Grande in Albuquerque, New Mexico during the 1872 to 1874 surveys of western United States fishes reported by Cope and Yarrow (1875). This strongly suggests that it likely occurred in many Texas rivers. This species presently is found in Texas only in the

Red River below Dennison Dam (Lake Texoma Reservoir). Freshwater. Special Concern.

Family POLYODONTIDAE—paddlefishes

Polyodon spathula (Walbaum)—paddlefish. Originally the paddlefish ranged throughout much of the Mississippi River drainage and eastward of the Appalachian Mountain range and the Great Lakes. In Texas this species occurred in every major river from the Trinity Basin eastward. By the 1950s, its numbers and range had been substantially reduced. A paddlefish restoration project has been initiated by the Texas Parks and Wildlife Department. Freshwater. Endangered.

Family LEPISOSTEIDAE—gars

- 1a. Large teeth in upper jaw in two rows on each side *Lepisosteus spatula*
 1b. Large teeth in upper jaw in one row on each side 2
 2a. Beak long and narrow, its least width about 12 to 20 times its length; snout more than two-thirds of head length *Lepisosteus osseus*
 2b. Beak short and blunt, its least width about five to seven times its length; snout less than two-thirds of head length 3
 3a. Fifty-nine to 63 lateral line scales; 50 to 54 predorsal scales; 38 to 44 scale rows around body *Lepisosteus platostomus*
 3b. Fifty-four to 57 lateral line scales; 46 to 49 predorsal scales; 32 to 38 scale rows around body *Lepisosteus oculatus*

Lepisosteus oculatus (Winchell)—spotted gar. This species occurs from Lake Erie southeastward through the Ohio and Missouri drainages of the Mississippi, and then westward through the coastal streams of Texas. Freshwater.

Lepisosteus osseus (Linnaeus)—longnose gar. Longnose gars are found from Quebec throughout the eastern United States southward to the Rio Grande drainage in Texas, Mexico, and New Mexico. The species may be found in most Texas rivers. Freshwater.

Lepisosteus platostomus Rafinesque—shortnose gar. Shortnose gars range throughout the Mississippi River drainage, especially in low gradient, slowly flowing streams, oxbow lakes, and backwater areas. This species inhabits the Red River Basin below Lake Texoma. Freshwater.

Lepisosteus spatula Lacépède—alligator gar. Alligator gars range along the Gulf Coast from Veracruz, Mexico, to western Florida, and northward to the lower reaches of the Mississippi, Missouri, and Ohio river drainages. A disjunct population also occurs in Nicaragua. In Texas, this species is found in coastal streams from the Red River to the Rio Grande. Freshwater.

Family AMIIDAE—bowfins

Amia calva Linnaeus—bowfin. Bowfins occur from the Great Lakes and drainages southward to central Texas and eastward throughout Florida. Not native to Appalachian streams, but introduced populations now occur in that region. In Texas, it is found in the Red, San Jacinto, and Sabine river systems and the downstream reaches of the Brazos and Colorado basins. Freshwater.

Family HIODONTIDAE—mooneyes

Hiodon alosoides (Rafinesque)—goldeye. This species ranges from the Northwest Territories, Canada, southward in the Mississippi Basin to Louisiana. In Texas, it is restricted to the Red River Basin and is especially abundant in Lake Texoma. Freshwater. Special Concern.

Family ELOPIDAE—tarpons

- 1a. Mouth terminal; last dorsal fin ray not elongated *Elops saurus*
 1b. Mouth superior; last dorsal fin ray elongated *Megalops atlanticus*

Elops saurus Linnaeus—ladyfish. A coastal inhabitant occurring throughout the Gulf of Mexico to Brazil, ladyfish may be found inhabiting most of the bays and estuaries in Texas. Specimens also often are found in the lower reaches of coastal streams. Estuarine.

Megalops atlanticus Valenciennes—tarpon. This species is found from Nova Scotia south through the Caribbean to Brazil; it inhabits coastal waters statewide. Estuarine.

Family ANGUILLIDAE—freshwater eels

Anguilla rostrata (Lesueur)—American eel. This species is known from most of the Atlantic and Gulf coastal areas of North America, including the Caribbean coasts of Middle America, and South America to Brazil. Texas records include specimens from the Red River to the Rio Grande in most of the large river systems of the state. Dams impede upstream migration of the species and have effectively eradicated it in the western part of the state. Estuarine.

Family OPHICHTHIDAE—snake eels

Myrophis punctatus Lutken—speckled worm eel. Occurring from North Carolina throughout the Gulf of Mexico and the Caribbean to Brazil, this species commonly is found burrowed into mud-bottomed habitats in the bays of the state. It also has been collected from downstream sections of a number of river systems including the Neches and the Rio Grande. Marine.

Family CLUPEIDAE—herrings

- 1a. Last ray of dorsal fin not elongated; mouth terminal or superior 2
 1b. Last ray of dorsal fin greatly elongated; lower jaw included (underslung) 4
 2a. Posterior margins of lateral scales fluted or pectinated; more than 60 longitudinal scale rows *Brevoortia gunteri*
 2b. Posterior margins of lateral scales entire; fewer than 60 longitudinal scale rows 3
 3a. Body depth contained fewer than three times in standard length; more than 30 gill rakers below angle of first arch *Harengula jaguana*
 3b. Body depth contained more than three times in standard length; fewer than 30 gill rakers below angle of first arch *Alosa chrysochloris*
 4a. Twenty-nine to 33 anal fin rays; base of dorsal fin contained 1.0 to 1.6 times in length of last ray; black shoulder spot (especially in young) equal to or larger than pupil; mouth below level of middle of eye *Dorosoma cepedianum*
 4b. Twenty-four to 28 anal fin rays; base of dorsal fin contained 1.5 to 1.8 times in length of last ray; black shoulder spot (especially in young) smaller than pupil; mouth at level of eye *Dorosoma petenense*

Alosa chrysochloris (Rafinesque)—skipjack herring. This anadromous fish is native to the Gulf of Mexico. It may be found occasionally in streams, lakes, and borrow pits in gulf drainages. Estuarine.

Brevoortia gunteri Hildebrand—finescale menhaden. This primarily coastal species, native to the western Gulf of Mexico, may be found inhabiting most of the bays and estuaries in Texas, especially in the southern half of the state. A related species, *B. patronus*, found throughout the Gulf of Mexico, also may occur in low salinity estuaries, especially when young. Marine.

Dorosoma cepedianum (Lesueur)—gizzard shad. Native to the eastern United States, from the Great Lakes south to northern Mexico (with the exception of New England, the Appalachian mountain chain and southern Florida), the gizzard shad may be found statewide in all major streams and is especially abundant in reservoirs, often constituting more than half of the fish biomass. Estuarine.

Dorosoma petenense (Günther)—threadfin shad. Threadfin shad are native to the lower Mississippi and southern Ohio river basins, and Gulf of Mexico coastal streams from Florida to Central America. This species may be found in all streams within the eastern half of the state. Threadfin shad have been widely introduced as a forage fish in reservoirs. Estuarine.

Harengula jaguana Poey—scaled sardine. Primarily a coastal species ranging from the east coast of Florida throughout the Gulf of Mexico and the Caribbean to Brazil, scaled sardines may be found inhabiting most of the bays and estuaries in Texas. Individuals commonly move short distances upstream in coastal streams. Estuarine.

Family ENGRAULIDAE—anchovies

- 1a. Twenty-three to 31 anal fin rays; 11 to 12 pectoral fin rays *Anchoa mitchilli*
 1b. Eighteen to 23 anal fin rays; 13 to 17 pectoral fin rays *Anchoa hepsetus*

Anchoa hepsetus (Linnaeus)—striped anchovy. Coastal in distribution from Nova Scotia through the Gulf of Mexico and the Caribbean to Uruguay, this species may be found inhabiting most of the bays and estuaries in Texas. Striped anchovies appear to be more common in the southern part of the state where bays tend to have higher salinities. Marine.

Anchoa mitchilli (Valenciennes)—bay anchovy. A coastal inhabiting species from Maine along the Atlantic and Gulf coasts to Yucatan, bay anchovies are abundant in most bays and estuaries in Texas. Specimens often are found in the lower reaches of coastal streams. Estuarine.

Family CYPRINIDAE—minnows

Note: species that have only one character for each alternative in a couplet should be keyed out in both subdivisions (the species should be found in both).

- 1a. More than 15 soft rays on dorsal fin; dorsal and anal fins each with a strong serrated spine 2
 1b. Fewer than 10 soft rays on dorsal fin; dorsal and anal fins without spines 3
 2a. Upper jaw with two long, fleshy barbels on each side; 35 to 38 lateral line scales (except mirror and leather carps); pharyngeal teeth 1, 1, 3-3, 1, 1 *Cyprinus carpio*
 2b. Upper jaw without barbels; 26 to 29 lateral line scales; pharyngeal teeth 4-4 *Carassius auratus*
 3a. Pharyngeal teeth with prominent parallel grooves; distance from origin of anal fin to end of caudal peduncle contained three or more times in distance from tip of snout to origin of anal fin *Ctenopharyngodon idella*
 3b. Pharyngeal teeth without prominent parallel grooves; distance from origin of anal fin to end of caudal peduncle contained two and one-half or fewer times in distance from tip of snout to origin of anal fin 4
 4a. Cartilaginous ridge of lower jaw prominent and separated by a definite groove from lower lip; intestine wound spirally around the air bladder 5
 4b. Cartilaginous ridge of lower jaw hardly evident and not separated by a definite groove from the lower lip; intestine not wound spirally around the air bladder 6
 5a. Lower jaw length greater than eye length; more than 65 lateral line scales *Campostoma ornatum*
 5b. Lower jaw length less than eye length; fewer than 60 lateral line scales *Campostoma anomalum*
 6a. Premaxillaries not protractile; upper lip connected with skin of snout by a frenum (a bridge of tissue across which the premaxillary groove does not pass) *Rhinichthys cataractae*
 6b. Premaxillaries protractile; upper lip separated from skin of snout by a deep groove continuous across the midline 7
 7a. Lateral line greatly decurved 8
 7b. Lateral line usually not decurved, either straight or with a broad arch 9

- 8a. Abdomen behind pelvic fins with fleshy keel over which the scales do not pass; pharyngeal teeth in one row 4-4 or 5-5; gill rakers long and slender, 17 to 19 on first gill arch; eyes and medial fins usually yellow-green *Notemigonus crysoleucas*
 8b. Abdomen behind pelvic fins scaled; pharyngeal teeth in two rows 3, 5-5, 3 or 2, 5-5, 2; gill rakers short and stout, nine to 10 on first gill arch; eyes and fins usually red *Scardinius erythrophthalmus*
 9a. Pharyngeal teeth in main row typically 5-5 or 5-4 10
 9b. Pharyngeal teeth in main row typically 4-4 11
 10a. Mouth very small, almost vertical; no pharyngeal teeth in lesser row *Opsopoeodus emiliae*
 10b. Mouth large and only moderately oblique; two pharyngeal teeth in lesser row *Semotilus atromaculatus*
 11a. Maxillary barbel present 12
 11b. No maxillary barbel present 14
 12a. Pharyngeal teeth 4-4; body speckled (for most specimens greater than 20 mm standard length) *Macrohybopsis aestivalis*
 12b. Pharyngeal teeth in two rows; body always silvery 13
 13a. Pharyngeal teeth 2, 4-4, 2; 49 to 57 lateral line scales; depth at occiput less than width *Platygobio gracilis*
 13b. Pharyngeal teeth 1, 4-4, 1; fewer than 50 lateral line scales; depth at occiput greater than width *Macrohybopsis storeriana*
 14a. Lower lip thick with a fleshy lobe on each side that is partially separated from mandible by a groove (best observed from the front) *Phenacobius mirabilis*
 14b. Lower lip thin, without a fleshy lobe 15
 15a. More than 50 lateral line scales *Gila pandora*
 15b. Fewer than 45 lateral line scales 16
 16a. Predorsal scales crowded, much smaller than those on rest of body; seven anal fin rays; first two obvious dorsal fin rays stout, well separated from the following well developed but unbranched ray by a membrane 17
 16b. Predorsal scales not crowded except for fish with nine or more anal fin rays; first obvious dorsal fin ray a thin splint, closely attached to the following well developed but unbranched ray, especially at tip 18
 17a. Intestine long, more than twice the length of the body; caudal spot not separated from longitudinal streak by a clear space *Pimephales promelas*
 17b. Intestine short, forming a simple S-shaped loop; caudal spot separated from longitudinal streak by a clear area *Pimephales vigilax*
 18a. Intestinal canal long, more than twice the length of the body 19
 18b. Intestinal canal short, forming a simple S-shaped loop 26
 19a. A black band through eye to snout; eye as long as snout 20
 19b. No black band through eye to snout; eye shorter than snout 23
 20a. Seven dorsal fin rays *Dionda serena*
 20b. Eight dorsal fin rays 21
 21a. Caudal peduncle depth wide; long postorbital *Dionda episcopa*
 21b. Caudal peduncle depth narrow; short postorbital 22
 22a. Double dashes present along lateral line canal; caudal spot wedge-shaped; prominent markings on dorsal scale pockets *Dionda diaboli*
 22b. Lateral canal without double dashes along its length; caudal spot rounded; without prominent markings on dorsal scale pockets *Dionda argentosa*
 23a. Middorsal with a thin stripe flanked on each side by another faint dark stripe *Hybognathus hayi*
 23b. Middorsal stripe broad and solid 24
 24a. Head width about equal to distance from tip of snout to back of eye; 11 to 15

- scale rows across belly (counted just in advance of pelvic insertion, excluding lateral line scales); eye contained in snout about one and one-half times 25
- 24b. Head width considerably greater than distance from tip of snout to back of eye; 14 to 22 scale rows across belly; eye contained in snout about two times *Hybognathus placitus*
- 25a. Scales with 10 radii (grooves) *Hybognathus nuchalis*
- 25b. Scales with eight radii *Hybognathus amarus*
- 26a. Mouth terminal and oblique; pharyngeal teeth in two rows, 1 or 2, 4-4, 2 or 1 (except in *Cyprinella lutrensis*) 27
- 26b. Mouth subinferior and horizontal; pharyngeal teeth 4-4 (except in *Notropis amnis* and *N. braytoni*) 55
- 27a. Dorsal fin less triangular, last fin ray about one-half length of the longest; interradial membranes of dorsal fin with melanophores (weak or lacking in young and female *Cyprinella proserpina*) 28
- 27b. Dorsal fin more triangular, last fin ray less than one-half length of the longest; interradial membranes of dorsal fin without melanophores (except along rays and except in *Notropis hubbsi*, which has more than eight anal fin rays and a prominent lateral stripe ending in a caudal spot) 29
- 28a. Caudal fin base with a large black spot (larger than eye); no dark bar above pectoral fin base *Cyprinella venusta*
- 28b. Caudal fin base without a large black spot; a dark bar above pectoral fin base 29
- 29a. Tubercles on head of high males larger on snout than on occiput; distinct black median stripe from chin to isthmus; snout length greater than upper jaw length *Cyprinella proserpina*
- 29b. Tubercles on head of dominant males larger on occiput than on snout; black median stripe on chin extends no farther posteriorly than below eye; upper jaw length greater than snout length 30
- 30a. Mouth slightly subinferior; head blunt and rounded; snout length plus upper jaw length 17 percent or less of standard length; body slenderer, distance between dorsal and anal fin origins 24 to 29 percent of standard length (higher percentages for adult males, lower percentages for females and young) *Cyprinella lepida*
- 30b. Mouth nearly terminal; head sharp and compressed; snout length plus upper jaw length 17 percent or more of standard length; body usually deeper, distance between dorsal and anal fin origins 26 to 36 percent of standard length (higher percentages for adult males, lower percentages for females and young) *Cyprinella lutrensis*
- 31a. Usually nine to 12 anal fin rays; pharyngeal teeth typically 2, 4-4, 2 32
- 31b. Usually six to eight anal fin rays; pharyngeal teeth typically 1, 4-4, 1 42
- 32a. Origin of dorsal fin opposite insertion of pelvic fin; dorsal origin nearer tip of snout than base of caudal fin 33
- 32b. Origin of dorsal fin behind insertion of pelvic fin; dorsal origin nearer base of caudal fin than tip of snout 36
- 33a. Scales with dark markings forming longitudinal stripes; exposed portions of lateral line scales greatly elevated; more than 18 predorsal scales *Luxilus chrysocephalus*
- 33b. Sides of body silvery; exposed portions of lateral line scales not markedly elevated; fewer than 17 predorsal scales 34
- 34a. Usually eight anal fin rays; depth at occiput more than width at occiput *Notropis shumardi*
- 34b. Usually seven anal fin rays; depth at occiput less than width at occiput 35
- 35a. Middorsal stripe about five chromatophores wide; iris black; about 15 chromatophores on line between orbits; snout definitely overhanging mouth *Notropis potteri*

- 35b. Middorsal stripe about 10 chromatophores wide; iris with some white anteriorly and posteriorly; more than 30 chromatophores on line between orbits; snout not definitely overhanging mouth *Notropis blennioides*
- 36a. Scales small, 41 or more in lateral line; 25 or more predorsal scales 37
- 36b. Scales large, 40 or fewer in lateral line; 24 or fewer predorsal scales 38
- 37a. Dorsal fin with prominent black spot at base of anterior rays; origin of dorsal fin midway between base of caudal fin and front of eye or nostril *Lythrurus umbratilis*
- 37b. Dorsal fin without prominent black spot; origin of dorsal fin midway between base of caudal fin and pupil *Lythrurus fumeus*
- 38a. Prominent black lateral stripe extending through eye and ending in a caudal spot one-half of caudal peduncle depth *Notropis hubbsi*
- 38b. No caudal spot; either fewer than 10 anal fin rays or no prominent black lateral stripe 39
- 39a. No chromatophores on lateral line scales other than on lateral stripe; middorsal stripe behind dorsal fin usually one to two chromatophores wide 40
- 39b. A few chromatophores on lateral line scales other than those on lateral stripe; middorsal stripe behind dorsal fin usually three to five chromatophores wide 41
- 40a. Eye larger, contained about two and one-half to three times in body depth (measured over curve) *Notropis amabilis*
- 40b. Eye smaller, contained about four times in body depth (measured over curve) *Notropis jemezianus*
- 41a. Eye shorter than snout; underside of opercle light *Notropis oxyrinchus*
- 41b. Eye longer than snout; underside of opercle gray *Notropis atherinoides*
- 42a. Eye large, contained about two and one-half to three times in body depth (measured over curve) *Notropis amabilis*
- 42b. Eye small, contained about four times in body depth (measured over curve) 43
- 43a. No paired dots along lateral line 44
- 43b. Paired dots along lateral line 52
- 44a. Prominent black lateral stripe extending through eye and ending in a caudal spot; lateral line incomplete *Notropis maculatus*
- 44b. No prominent lateral stripe extending through eye; no caudal spot; lateral line complete 45
- 45a. Depth at occiput more than width at occiput; usually eight anal fin rays 46
- 45b. Depth at occiput equal to or less than width at occiput; usually seven anal fin rays 49
- 46a. Dorsal fin insertion well behind insertion of pelvic fin, nearer base of caudal fin than tip of snout 47
- 46b. Dorsal fin insertion opposite insertion of pelvic fin, nearer tip of snout than base of caudal fin 48
- 47a. Usually eight anal fin rays; nine or 10 gill rakers on first gill arch; 14 to 16 rakers on second arch; 10 or 11 rakers on third arch; pharyngeal arch slender; posterior edge of jaw does not reach level of pupil *Notropis orca*
- 47b. Usually nine or 10 anal fin rays; six to eight gill rakers on first gill arch; 11 to 13 rakers on second arch; eight or nine rakers on third arch; pharyngeal arch broad; posterior edge of jaw under pupil *Notropis simus*
- 48a. Pectoral fin contained more than five times in standard length; no caudal spot *Notropis shumardi*
- 48b. Pectoral fin contained fewer than four times in standard length; caudal spot faint *Notropis braytoni*
- 49a. Dorsal stripe conspicuously interrupted in base of dorsal fin, producing a dark dash at base of dorsal fin 50

- 49b. Dorsal stripe not conspicuously interrupted in base of dorsal fin 51
- 50a. Snout length greater than distance from anterior tip of mandible to posterior tip of maxillary; head depth 15.9 to 17.7 percent of standard length; opercle length 8.0 to 9.6 percent of standard length *Notropis buccula*
- 50b. Snout length shorter than distance from anterior tip of mandible to posterior tip of maxillary; head depth 17.4 to 19.5 percent of standard length; opercle length 9.5 to 11.4 percent of standard length *Notropis bairdi*
- 51a. Pharyngeal teeth in lesser row stout; body depth contained four and one-quarter times in standard length *Notropis potteri*
- 51b. Pharyngeal teeth in lesser row thin; body depth contained about four times in standard length *Notropis blenniis*
- 52a. Lateral stripe diffuse *Notropis shumardi*
- 52b. Lateral stripe distinct 53
- 53a. Caudal spot separated from stripe by a light space; pharyngeal teeth 4-4 *Notropis atrocaudalis*
- 53b. Caudal spot, if present, attached to stripe; pharyngeal teeth in two rows 54
- 54a. Usually eight anal fin rays *Notropis chalybaeus*
- 54b. Usually seven anal fin rays *Notropis texanus*
- 55a. Last ray of dorsal fin about one-half the length of the longest; interradial membranes of dorsal fin with melanophores (weak or lacking in female and young of *C. proserpina*) 56
- 55b. Last ray of dorsal fin much less than one-half the length of the longest; interradial membranes of dorsal fin without melanophores (except along edge of rays or forming a dash on the anterior two membranes) 58
- 56a. Tubercles on head of dominant males larger on snout than on occiput; a distinct black median stripe from chin to isthmus; snout length greater than upper jaw length *Cyprinella proserpina*
- 56b. Tubercles on head of dominant males larger on occiput than on snout; black median stripe on chin extends no farther posteriorly than below eye; upper jaw length greater than snout length 57
- 57a. Mouth slightly subinferior; head blunt and rounded; snout length plus upper jaw length 17 percent or less of standard length; body slenderer, distance between dorsal and anal fin origins 24 to 29 percent of standard length (higher percentages for adult males, lower percentages for young females) *Cyprinella lepida*
- 57b. Mouth nearly terminal; head sharp and compressed; snout length plus upper jaw length 17 percent or more of standard length; body usually deeper, distance between dorsal and anal fin origins 26 to 36 percent of standard length (higher percentages for adult males, lower percentages for young females) *Cyprinella lutrensis*
- 58a. Lateral line incomplete; dark dash on proximal one-third of first two dorsal fin membranes *Notropis maculatus*
- 58b. Lateral line complete; no pronounced dark markings on dorsal fin membranes 59
- 59a. Lateral line scales markedly elevated anteriorly (higher than wide), height two to five times width; usually eight anal fin rays; pharyngeal teeth 4-4 60
- 59b. Lateral line scales not markedly elevated anteriorly, height one to two times width; usually seven anal fin rays; pharyngeal teeth 4-4 or 1, 4-4, 1 61
- 60a. Body dark, with pronounced dark lateral stripe; dorsal fin height contained 2.1 or more times in predorsal length *Notropis volucellus*
- 60b. Body light, with predorsal spot most prominent color mark; dorsal fin height contained 2.0 or fewer times in predorsal length *Notropis buechanani*
- 61a. Upper sides of body with scattered giant melanophores *Notropis chihuahua*

- 61b. Upper sides of body without scattered giant melanophores 62
- 62a. Eye small, shorter than snout and contained about four times in head length 63
- 62b. Eye larger, equal to or longer than snout and contained three and one-half or fewer times in head length 64
- 63a. Fins not falcate, first anal fin ray less than twice as long as last; caudal peduncle depth about one-half greatest body depth (measured over curve) *Notropis sabiniae*
- 63b. Fins falcate, first anal fin ray more than twice as long as last; caudal peduncle depth about one-third greatest body depth (measured over curve) *Notropis girardi*
- 64a. Depressed dorsal fin longer than head; distance from corner of mouth to posterior end of maxillary about equal to distance from corner of mouth to tip of mandible *Notropis amnis*
- 64b. Depressed dorsal fin shorter than head; distance from corner of mouth to posterior end of maxillary much less than distance from corner of mouth to tip of mandible 65
- 65a. Lateral stripe composed of a series of doubled dashes; dorsal base with two distinct black dashes separated by a clear space when viewed from above *Notropis stramineus*
- 65b. Lateral stripe solid, not composed of a series of doubled dashes, dorsal base without distinct black dashes separated by a clear space when viewed from above 66
- 66a. Pharyngeal teeth 1, 4-4, 1; lateral line below lateral stripe between pectoral and pelvic fins; lateral stripe of scattered melanophores *Notropis braytoni*
- 66b. Pharyngeal teeth 4-4; lateral line never below lateral stripe; lateral stripe solid *Notropis atrocaudalis*

Campostoma anomalum (Rafinesque)—central stoneroller. This widespread species is found throughout the eastern United States. In Texas, it is primarily found in streams of the Edwards Plateau and occurs as far west as the Devils River and Sycamore Creek. Freshwater.

Campostoma ornatum Girard—Mexican stoneroller. Primarily occurring in Mexico, this species ranges into Texas in Rio Grande tributaries in Brewster and Presidio counties (Big Bend region). Freshwater. Threatened.

Carassius auratus (Linnaeus)—goldfish. Goldfish are native to Asia and have been introduced statewide, often as a result of aquarium releases. They survive only in scattered locations, and usually only for short periods of time. Freshwater. Introduced.

Ctenopharyngodon idella (Valenciennes)—grass carp. Found widely scattered in the Canadian, Red, Sabine, Trinity, and Rio Grande basins of Texas. This species, introduced from Asia, is rapidly extending its range in Texas, primarily from initial stockings. Freshwater. Introduced.

Cyprinella lepida Girard—plateau shiner. A Texas endemic that inhabits streams in the Nueces Basin on the Edwards Plateau. According to Mayden (1989), this species is also endemic to the upper reaches of the Guadalupe Basin. Freshwater.

Cyprinella lutrensis (Baird and Girard)—red shiner. Ranges throughout the southern Great Plains of the United States into Mexico. This plains species occurs widely throughout the state. One subspecies, the

Maravillas red shiner (*C. l. blairi*), was found only in a limited area of the Big Bend region and is thought to be extinct (Miller et al., 1989), although attempts to document this race in the region have been limited. Freshwater.

Cyprinella proserpina (Girard)—proserpine shiner. Extremely limited range includes the Devils and lower Pecos rivers, Las Moras, Pinto, and San Felipe creeks in western Texas, and the Rio San Carlos in Mexico. Freshwater. Threatened.

Cyprinella venusta Girard—blacktail shiner. Ranges in most streams in Texas as far west as the Edwards Plateau. The species has been introduced into the Pecos River near Pandale. Freshwater.

Cyprinus carpio Linnaeus—common carp. Carp are native to Eurasia and have been introduced statewide. They are widespread and are most abundant in large bodies of water. They may be expected in nearly any body of water in the state. Freshwater. Introduced.

Dionda argentosa Girard—manantial roundnose minnow. Limited to the spring-influenced headwaters and spring runs of the Devils River, and San Felipe and Sycamore creeks. The common name we have chosen is the Spanish word that translates as “spring-run,” a reference to the type of habitat necessary for survival of this species. Freshwater.

Dionda diaboli Hubbs and Brown—Devils River minnow. Restricted to the Devils River, and San Felipe and Sycamore creeks in Val Verde County. A population that once inhabited Las Moras Creek in Kinney County apparently has been extirpated. This species has declined significantly in abundance in the last decade. Freshwater. Endangered.

Dionda episcopa Girard—roundnose minnow. Inhabits the spring-influenced headwaters of Edwards Plateau streams of the Colorado, Guadalupe, and Pecos drainages. Freshwater.

Dionda serena Girard—Nueces roundnose minnow. This Texas endemic occupies the spring-fed Edwards Plateau streams in the Nueces Basin. We propose the common name as a reflection of its distribution. Freshwater.

Gila pandora (Cope)—Rio Grande chub. One isolated population inhabits Little Aguja Creek (Nations Canyon) in the Davis Mountains of Trans-Pecos Texas. The species inhabits limited areas of the Rio Grande and Pecos basins in New Mexico and southern Colorado. Freshwater. Threatened.

Hybognathus amarus (Girard)—Rio Grande silvery minnow. Formerly abundant throughout the Rio Grande and Pecos basins, *H. amarus* apparently is extirpated in Texas and exists only in scattered Rio Grande locations in New Mexico. Freshwater. Extirpated.

Hybognathus hayi Jordan—cypress minnow. Cypress minnows occur in lowland streams of the southern Mississippi and adjacent basins from

Illinois and Indiana southward. This species is restricted in the state to the Sabine and Cypress basins. Freshwater.

Hybognathus nuchalis Agassiz—Mississippi silvery minnow. Found in eastern Texas streams from the Brazos River eastward and northward to the Red River. The range continues throughout the Mississippi Basin to the Great Lakes. Freshwater.

Hybognathus placitus Girard—plains minnow. Native to the Great Plains from Texas northward to North Dakota and Montana. Plains minnows range in central Texas from the Colorado and Brazos basins northward to the Red River. Freshwater.

Luxilus chrysocephalus Rafinesque—striped shiner. Early records of this species commonly were reported as *Luxilus* (= *Notropis*) *cornutus* (Mitchill). *Luxilus chrysocephalus* was elevated to specific rank by Gilbert (1961). It has a limited distribution in Texas, occurring only in the northeastern corner of the state in tributaries of the Red, Sulphur, and Cypress drainages. The subspecies found in Texas, *L. c. isolepis*, occurs throughout the south-central United States. Freshwater.

Lythrurus fumeus (Evermann)—ribbon shiner. Found essentially east of the Balcones Escarpment and in the Coastal Plain of eastern and northeastern Texas, from the Lavaca drainage northward to the Red River. Elsewhere this species is widespread in the lower Mississippi drainages. Freshwater.

Lythrurus umbratilis (Girard)—redfin shiner. Ranging throughout the Mississippi and Ohio River valleys and into the Great Lakes region, this species reaches the southwestern edge of its range in Texas. It has been found in the Red, Sabine, Neches, and Trinity basins in the state. Freshwater.

Macrohybopsis aestivalis (Girard)—speckled chub. This species is found in most Gulf of Mexico drainages from the Rio Grande to the Apalachicola River and northward to the Great Lakes. In Texas, the speckled chub occurs in streams from the Rio Grande to the Red River. Freshwater.

Macrohybopsis storeriana (Kirtland)—silver chub. This species is found in Texas in the Red River and the lower Brazos River. The Brazos River population is apparently disjunct from other populations of this species, which range through the Mississippi River Basin to Mobile Bay. Freshwater.

Notemigonus crysoleucas (Mitchill)—golden shiner. Widely distributed throughout the state, primarily as a result of bait releases. This species is probably native only to the streams of eastern Texas. Freshwater.

Notropis amabilis (Girard)—Texas shiner. Ranges primarily within Edwards Plateau streams (including portions of the San Gabriel River on the northeast) and to the Pecos River in the west. The species also is

found in Rio Grande tributaries in Mexico, including the Rio Salado and Rio San Juan. Freshwater.

Notropis amnis Hubbs and Greene—pallid shiner. Ranges widely throughout the Mississippi River basin southward along the Gulf Coastal Plain in Texas to the Guadalupe Basin. Freshwater.

Notropis atherinoides Rafinesque—emerald shiner. A wide ranging species throughout the central United States, especially the Mississippi Basin, this species is at the edge of its range in Texas, occurring in the Red, Sabine, Neches, and the lower Trinity drainages. Freshwater.

Notropis atrocaudalis Evermann—blackspot shiner. Primarily an eastern Texas species, this shiner ranges within the state from the lower Brazos Basin north and eastward to the Red River. Freshwater.

Notropis bairdi Hubbs and Ortenburger—Red River shiner. This species is restricted to the Red River Basin in Texas and Arkansas. Freshwater.

Notropis blennioides (Girard)—river shiner. This species extends from Hudson Bay south through the Mississippi Basin to Texas, Louisiana, and Mississippi. Primarily a mainstream inhabitant, it occurs in the state only in the Red River drainage. Freshwater.

Notropis braytoni Jordan and Evermann—Tamaulipas shiner. This species is restricted to the Rio Grande and Rio Conchos basins in Texas and Mexico. It also occurs in the lower Pecos River. This shiner appears to have declined substantially in abundance. Freshwater.

Notropis buccula Cross—smalleye shiner. Native to the middle and upper Brazos River drainage. This species is presumed to have been introduced into the Colorado River near Austin. This shiner has not been collected for more than 20 years and may be extinct. Freshwater. Threatened.

Notropis burchanani Meek—ghost shiner. This species ranges from the lower Rio Grande and its Mexican tributaries northward to the Great Lakes. It inhabits large silt-laden streams. Freshwater.

Notropis chalybaeus (Cope)—ironcolor shiner. Found in coastal streams from New York to Texas, and in the southern Great Lakes through parts of the Mississippi River to the Gulf of Mexico. In Texas, this species is found only in northeastern streams from the Sabine to the Red River with the exception of an isolated population found in the San Marcos River headwaters. Freshwater. Special Concern.

Notropis chihuahua Woolman—Chihuahua shiner. Limited in Texas to small tributaries of the Rio Grande in the Big Bend region. Elsewhere, it occurs primarily in the Rio Conchos Basin in Chihuahua, Mexico. Freshwater. Threatened.

Notropis girardi Hubbs and Ortenburger—Arkansas River shiner. In Texas, found in the Canadian River. This species is apparently declining

throughout much of its natural range, the Arkansas River drainage. Freshwater.

Notropis hubbsi Bailey and Robison—bluehead shiner. Inhabits Caddo Lake in Texas. Elsewhere this species is found sporadically in cypress swamps in parts of Arkansas and Louisiana. Freshwater. Threatened.

Notropis jemezianus (Cope)—Rio Grande shiner. The species originally ranged throughout the Rio Grande Basin, including the Pecos, Conchos, San Juan, and Salado drainages. It has declined in abundance in recent years and appears spottily distributed within the basin. Freshwater. Threatened.

Notropis maculatus (Hay)—taillight shiner. Restricted in Texas to the Sulphur and Cypress drainages in the extreme northeast. Freshwater. Threatened.

Notropis orca Woolman—phantom shiner. Originally found from near El Paso to the mouth of the Rio Grande, this species is thought to be extinct (Miller et al., 1989). It is closely related to the bluntnose shiner, *Notropis simus*. Freshwater. Extinct.

Notropis oxyrhynchus Hubbs and Bonham—sharpnose shiner. This species is endemic to the Brazos River. A presumed introduced population exists in the Colorado River above Buchanan Reservoir. This species is apparently decreasing in abundance, perhaps as a result of decreased turbidity downstream from reservoirs in the Brazos Basin. Freshwater. Threatened.

Notropis potteri Hubbs and Bonham—chub shiner. Ranges in Texas throughout the Brazos and Red basins. A population also is known from the San Jacinto Drainage near Conroe. Freshwater.

Notropis sabiniae Jordan and Gilbert—Sabine shiner. Inhabits small Austroriparian streams of eastern Texas from the San Jacinto Drainage northward along the Gulf Coast to the Sabine River Basin. Freshwater.

Notropis shumardi (Girard)—silverband shiner. Primarily a large-stream species inhabiting the Mississippi and Missouri river systems, this species is abundant in the Brazos Basin in Texas and is found in limited numbers in the Red River and other coastal plain streams as far south as the Lavaca Drainage. Freshwater.

Notropis simus (Cope)—bluntnose shiner. Once found throughout the Rio Grande and Pecos rivers, this species is composed of two subspecies, *N. s. simus* (inhabiting the Rio Grande proper) and *N. s. pecosensis* from the Pecos River in New Mexico (Chernoff et al., 1982). *Notropis simus simus* has not been captured since 1964 and now is considered extinct (Miller et al., 1989). Freshwater. Extinct.

Notropis stramineus (Cope)—sand shiner. This species is found sporadically on the Edwards Plateau, in the Big Bend region of the Rio Grande, and along the Red River. Elsewhere, it is found throughout the

Great Plains and the upper Mississippi and Missouri river basins, eastward through the Great Lakes region. Freshwater.

Notropis texanus (Girard)—weed shiner. Distributed in low gradient streams in the eastern part of the state from the Nueces Basin northward to the Red River about at Lake Texoma. Freshwater.

Notropis volucellus (Cope)—mimic shiner. Found throughout the eastern half of the state from the Nueces Basin northward, but apparently not found in the Red River in Texas. Freshwater.

Opsopoeodus emiliae Hay—pugnose minnow. The range of the pugnose minnow in Texas is primarily in streams of the Coastal Plain. There is a record of this species in the Trinity River near the Dallas area. Elsewhere, it is found throughout the Mississippi Valley, usually in slow moving rivers and streams. Freshwater.

Phenacobius mirabilis (Girard)—suckermouth minnow. A wide ranging species throughout the central United States, this species occurs in limited numbers in Texas coastal plain streams including the Red, Sabine, Trinity, and Colorado drainages. Freshwater.

Pimephales promelas Rafinesque—fathead minnow. A widespread species east of the Rocky Mountains in North America, this minnow may be found throughout much of Texas, presumably as a result of bait releases. Freshwater.

Pimephales vigilax (Baird and Girard)—bullhead minnow. This species occurs statewide. Populations apparently have been introduced into the upper Rio Grande Basin and upper Red and Canadian basins in Texas. Freshwater.

Platygobio gracilis (Richardson)—flathead chub. An extremely rare species in Texas, the flathead chub is known from the Canadian River in the Panhandle in Texas and also occurs in the Rio Grande in northern New Mexico. Its main distribution is within the Mississippi and Missouri river systems in the central United States and Canada. Freshwater.

Rhinichthys cataractae (Valenciennes)—longnose dace. This species inhabits a wide area of northern North America. Its range extends south along the Rio Grande and Pecos rivers in New Mexico and it occurs into Texas throughout the Rio Grande about to Laredo. Freshwater.

Scardinius erythrophthalmus (Linnaeus)—rudd. Native to Europe, this species originally was introduced into New York and recently has spread throughout the southeast as a bait minnow. This introduced species has been found in Texas in widely scattered localities throughout the state. Freshwater. Introduced.

Semotilus atromaculatus (Mitchill)—creek chub. This species is found throughout the eastern United States. In Texas, it is limited to the smaller streams of eastern Texas and to coastal waters of the Brazos Basin. Freshwater.

CATOSTOMIDAE—suckers

- 1a. Dorsal fin base more than one-third standard length; 22 to 30 dorsal fin rays 2
 1b. Dorsal fin base less than one-fourth standard length; four to 18 dorsal fin rays 6
 2a. More than 50 lateral line scales; eye nearer back of head than tip of snout; head abruptly slenderer than body (in adults) *Cycleptus elongatus*
 2b. Fewer than 45 lateral line scales; eye nearer tip of snout than back of head; head gradually slenderer than body 3
 3a. Subopercle broadest below middle, subtriangular; cheek deep and long (eye about equidistant between upper corner of gill slit and posteroventral angle of preopercle) *Carpiodes carpio*
 3b. Subopercle broadest at middle, subsemicircular; cheek shallow and foreshortened (distance from eye to posteroventral angle of preopercle three-quarters of distance to upper corner of gill slit) 4
 4a. Mouth large and noticeably oblique; upper jaw as long as snout; upper lip about level with lower margin of orbit; lips thin and faintly striate *Ictiobus cyprinellus*
 4b. Mouth small and only slightly oblique; upper jaw distinctly shorter than snout; upper lip well below lower margin of orbit; lips thick and coarsely striate 5
 5a. Body more elongate, greatest depth contained 2.6 to 3.3 times in standard length; thickness of head contained fewer than five times in standard length; distance from posterior tip of maxillary to front of mandible greater than eye length (about twice eye length in large adults) *Ictiobus niger*
 5b. Body deeper and narrower, greatest depth contained 2.2 to 2.8 times in standard length; thickness of head contained more than five times in standard length; distance from the posterior tip of maxillary to front of mandible less than eye (about equal to eye in large adults) *Ictiobus bubalus*
 6a. Lateral line complete and well developed in adults; air bladder with three chambers 7
 6b. Lateral line incomplete or absent in adults; air bladder with two chambers 10
 7a. Caudal fin with a black streak on lower lobe *Moxostoma poecilurum*
 7b. Caudal fin without a black streak 8
 8a. Dorsal fin rays 13; tip of dorsal fin blackish; caudal fin yellowish; lower sides golden to red *Moxostoma erythrurum*
 8b. Dorsal fin rays 11 or 12; distal one-half of dorsal fin membranes dusky; caudal fin dusky; lower sides olive to yellow 9
 9a. Pectoral fin length equal to head length; width of eye contained four to four and one-half times in head length; 44 to 46 scales along the lateral line *Moxostoma congestum*
 9b. Pectoral fin length less than head length; width of eye contained nearly five and one-half times in head length; 47 to 50 scales along the lateral line *Moxostoma austrinum*
 10a. Lateral line somewhat developed in adults; mouth inferior and horizontal; color pattern (except in the pale, obscurely mottled young) consists of rows of black spots (one on each scale) *Minytrema melanops*
 10b. Lateral line always absent; mouth subterminal and oblique; color pattern (except in young with two dark stripes) consists of narrow vertical bars 11
 11a. Thirty-four to 38 (usually 36 to 38) longitudinal scale rows; eye larger (eye length approximately one-half of snout length); back with crescentic scale marks *Erimyzon sucetta*
 11b. Thirty-nine to 43 (usually 39 to 41) longitudinal scale rows; eye smaller (eye length contained more than two times in snout length); back without crescentic scale marks *Erimyzon oblongus*

Carpoides carpio (Rafinesque)—river carpsucker. Ranges statewide, most commonly in the larger rivers and reservoirs. Young individuals often are found in small streams. Freshwater.

Cytleptus elongatus (Lesueur)—blue sucker. Inhabits large rivers throughout the Mississippi Basin and continuing southward in limited numbers through the major streams of Texas to the Rio Grande. Freshwater. Special Concern.

Erimyzon oblongus (Mitchill)—creek chubsucker. Occurs in eastern Texas streams from the Red River southward to the San Jacinto Drainage. Elsewhere it occurs throughout the southern Great Plains, the lower Mississippi Valley, and Atlantic Coast drainages. An early record exists from the Devils River. Freshwater. Special Concern.

Erimyzon sucetta (Lacépède)—lake chubsucker. Occurs widely in the Mississippi, Gulf of Mexico, and southeastern Atlantic seaboard drainages to Virginia. Ranges in Texas primarily in the eastern part of state from the Red River to the Brazos. Additionally, a disjunct population has been recorded in the upper Guadalupe River. Freshwater.

Ictiobus bubalus (Rafinesque)—smallmouth buffalo. A wide ranging species, smallmouth buffalo are native to streams from Pennsylvania and West Virginia west to Montana and south to Mexico. In Texas, this species may be found throughout the state with the exception of the Panhandle. It is commonly found in reservoirs and larger streams. Freshwater.

Ictiobus cyprinellus (Valenciennes)—bigmouth buffalo. Ranges from the Great Lakes southward through the Ohio and Mississippi river basins. In Texas, limited to the Red River east of Lake Texoma and the Sulphur River in the extreme northeastern part of the state. Freshwater.

Ictiobus niger (Rafinesque)—black buffalo. This species occurs throughout the Mississippi, Ohio, Missouri, and adjacent basins. Scattered records are known from throughout Texas, including from the Rio Grande, Colorado, Brazos, Sabine, and Red basins. Early taxonomic difficulties in recognizing this species, its unusually disjunct distribution pattern, and its apparent rarity in the state suggest a possible introduction of this species at many localities (Conner, 1977), or many intermediate records have been published that are misidentifications of the common smallmouth buffalo, *I. bubalus*. Freshwater.

Minytrema melanops (Rafinesque)—spotted sucker. Ranges widely in the United States. In Texas, the spotted sucker is found primarily in eastern Texas streams from the Red to the Brazos basins. A disjunct population occurs in the Llano River (Colorado River Basin) near Junction downstream about to Mason. Freshwater.

Moxostoma austrinum (Bean)—west Mexican redhorse. Recorded from Texas in the Alamito Creek area of the Big Bend region. The range of this species extends to the Pacific slope drainages in Mexico. This species is closed related to the gray redhorse. Freshwater.

Moxostoma congestum (Baird and Girard)—gray redhorse. This species is restricted in Texas to the streams within the Edwards Plateau including the Brazos, Colorado, Guadalupe, San Antonio, Nueces, and the Rio Grande drainages. Elsewhere, its range includes Gulf of Mexico coastal streams as far south as the Rio Soto la Marina in Mexico. Freshwater.

Moxostoma erythrurum (Rafinesque)—golden redhorse. Although widely distributed throughout the eastern United States, this species occurs only in the Red River in Texas. Freshwater.

Moxostoma poecilurum (Jordan)—blacktail redhorse. Found in streams emptying into the Gulf of Mexico; in Texas, limited to the Sabine Basin west through the San Jacinto Drainage. Freshwater.

Family CHARACIDAE—characins

Astyanax mexicanus (Filippi)—Mexican tetra. In Texas, the Mexican tetra is native to the Rio Grande and possibly the Nueces River drainages. It has been introduced statewide by "bait bucket" release. The most successful introductions have been in areas with substantial spring flows. Freshwater.

Family ICTALURIDAE—bullhead catfishes

- | | | |
|-----|--|--------------------------------|
| 1a. | Eyes absent; skin without pigment | 2 |
| 1b. | Eyes present; skin pigmented | 3 |
| 2a. | No teeth on jaws; lips at corner of mouth thin | <i>Trogloglanis pattersoni</i> |
| 2b. | Well developed teeth on jaws; lips at corner of mouth thick | <i>Satan eurystomus</i> |
| 3a. | Adipose fin joined to the caudal fin or separated from it by not more than a shallow notch | 4 |
| 3b. | Adipose fin free at tip, not joined to caudal fin | 5 |
| 4a. | Jaws nearly equal, mouth terminal; pectoral fin spine not serrated; dark axial streak conspicuous; dorsal, anal and caudal fins not dark-edged; lower lip and chin not heavily speckled with dark pigment | <i>Noturus gyrinus</i> |
| 4b. | Lower jaw included (underslung), mouth subterminal; pectoral spine serrated; axial streak inconspicuous; dorsal, anal and caudal fins with dark edges; lower lip and chin heavily speckled with dark pigment | <i>Noturus nocturnus</i> |
| 5a. | Premaxillary band of teeth on upper jaw with a lateral backward extension on each side; head depressed | <i>Pylodictis olivaris</i> |
| 5b. | Premaxillary band of teeth on upper jaw without a lateral backward extension on each side; head rounded | 6 |
| 6a. | Caudal fin rounded or shallowly emarginate; anal fin rays (including all rudiments) 17-27 | 7 |
| 6b. | Caudal fin deeply forked; anal fin rays (including all rudiments) 23-35 | 8 |
| 7a. | Anal fin rays 17 to 23; caudal fin square or slightly emarginate; chin barbels blackish; eye contained in snout length 2.4 or fewer times | <i>Ameiurus melas</i> |
| 7b. | Anal fin rays 24 to 27; caudal fin rounded; chin barbels whitish; eye contained in snout length 2.6 or more times | <i>Ameiurus natalis</i> |
| 8a. | Anal fin rays 30 to 36 | <i>Ictalurus furcatus</i> |
| 8b. | Anal fin rays 22 to 29 | 9 |

- 9a. Anal fin rays 27 to 29; pectoral fin spine contained less than five times in standard length *Ictalurus punctatus*
- 9b. Anal fin rays 22 to 26; pectoral fin spine contained more than five times in standard length 10
- 10a. Anal fin rays 23 to 26; pectoral spine length much less than caudal peduncle depth *Ictalurus lupus*
- 10b. Anal fin rays 22 to 25; pectoral spine length about equal to caudal peduncle depth *Ictalurus* sp.

Ameiurus melas (Rafinesque)—black bullhead. A wide ranging species in eastern North America, its Texas native distribution is statewide except for the Trans-Pecos drainages. This species has been widely introduced throughout the state. Freshwater.

Ameiurus natalis (Lesueur)—yellow bullhead. A wide ranging species in eastern North America, this bullhead occurs throughout all but the Trans-Pecos and Panhandle drainages within Texas. Freshwater.

Ictalurus furcatus (Lesueur)—blue catfish. Ranges in all except the northwestern part of Texas, mainly in the larger rivers and streams. Freshwater.

Ictalurus lupus (Girard)—headwater catfish. Native to the Pecos and Rio Grande basins of Texas and New Mexico. This species once was found in the upper Nueces, San Antonio, Guadalupe, and Colorado basins, but appears to be extirpated from these systems (Kelsch and Hendricks, 1990). Freshwater. Special Concern.

Ictalurus punctatus (Rafinesque)—channel catfish. Widespread east of the Rocky Mountains in temperate North America. Ranges throughout the state; however, the species is presumably not native, but introduced, to the upper Rio Grande and Pecos basins. Freshwater.

Ictalurus sp.—Chihuahua catfish. Restricted to the Rio Grande Basin from New Mexico south through Texas and into Mexico as far as the Rio San Fernando. In Texas, this undescribed species was native to the Rio Grande and Big Aguja Creek (Davis Mountains) in western Texas. Irrigation and indiscriminant stockings of *I. punctatus* were likely factors in its extirpation from the state. It may still occur in the Conchos, Salado, and San Fernando rivers in Mexico. Freshwater. Special Concern.

Noturus gyrinus (Mitchill)—tadpole madtom. Occurs widely throughout eastern Texas from the Red River to the Nueces Basin. There is also a report of this species from the Rio Grande in Webb County that may be a result of an introduction. Elsewhere, this species ranges widely east of the Rocky Mountains, except in upland streams draining the Appalachian mountain chain. Freshwater.

Noturus nocturnus Jordan and Gilbert—freckled madtom. Found primarily in eastern Texas from the Red River southward to the Brazos Basin. Freshwater.

Pylodictis olivaris (Rafinesque)—flathead catfish. Ranges throughout the Mississippi, Ohio, and Missouri basins southward along the Gulf coastal drainages to Mexico. Occurs statewide. Freshwater.

Satan eurystomus Hubbs and Bailey—widemouth blindcat. Restricted to the San Antonio Pool of the Edwards Aquifer in the vicinity of San Antonio at depths of 300 to 600 meters. Freshwater. Endangered.

Trogloglanis pattersoni Eigenmann—toothless blindcat. Restricted to the San Antonio Pool of the Edwards Aquifer in the vicinity of San Antonio at depths of 300 to 600 meters. Freshwater. Endangered.

Family ARIIDAE—sea catfishes

- 1a. Lower jaw with four barbels; pectoral and dorsal fins with long filaments *Bagre marinus*
- 1b. Lower jaw with six barbels; pectoral and dorsal fins without long filaments *Arius felis*

Arius felis (Linnaeus)—hardhead catfish. Hardhead catfish inhabit coastal waters from Massachusetts to Mexico; they often migrate upstream short distances in coastal rivers. Estuarine.

Bagre marinus (Mitchill)—gafftopsail catfish. This species ranges along coastal waters of the Atlantic and Gulf coasts from Massachusetts to Panama. It may be found throughout the Texas coast. Marine.

Family LORICARIIDAE—suckermouth catfishes

Hypostomus sp.—armadillo del río. Native to the Amazon Basin in South America, this species has been introduced into the headwaters of San Antonio River, Bexar County, and Comal Springs, Comal County. This species or a close relative to *H. plecostomus* has been introduced into many other sites in the United States. We prefer the common name “armadillo del río” for the species introduced to Texas rather than the Robins et al. (1991) name of “suckermouth” catfish because of long usage (Hubbs et al., 1978) and because it adheres to the American Fisheries Society’s guidelines (especially guidelines 2, 10, and 14) for the establishment of official common names of fishes. Freshwater. Introduced.

Family ESOCIDAE—pikes

- 1a. Opercles with scales on dorsal half only *Esox lucius*
- 1b. Opercles with scales covering most of ventral half 2
- 2a. Eleven to 13 branchiostegal rays; fewer than 115 scale rows along body *Esox americanus vermiculatus*
- 2b. Fourteen to 17 branchiostegal rays; more than 120 scale rows along body ... *Esox niger*

Esox americanus vermiculatus Lesueur—grass pickerel. This subspecies inhabits Mississippi River drainages from the Great Lakes to the Brazos River. In Texas, this pickerel is primarily restricted to the eastern part of the state and coastal streams from the Red River Basin south to the Brazos River Basin. The other subspecies occurs in the Atlantic Coast Drainage and has a different common name. Freshwater.

Esox lucius Linnaeus—northern pike. This species has a world-wide northern circumpolar distribution. Northern pike have been introduced into a few northern Texas reservoirs. Freshwater. Introduced.

Esox niger Lesueur—chain pickerel. The chain pickerel is native to the Atlantic and Gulf drainages as far west as the Red and Sabine basins. Freshwater.

Family SALMONIDAE—salmons

- 1a. One hundred twenty to 140 lateral scale rows; basibranchial teeth (small teeth behind those on tongue) absent; paired fins with white border; no deep red to orangish slash on each side of throat along inner side of dentary bone; small spots heavily scattered along sides and caudal fin *Oncorhynchus mykiss*
- 1b. One hundred fifty to 180 lateral scale rows; basibranchial teeth usually present, but small or vestigial; paired fins uniformly brown or reddish but without a white border; deep red to orangish slash on each side of throat along inner side of dentary bone; large spots concentrated on caudal peduncle in adults *Oncorhynchus clarki*

Oncorhynchus clarki (Richardson)—cutthroat trout. Although evidence is largely circumstantial, cutthroat trout likely were native to the state. The trout that probably occurred in Texas was the Rio Grande cutthroat trout, *O. c. virginialis* (Girard). The current range of this subspecies includes the headwaters of the Rio Grande and Pecos drainages, possibly the headwaters of the Canadian drainage (Behnke, 1979). It is thought to have been present originally in at least Limpia and McKittrick creeks in Texas and possibly elsewhere in the Davis Mountains (Garrett and Matlock, 1991). Freshwater. Presumed Extirpated.

Oncorhynchus mykiss (Walbaum)—rainbow trout. Native to streams of the Pacific Northwest from California to Alaska, this introduced species in Texas has a self-sustaining population only in McKittrick Canyon in the Guadalupe Mountains. Introduced individuals may be found in many other localities that provide a "put and take" fishery. Freshwater. Introduced.

Family APHREDODERIDAE—pirate perch

Aphredoderus sayanus (Gilliams)—pirate perch. Ranges widely throughout the Atlantic slope, Gulf Coast, and Mississippi Valley streams. Occurs primarily in eastern Texas from the Red River southward through the lower Brazos Basin. Freshwater.

Family BELONIDAE—needlefishes

Strongylura marina (Walbaum)—Atlantic needlefish. This species inhabits coastal waters from Maine to Brazil. It also may be found considerable distances upstream in the lower portions of coastal streams. Estuarine.

Family CYPRINODONTIDAE—killifishes

- 1a. Distance from origin of dorsal fin to end of hypural plate less than distance from origin of dorsal fin to preopercle or occasionally about equal to that distance; more than 30 longitudinal scale rows 2
- 1b. Distance from origin of dorsal fin to end of hypural plate more than distance from origin of dorsal fin to preopercle; 30 or fewer longitudinal scale rows 10
- 2a. More than 40 longitudinal scale rows; gill slit not extending dorsal to uppermost pectoral fin ray *Fundulus zebrinus*
- 2b. Fewer than 40 longitudinal scale rows; gill slit extending dorsal to uppermost pectoral fin ray 3
- 3a. Body with a distinct dark lateral band 4
- 3b. Body without a distinct dark lateral band 5
- 4a. Spots on body distinct, color resembles lateral band *Fundulus olivaceus*
- 4b. Spots on body diffuse, color resembles back coloration *Fundulus notatus*
- 5a. Eye contained more than one and one-half times in snout; body with about 10 dark bars, the last with dark spot dorsally *Fundulus similis*
- 5b. Eye contained fewer than one and one-half times in snout; body barred or not, but never with a dark spot on dorsal part of caudal peduncle 6
- 6a. A dark subocular bar; most prominent dark spots on body arranged in more than two lengthwise stripes *Fundulus dispar*
- 6b. No dark subocular bar; body mottled, barred or irregularly spotted 7
- 7a. Dorsal fin originating posterior to anal fin origin; fewer than 15 scale rows from pelvic fin origin to isthmus 8
- 7b. Dorsal fin originating anterior to anal fin origin; more than 15 scale rows from pelvic fin origin to isthmus 9
- 8a. Large black spots on body arranged in two irregular rows; 11 to 13 anal fin rays *Fundulus jenkinsi*
- 8b. Dark spots on body absent or small and not in rows; usually 10 anal fin rays *Fundulus chrysotus*
- 9a. Predorsal stripe absent or not reaching occiput *Fundulus grandis*
- 9b. Predorsal stripe reaching occiput; dark markings on scales not concentrated at posterior edge; no noticeable cross-hatched pattern *Fundulus pulvereus*
- 10a. Teeth conical and simple; eight to 13 scale rows from pelvic origin to isthmus 11
- 10b. Teeth compressed and with three cusps; belly naked or with more than 15 scale rows from pelvic origin to isthmus 12
- 11a. Body barred; body depth contained three times in standard length; fewer than 10 dorsal fin rays *Adinia xenica*
- 11b. Body not barred; body depth contained four times in standard length; more than 10 dorsal fin rays *Lucania parva*
- 12a. Distance from origin of dorsal fin to end of hypural plate more than distance from origin of dorsal to anterior nostril *Cyprinodon variegatus*
- 12b. Distance from origin of dorsal fin to end of hypural plate less than distance from origin of dorsal to anterior nostril 13
- 13a. Abdomen fully scaled 14

- 13b. Abdomen naked anterior to pelvic fins 16
- 14a. Lateral scale rows 26 to 27; lateral blotches of female deeper than long; dark terminal caudal bar of adult males about one-fourth of caudal depth *Cyprinodon eximius*
- 14b. Lateral scale rows 24 or 25; lateral blotches of female longer than deep; dark terminal caudal bar of adult males about one-third of caudal length 15
- 15a. Dorsal fin speckled at base; basal exposed part of lateral scales darker than edge *Cyprinodon elegans*
- 15b. Dorsal fin unicolor; lateral scales evenly colored *Cyprinodon bovinus*
- 16a. Caudal peduncle depth less than distance from snout to back of eye; in adults greatest body depth contained more than two and one-half times in standard length *Cyprinodon rubrofluvialtilis*
- 16b. Caudal peduncle depth more than distance from snout to back of eye; in adults greatest body depth contained less than two and one-half times in standard length *Cyprinodon pecosensis*

Adinia xenica (Jordan and Gilbert)—diamond killifish. A species most commonly found in coastal waters from Florida to Texas. Individuals may penetrate short distances upstream in coastal streams. Marine.

Cyprinodon bovinus Baird and Girard—Leon Springs pupfish. Occurs in the Leon Creek drainage, a flood tributary of the Pecos River (Pecos County) in western Texas. This population nearly became extinct when introduced sheepshead minnows extensively hybridized with them. Historically, the species also occurred in Leon Springs, approximately 15 kilometers southwest from the presently inhabited location but was extirpated when the springs were impounded and then pumped dry. Freshwater. Endangered.

Cyprinodon elegans Baird and Girard—Comanche Springs pupfish. The distribution of this species is restricted to a small series of springs, their outflows and man-made irrigation canals in the vicinity of Balmorhea, Texas, including, Phantom Springs (Jeff Davis County), San Solomon Springs, Giffen Springs, and Toyah Creek (Reeves County). The population in Comanche Springs (Pecos County) was extirpated when the springs were pumped dry. Freshwater. Endangered.

Cyprinodon eximius Girard—Conchos pupfish. The range of this species is from the Conchos River, Chihuahua, to the Devils River, Texas. The Devils River population is morphologically and biochemically distinct from the Alamito Creek and Conchos populations. Freshwater. Threatened.

Cyprinodon pecosensis Echelle and Echelle—Pecos pupfish. Restricted to the Pecos River in Texas and New Mexico. This species is nearly extirpated in Texas due to hybridization with introduced sheepshead minnows. Freshwater. Endangered.

Cyprinodon rubrofluvialtilis Fowler—Red River pupfish. Occurs naturally in the upper Red and Brazos basins. The Red and Brazos populations may be genetically distinct at the species level. Introduced

populations also exist in the Canadian and Colorado basins. Freshwater.

Cyprinodon variegatus Lacépède—sheepshead minnow. This species inhabits primarily coastal waters on the Atlantic and Gulf coasts from Maine south through the Gulf of Mexico and the Caribbean to Venezuela. It sometimes extends considerable distances upstream in coastal streams, especially in the Rio Grande. Introduced populations exist at a number of localities in the Trans-Pecos region and in the San Antonio Basin. Estuarine.

Fundulus chrysotus (Gunther)—golden topminnow. Native to coastal drainages from South Carolina, Florida, and Georgia west to Texas and north to southeastern Missouri, this species ranges in Texas from the Sabine River southward in coastal streams to the Lavaca River. Freshwater.

Fundulus dispar (Agassiz)—starhead topminnow. This species is found throughout the Mississippi River and adjacent basins from Michigan south and east to Alabama and west to eastern Texas. It ranges in the state from the Red River southward to the Brazos River near College Station. The subspecies found in Texas is *F. d. blirae* Wiley and Hall. Freshwater.

Fundulus grandis Baird and Girard—gulf killifish. Primarily found in coastal waters from Florida approximately to Veracruz, Mexico. Often introduced as a “bait minnow” and occurs widely in the Brazos, Rio Grande, and Pecos basins. Estuarine.

Fundulus jenkinsi (Evermann)—saltmarsh topminnow. Occurs sporadically along the Gulf Coast from western Florida to Texas. Originally described and known in Texas only from Dickinson Bayou (near Galveston Bay). Estuarine.

Fundulus notatus (Rafinesque)—blackstripe topminnow. Occurs in the central United States throughout the Mississippi Basin and adjacent drainages. Native to eastern Texas from the Red to the San Antonio basins. Freshwater.

Fundulus olivaceus (Storer)—blackspotted topminnow. Occurs in the central United States throughout the Mississippi and adjacent drainages. Ranges in Texas from the San Jacinto Drainage north and eastward to the Red River Basin. Freshwater.

Fundulus pulvereus (Evermann)—bayou killifish. Occurs in coastal waters and short distances inland from about Corpus Christi to Sabine Lake in Texas and then eastward along the coast to Mobile Bay, Alabama. Estuarine.

Fundulus similis (Baird and Girard)—longnose killifish. A species most commonly found in coastal waters from northeastern Florida to central Mexico, but individuals may penetrate short distances upstream in coastal rivers. Marine.

Fundulus zebrinus Jordan and Gilbert—plains killifish. This species is

abundant throughout the southern Great Plains of the United States. In Texas, it occurs widely in the western half of the state. An introduced population occurs in the Rio Grande and some of its tributaries in and near Big Bend National Park. A native population once found in Austin now is extirpated. Freshwater.

Lucania parva (Baird and Girard)—rainwater killifish. Native to coastal waters from Massachusetts to Tampico, Mexico, this species also occurs in the Pecos River, Leon Creek, and in Falcon Reservoir in the Rio Grande Basin. It recently (*ca.* 1980) has been introduced into Clear Creek (Menard County, San Saba River Drainage). Estuarine.

Family POECILIIDAE—livebearers

- 1a. Origin of dorsal fin anterior to origin of anal fin; intestinal canal long with many convolutions; teeth not moveable 2
- 1b. Origin of dorsal fin posterior to origin of fin; intestinal canal short with few convolutions; teeth barely movable 4
- 2a. Ten or more dorsal fin rays 3
- 2b. Fewer than nine dorsal fin rays (usually seven or eight) *Poecilia reticulata*
- 3a. Dorsal fin rays 12 to 14; dorsal fin base more than one-half predorsal length; dark spots on scales obscure diamond-shaped color pattern *Poecilia latipinna*
- 3b. Dorsal fin rays 10 to 12; dorsal fin base less than one-half predorsal length; dark spots on scales do not obscure diamond-shaped color pattern; exists only as females *Poecilia formosa*
- 4a. Origin of dorsal fin slightly behind origin of anal fin; dark band on sides with vertical bars; large black spots near bases of dorsal and caudal fins of both sexes and on anal fin of females *Heterandria formosa*
- 4b. Origin of dorsal fin well behind origin of anal fin; no dark band on sides; median fins without large black spots near their bases 5
- 5a. Spines at tip of third anal fin ray of male gonopodium (first enlarged ray) one to three times longer than wide 6
- 5b. Spines at tip of third anal fin ray of male gonopodium four to 10 times longer than wide 7
- 6a. Six (rarely seven) dorsal fin rays; distal end of the fourth fin ray of gonopodium in male parallel or curved in only a weak arch *Gambusia affinis*
- 6b. Seven dorsal fin rays; distal end of the fourth fin ray of gonopodium in male curved in a wide arch *Gambusia speciosa*
- 7a. Distal hook on fourth ray of gonopodium always segmented, usually with two to four sutures; distal segments of anterior branch of fourth fin ray of gonopodium coalesced to elbow *Gambusia georgei*
- 7b. Distal hook on fourth ray of gonopodium usually unsegmented; distal segments of anterior branch of fourth fin ray of gonopodium not coalesced to elbow 8
- 8a. Dorsal and anal fins without yellow pigmentation; dusky lateral stripe indistinct; mouth without dark markings and anal spot of females not restricted to area immediately around anus; pectoral fin of males with indentation, much deeper than widest pectoral fin ray *Gambusia heterochir*
- 8b. Dorsal and (in females) anal fins with yellow pigmentation (lost in preservation); dusky lateral stripe pronounced; mouth with dark markings, or anal spot of females restricted to area immediately around anus; pectoral fin of males with slight indentation, shallower than widest pectoral fin ray 9

- 9a. Lateral stripe broad; caudal fin without prominent dark markings; markings on sides crescentic; tip of anterior branch of fourth ray of male gonopodium does not extend to tip of posterior branch 10
- 9b. Lateral stripe thin and threadlike; caudal fin with prominent dark markings; markings on sides rounded specks; tip of anterior branch of fourth ray of male gonopodium extends as far as tip of posterior branch 12
- 10a. Elbow of gonopodium of usually four fused segments; no dark markings around mouth or anus of mature females *Gambusia senilis*
- 10b. Elbow of gonopodium composed of usually two (rarely three) fused segments; dark markings on anus of mature females 11
- 11a. Body deep, maximum body depth contained in standard length about four times in females; longest serra contained 1.2 times (usually ranges from 1.0 to 1.4) into width of segment on ray 4p of gonopodium; suborbital bar weak; chin bar faint; few crescentic lateral marks; predorsal streak weak to absent *Gambusia gaigei*
- 11b. Body slender, maximum body depth contained in standard length about five times in females; longest serra contained 1.7 times (usually ranges from 1.5 to 1.9) into width of segment on ray 4p of gonopodium; suborbital bar prominent; lateral stripe broad and conspicuous *Gambusia amistadensis*
- 12a. Postanal streak prominent (darker than markings on scale pockets); dark markings on mouth; median row of spots on dorsal fin; terminal hook on fourth and fifth rays of gonopodium angular at tip *Gambusia geiseri*
- 12b. Postanal streak weaker than markings on scale pockets; dusky or no markings on mouth; no prominent spots in middle of caudal fin; a subbasal row of spots on dorsal fin; terminal hooks on fourth and fifth rays of gonopodium rounded at tip *Gambusia nobilis*

Gambusia affinis (Baird and Girard)—western mosquitofish. This is a wide ranging species in the southern half of the United States east of the Rocky Mountains and west of the Appalachians. It may be found throughout the state of Texas and has been widely introduced throughout the world for mosquito control. Estuarine.

Gambusia amistadensis Peden—Amistad gambusia. This species now is extinct. The original range included the headsprings and the 1.3-kilometer springrun of Goodenough Springs (Val Verde County) to its confluence with the Rio Grande (Peden, 1973). The species became extinct in the wild when Goodenough Springs, once the third largest spring system in Texas was inundated by Amistad Reservoir in 1968 (Peden, 1973; Brune, 1981). Culture populations were maintained until the late 1970s at the University of Texas at Austin and at the U.S. Fish and Wildlife Service's endangered species culture facility in Dexter, New Mexico. These populations were contaminated by western mosquitofish (*Gambusia affinis*), which eliminated the Amistad gambusia in these cultures prior to 1983 (Hubbs and Jensen, 1984; Miller et al., 1989). Freshwater. Extinct.

Gambusia gaigei Hubbs—Big Bend gambusia. The Big Bend gambusia is restricted to an extremely limited series of springs in the Boquillas Crossing and Rio Grande Village areas of Big Bend National Park. At least two populations are believed to have originally existed; one at Boquillas Spring and the other at "Spring 4," east of the Rio Grande

Village campground in the park. The population inhabiting Boquillas Spring is extinct and the population in Spring 4 once was extirpated. However, the species now consists of descendents of three individuals of the Spring 4 population, and is maintained in refugia in Big Bend National Park and at the U.S. National Fish Hatchery in Dexter, New Mexico, as well as Spring 4. Freshwater. Endangered.

Gambusia geiseri Hubbs and Hubbs—largespring gambusia. The range of this species originally was restricted to the headwaters of San Marcos and Comal rivers in central Texas. It has been introduced into a number of other drainages, including the headwaters of the Concho River (Tom Green County), San Solomon Springs and associated irrigation network (Reeves County), Leon Creek (Pecos County), and Independence Creek (Terrell County). Freshwater.

Gambusia georgei Hubbs and Peden—San Marcos gambusia. This species was restricted to a limited portion of the San Marcos River springrun a few kilometers below the headsprings. It always has been rare, and its existence difficult to document. San Marcos gambusia were captured alive and an artificial culture established in Austin and in Dexter, New Mexico, in 1979 and 1980, respectively. Both of these cultures were contaminated by *Gambusia affinis* in the early 1980s (see also *Gambusia amistadensis*) and the last individual taken from the wild was captured in 1982. Despite considerable efforts to secure this species since then, none has been taken. It is likely extinct (Miller et al., 1989). Freshwater. Extinct.

Gambusia heterochir Hubbs—Clear Creek gambusia. This species is restricted to the impounded headwater springs of Clear Creek, a tributary to the San Saba River, Menard County, Texas. A series of old dams located at the extreme headwaters contributed to a competitive advantage by *G. affinis* at this location and also resulted in a long established hybrid swarm (Hubbs, 1971) between these two species. A major dam reconstruction during the late 1970s has had the effect of reducing the incidence of hybridization above the dam (Edwards and Hubbs, 1985). Freshwater. Endangered.

Gambusia nobilis (Baird and Girard)—Pecos gambusia. Known from scattered localities in western (Trans-Pecos) Texas and eastern New Mexico. In Texas, this species inhabits the headwaters of Phantom Lake (Jeff Davis County), San Solomon, Giffen, and East Sandia springs (Reeves County), Leon Creek and Diamond-Y Springs (Pecos County). Originally, it also inhabited Leon Springs (its type locality, approximately 16 kilometers upstream from Diamond-Y Springs) and also Comanche Springs (within the city of Fort Stockton) prior to their dessication. Freshwater. Threatened.

Gambusia senilis Girard—blotched gambusia. Although the species is found primarily within the Rio Conchos drainage of Chihuahua, Mexico,

a population once was known from the Devils River in Texas. This population probably was extirpated shortly after Amistad Reservoir was constructed. Freshwater. Extirpated.

Gambusia speciosa Girard—Mexican mosquitofish. We follow the evidence of Rauchenberger (1989) in recognizing this mosquitofish as a distinct species. It occurs primarily in Mexico, occupying streams and tributaries to the Rio Grande and more southern drainages. Mexican mosquitofish have a limited distribution in Texas, occurring only in the Devils River and associated streams in Val Verde County. Freshwater.

Heterandria formosa Agassiz—least killifish. A coastal species ranging from North Carolina through Florida and west to the Texas border, this killifish has been found in Texas only on the west bank of the Sabine River near the Interstate Highway 10 crossing in Orange County (Hanks and McCoid, 1988). Freshwater.

Poecilia formosa (Girard)—Amazon molly. The native range of this species in Texas is the lower Rio Grande; however, it has been introduced in a number of localities in the lower Nueces, San Antonio, and San Marcos rivers. Elsewhere, this species is also native to Gulf coastal streams in northeastern Mexico. This all female species reproduces by gynogenesis. Freshwater.

Poecilia latipinna (Lesueur)—sailfin molly. Primarily found in coastal waters from North Carolina to the Yucatan in Mexico, this species is known from numerous inland localities, primarily in spring-influenced central Texas headwaters and in the lower Rio Grande. Contrary to some reports in which it was argued that all Texas inland localities are native (Burgess, 1980), we agree with Brown (1953) that these represent introductions. Estuarine.

Poecilia reticulata Peters—guppy. Native to the Caribbean, this popular aquarium species has been introduced widely within the state. An established population in the wild exists only in the San Antonio River near Brackenridge Park. Freshwater. Introduced.

Family ATHERINIDAE—silversides

- 1a. Jaws produced into a short beak; snout length much longer than eye length; scales small, more than 60 scales in lateral series; more than 20 anal fin rays *Labidesthes sicculus*
- 1b. Jaws not produced into a beak; snout length equal to or shorter than eye length; scales large, usually fewer than 50 in lateral series; fewer than 20 anal fin rays 2
- 2a. Scales ctenoid, rough to the touch; double pairs of dark spots on dorsum; bases of dorsal and anal fin covered with scales *Membras martinica*
- 2b. Scales cycloid, smooth to the touch; dorsum with crosshatching, but not double pairs of dark spots; bases of dorsal and anal fins not covered with scales 3
- 3a. Usually eight second dorsal fin rays; air bladder long and opaque when viewed in bright light, with usually four or more anal fin rays in front of posterior tip of air bladder; exists only as females *Menidia clarkhubbsi*

- 3b. Usually nine second dorsal fin rays; air bladder long and transparent or short and opaque; either male or female 4
- 4a. Air bladder long and transparent, its posterior tip smoothly rounded; usually four or more anal fin rays in front of the posterior tip; horizontal distance between spinous dorsal and anal fin origin less than seven percent of standard length *Menidia beryllina*
- 4b. Air bladder short and opaque, its posterior tip blunt and rectangular; usually three or fewer anal fin rays in front of the posterior tip; horizontal distance between spinous dorsal and anal fin origin greater than seven percent of standard length *Menidia peninsulae*

Labidesthes sicculus (Cope)—brook silverside. Ranges from the Great Lakes southward through the Mississippi Basin and Gulf Coastal Plain drainages. In Texas, this species is restricted to the Sabine and portions of the Red River of eastern Texas. Freshwater.

Membras marinica (Valenciennes)—rough silverside. Primarily found in coastal waters from New York to Mexico. Introduced populations thrive in both Amistad and Falcon reservoirs. Marine.

Menidia beryllina (Cope)—inland silverside. Originally found in coastal waters and upstream in coastal streams along the Atlantic and Gulf coasts. Widely introduced into freshwater impoundments. In Texas, this species may be found in many reservoirs. Estuarine.

Menidia clarkhubbsi Echelle and Mosier—Amazon silverside. Known from only scattered localities in Texas including near Copano Bay and Galveston Bay. We use the common name "Amazon silverside" rather than "Texas silverside" as proposed by Robins et al. (1991) as our name is more descriptive of the reproductive biology of the species. This all-female species of apparent hybrid origin reproduces by gynogenesis. Marine.

Menidia peninsulae (Goode and Bean)—tidewater silverside. Tidewater silversides are native to coastal waters from Florida to Texas. This species inhabits more saline environments than *Menidia beryllina*. Marine.

Family SYNGNATHIDAE—pipefishes

- 1a. Median trunk ridge deflected ventrally at anus and continuous with inferior trunk ridge; 40 to 47 dorsal rays; obvious spiny projections on rings; brood pouch on males under belly *Microphis brachyurus*
- 1b. Median trunk ridge terminates at anus; lateral tail ridge with a slight discontinuity and then an upward swing posteriorly 2
- 2a. Snout short, 40 to 50 percent of head length; 27 to 36 dorsal fin rays; 15 to 17 trunk rings; 30 to 34 tail rings *Syngnathus scovelli*
- 2b. Snout long, 49 to 66 percent of head length; 33 to 36 dorsal fin rays; 19 to 21 trunk rings; 34 to 37 tail rings *Syngnathus louisianae*

Microphis brachyurus (Bleeker)—opossum pipefish. Found in Texas only in the lowermost reaches of the Rio Grande in Cameron County

although this species is widespread throughout the brackish waters of Central America, the Antilles, and scattered localities along the eastern Gulf and Atlantic coasts of the United States. Estuarine. Special Concern.

Syngnathus louisianae Gunther—chain pipefish. Found in coastal waters from Maryland south to the Caribbean and through most of the Gulf of Mexico, this species may migrate upstream considerable distances in coastal streams. Marine.

Syngnathus scovelli (Evermann and Kendall)—gulf pipefish. Found in coastal waters from Florida to Mexico. This species may migrate upstream considerable distances in coastal streams. Estuarine.

Family CENTROPOMIDAE—snooks

- 1a. Second anal fin spine not reaching caudal fin base; tips of pelvic fins reaching barely to anus; nine to 10 gill rakers on lower arch *Centropomus undecimalis*
- 1b. Second anal fin spine reaching past caudal fin base; tips of pelvic fins reaching past anus; 13 to 16 gill rakers, excluding rudiments on lower arch *Centropomus parallelus*

Centropomus parallelus Poey—fat snook. This species is known in Texas only from the lower Rio Grande near its confluence with the Gulf of Mexico. Its range extends from the Atlantic and Gulf coasts of Florida through the Gulf of Mexico south to Brazil. Throughout its range it is known to ascend great distances in coastal streams (Rivas, 1986). Estuarine. Special Concern.

Centropomus undecimalis (Bloch)—common snook. Found in coastal waters from North Carolina through the Gulf of Mexico south to Brazil. This species commonly inhabits the lower reaches of coastal streams, especially in southern Texas. Estuarine. Special Concern.

Family PERCICHTHYIDAE—temperate basses

- 1a. Dorsal fins united at base; second and third dorsal fin spines approximately equal in length; no teeth on tongue; nine to 10 anal fin soft rays; stripes along sides usually sharply broken and offset above front of anal fin *Morone mississippiensis*
- 1b. Dorsal fins separated; second dorsal fin spine much shorter than third; base of tongue with teeth; 11 to 13 anal fin soft rays; stripes along sides usually continuous 2
- 2a. Body depth contained less than three times in standard length; teeth in single patch on back of tongue *Morone chrysops*
- 2b. Body depth contained more than three times in standard length; teeth in two parallel patches on back of tongue *Morone saxatilis*

Morone chrysops (Rafinesque)—white bass. A widespread species throughout the Ohio and Mississippi drainages, the Great Lakes region,

and southward to the Red River Basin. This species has been widely introduced in the state, especially into reservoirs. Freshwater.

Morone mississippiensis Jordan and Eigenmann—yellow bass. This species is native to the central Mississippi Valley and adjacent drainages. It is restricted in Texas from the Red River southward to the San Jacinto Drainage. Although now reduced in abundance, this was a common, commercially harvested fish in the late 1800s. It was often erroneously referred to as "striped bass." Freshwater.

Morone saxatilis (Walbaum)—striped bass. This species ranges along the Atlantic and Gulf coasts west to near Lake Ponchartrian, Louisiana. Although not native to Texas, it has been widely stocked and maintains a significant fishery in many reservoirs, commonly replacing the previously introduced white bass. Estuarine. Introduced.

Family CENTRARCHIDAE—sunfishes

- 1a. Four or five dorsal fin spines; lateral line absent; scales cycloid; five branchiostegals *Elassoma zonatum*
- 1b. Six to 13 dorsal fin spines; lateral line present; scales ctenoid; six or seven branchiostegals 2
- 2a. Three anal spines (rarely two or four) 3
- 2b. Five to eight anal spines 16
- 3a. Body depth usually contained three to five times in standard length; more than 55 lateral line scales 4
- 3b. Body depth usually contained two to two and one-half times in standard length; fewer than 55 lateral line scales 7
- 4a. Shortest dorsal fin spine contained 2.4 to 3.9 times in longest dorsal spine; bases of soft dorsal and anal fins without scales; pyloric caecae branched at base *Micropterus salmoides*
- 4b. Shortest dorsal fin spine contained 1.1 to 2.5 times in longest dorsal spine; bases of soft dorsal and anal fins scaled; pyloric caecae not branched 5
- 5a. Thirteen to 15 dorsal soft rays; 28 to 32 scales around caudal peduncle; 11 to 14 scales above lateral line; 19 to 25 scales below lateral line *Micropterus dolomieu*
- 5b. Twelve dorsal fin soft rays; 22 to 28 scales around caudal peduncle; seven to 10 scales above lateral line; 14 to 19 scales below lateral line 6
- 6a. Small spots on scales not present dorsal to lateral line; dark lateral stripe prominent; caudal spot prominent; maximum depth of bars making up lateral stripe contained three to four times in maximum body depth *Micropterus punctulatus*
- 6b. Small spots on scales extend to near dorsal; dark lateral stripe obscured by barring; caudal spot usually indistinct (more so in adults); maximum depth of bars on body contained one and one-half to two times in maximum body depth *Micropterus treculi*
- 7a. Teeth on tongue and pterygoids; supramaxilla longer than breadth of maxilla; maxillary width exceeds suborbital *Lepomis gulosus*
- 7b. No teeth on tongue or pterygoids; supramaxilla absent or shorter than breadth of maxilla; maxillary width less than suborbital 8
- 8a. Pectoral fins short and rounded; pectoral fin contained 3.75 or more times in standard length 9
- 8b. Pectoral fins long and pointed, upper pectoral fin rays much longer than lower; pectoral fin contained 3.5 or fewer times in standard length 14

- 9a. Opercle stiff to its margin (not including membrane); posterior edge of opercle within opercular membrane smooth 10
- 9b. Opercle produced into a thin flexible projection lying within the opercular membrane; posterior edge of opercle within opercular membrane fimbriate 12
- 10a. Fewer than 40 scales on incomplete lateral line; black spot on dorsal fin with a pale margin *Lepomis symmetricus*
- 10b. More than 35 scales on complete lateral line; black spot on dorsal fin without a pale margin 11
- 11a. Dark spot at posterior base of dorsal fin; gill rakers in adults long, when depressed reaching beyond base of second raker below; supramaxilla two-thirds width of maxilla *Lepomis cyanellus*
- 11b. No dark spot at posterior base of dorsal fin; gill rakers in adults short, when depressed not reaching base of second raker below; supramaxilla one-third width of maxilla *Lepomis punctatus*
- 12a. Palatine teeth present; opercular membrane dark to its margin *Lepomis auritus*
- 12b. Palatine teeth absent; opercular membrane not dark to its margin 13
- 13a. Three to five cheek scales; 12 (rarely 13) pectoral fin rays; 33 to 40 lateral line scales; anal base convex *Lepomis marginatus*
- 13b. Five to seven cheek scales; 13 to 15 pectoral fin rays; 38 to 49 lateral line scales; anal base nearly straight *Lepomis megalotis*
- 14a. Opercle margined with scarlet (normally faded in preserved material), stiff to its margin; gill rakers short, not reaching beyond base of second raker below when depressed *Lepomis microlophus*
- 14b. Opercle not margined with scarlet, flexible; gill rakers reaching at least to base of second below when depressed 15
- 15a. Anal fins with three spines and seven to nine fin rays; no dark spot on posterior part of dorsal fin; palatine teeth present *Lepomis humilis*
- 15b. Anal fins with three spines and 10 to 12 fin rays; a dark spot on posterior part of dorsal fin; palatine teeth absent *Lepomis macrochirus*
- 16a. Eleven to 13 dorsal fin spines 17
- 16b. Six to eight dorsal fin spines 18
- 17a. Anal fin with six spines and 10 to 11 soft rays; fewer than 20 gill rakers on first arch; preopercle entire or weakly crenate *Ambloplites rupestris*
- 17b. Anal fin with seven to eight spines and 13 to 15 soft rays; more than 24 gill rakers on first arch; preopercle finely serrate *Centrarchus macropterus*
- 18a. Usually six dorsal fin spines; length of dorsal fin base less than distance from its origin to posterior margin of eye; body pigmentation in vertical bands *Pomoxis annularis*
- 18b. Seven or eight dorsal fin spines; length of dorsal fin base equal to or greater than distance from its origin to posterior margin of eye; body pigmentation in scattered spots *Pomoxis nigromaculatus*

Ambloplites rupestris (Rafinesque)—rock bass. Introduced into the state from Neosho, Missouri, in the late 1800s, this species now occurs in the San Marcos, Comal, and upper Guadalupe rivers. Freshwater. Introduced.

Centrarchus macropterus (Lacépède)—flier. Found in Atlantic coastal drainages from Virginia across the Gulf coastal plain to Texas and extending north through the Mississippi Basin to southern Illinois, this species is restricted in the state to lowland streams in eastern Texas including the Sabine, Neches, and San Jacinto drainages. Freshwater.

Elassoma zonatum Jordan—banded pygmy sunfish. This is a wide-ranging species occurring in lowland streams of the Atlantic and Gulf coastal plains. It inhabits eastern Texas from the Red River southward to the Brazos River Basin. Freshwater.

Lepomis auritus (Linnaeus)—redbreast sunfish. Introduced into the state from its original range of the streams of the Atlantic slope, this species now occurs throughout the eastern and southern parts of Texas as far west as Independence Creek (Pecos Drainage). Freshwater. Introduced.

Lepomis cyanellus Rafinesque—green sunfish. The original range of this species was a broad area of the United States east of the Rocky Mountains and west of the Appalachian chain. It occurs throughout the state of Texas and has been widely introduced beyond its natural range in the United States. Freshwater.

Lepomis gulosus (Cuvier)—warmouth. This species is widely distributed throughout much of the eastern United States. It may be found statewide with the exception of the plains streams in the Texas Panhandle area. Freshwater.

Lepomis humilis (Girard)—orangespotted sunfish. This species occurs in the central United States to the south of the Great Lakes, and extends into Texas throughout the northern half of the state to the Colorado River drainage. A number of introductions have occurred into various systems as far south as the Rio Grande Basin. Freshwater.

Lepomis macrochirus Rafinesque—bluegill. This wide ranging species occurs naturally in the United States east of the Rocky Mountains and may be found statewide. Two subspecies are native to the state, *L. m. macrochirus* in the northeastern half of the state and *L. m. speciosus* in the central, southern, and western parts of the state. A third subspecies, *L. m. purpurescens*, native to Atlantic coastal plain drainages, has been introduced widely as a sport and forage fish. Freshwater.

Lepomis marginatus (Holbrook)—dollar sunfish. This species occurs in southern Atlantic coastal drainages from North Carolina to Florida and west to Texas. It is restricted in the state to eastern Texas from the Sulphur and Sabine basins, southward to the Navasota River (Brazos Drainage). Freshwater.

Lepomis megalotis (Rafinesque)—longear sunfish. This species is wide ranging throughout much of the central United States. It may be found statewide in Texas except in the headwaters of the Canadian and Brazos rivers. A number of populations have been introduced in the state. Freshwater.

Lepomis microlophus (Gunther)—reardear sunfish. This species ranges throughout most of the southeastern United States. It is native to the eastern two-thirds of Texas from the Red River to the Rio Grande. This sunfish has been widely transplanted throughout the state. Freshwater.

Lepomis punctatus (Valenciennes)—spotted sunfish. This species ranges throughout most of the southeastern United States. Spotted sunfish may be found in most drainages in Texas, with the exception of streams in the northwestern part of the state. Freshwater.

Lepomis symmetricus Forbes—bantam sunfish. This species is found primarily in western Mississippi River lowlands from southern Illinois to Texas. In the state, the bantam sunfish is limited to coastal drainages from the Red River southward to the Colorado River Basin near the coast. Freshwater.

Micropterus dolomieu Lacépède—smallmouth bass. Native to northern streams east of the Rocky Mountains but has been widely introduced throughout the world. In Texas, smallmouth bass have been widely stocked, particularly in Edwards Plateau streams and reservoirs. Freshwater. Introduced.

Micropterus punctulatus (Rafinesque)—spotted bass. Native to streams of the lower Mississippi and Ohio basins, extending eastward to northwestern Florida. Native to eastern Texas from the Red River to the Guadalupe Basin exclusive of the Edwards Plateau. Freshwater.

Micropterus salmoides (Lacépède)—largemouth bass. A wide-ranging species originally found throughout much of the United States east of the Rocky Mountains, including all of Texas except parts of the Panhandle region. This game species has been widely introduced and transplanted throughout the world. In addition to the native subspecies, *M. s. salmoides*, a race from peninsular Florida, *M. s. floridanus*, has been stocked widely in state waters, especially in reservoirs. Freshwater.

Micropterus treculi (Vaillant and Bocourt)—Guadalupe bass. Endemic to the streams of the northern and eastern Edwards Plateau including portions of the Brazos, Colorado, Guadalupe, and San Antonio basins. This species also is found outside of the Edwards Plateau streams in decreased abundance, primarily in the lower Colorado River. Two introduced populations have been established in the Nueces River system. The Guadalupe bass is the official state fish of Texas. Freshwater. Special Concern.

Pomoxis annularis Rafinesque—white crappie. Although the natural range of this species was through most of the south-central United States, it has been widely stocked as a game fish. It occurred naturally in the eastern two-thirds of Texas, but introduced populations now may be found statewide except in the upper Texas portions of the Rio Grande and Pecos basins. Freshwater.

Pomoxis nigromaculatus (Lesueur)—black crappie. The native range of this species originally included the eastern Great Plains, north through the Great Lakes region and east to the southern Atlantic coastal drainages of Virginia. In Texas, the range included the central part of the state eastward, exclusive of the Edwards Plateau. It has been widely

introduced as a game species, although not quite to the extent of *Pomoxis annularis*. Freshwater.

Family PERCIDAE—perches

- 1a. Preopercle strongly serrate; upper jaw extending to below middle of eye or farther 2
- 1b. Preopercle smooth or weakly serrate; upper jaw not extending as far as to below middle of eye 4
- 2a. Six to eight anal fin soft rays; no canine teeth *Perca flavescens*
- 2b. Twelve to 13 anal fin soft rays; canine teeth well developed 3
- 3a. Cheeks well scaled; 17 to 19 dorsal fin soft rays; five or six pyloric caecae *Stizostedion canadense*
- 3b. Cheeks sparsely scaled; 19 to 22 dorsal fin soft rays; three or four pyloric caecae *Stizostedion vitreum*
- 4a. Belly naked; body depth contained in standard length more than seven times 5
- 4b. Belly scaled (a narrow naked band may be present on midline); body depth contained in standard length less than seven times 6
- 5a. Scales restricted to lateral line region; lateral blotches longer than deep *Ammocrypta clara*
- 5b. Scales not restricted to lateral line region; lateral blotches deeper than long *Ammocrypta vivax*
- 6a. More than 77 scales in lateral line; snout conical extending beyond upper lip 7
- 6b. Less than 77 scales in lateral line; snout less conical, not extending beyond upper lip 9
- 7a. Lateral bars wide, nine to 10 whole bars; midbars between whole bars short, about half the length of whole bars 8
- 7b. Lateral bars thin, 14 to 16 whole bars (usually 15); midbars between whole bars long, about equal to length of whole bars *Percina macrolepidia*
- 8a. Vertical bars on sides of body with obvious constriction medially; bars expanded dorso- and ventrolaterally; breeding males with black on breast and the pelvic and anal fins *Percina carbonaria*
- 8b. Vertical bars on sides of body equal thickness throughout length, without obvious constrictions medially; breeding males without black on breast or pelvic or anal fins *Percina caprodes*
- 9a. Sides with large black rectangular blotches; midline of belly with a series of enlarged scales or naked 10
- 9b. Sides without large black rectangular blotches; scales on belly normal 12
- 10a. Less than 60 scales in lateral line; upper lip connected to snout by a narrow frenum *Percina shumardi*
- 10b. More than 60 lateral line scales; upper lip connected to snout by a broad frenum 11
- 11a. Nape naked; upper jaw reaches level of pupil of eye *Percina maculata*
- 11b. Nape scaled; upper jaw reaches level of anterior one-third of eye *Percina sciera*
- 12a. Lateral line short, fewer than six scales with pores 13
- 12b. More than six pored lateral line scales 14
- 13a. Six dorsal fin spines (occasionally seven); one anal fin spine *Etheostoma fonticola*
- 13b. Eight dorsal fin spines; two anal fin spines *Etheostoma proeliare*
- 14a. Pectoral fin longer than head, reaching beyond anus; head angular, profile in front of eye more than 45 degrees *Etheostoma histrio*
- 14b. Pectoral fin shorter than head, not reaching anus; head profile rounded, profile in front of eye less than 45 degrees 15
- 15a. Lateral line with a slight upward curve anteriorly 16

- 15b. Lateral line straight 17
- 16a. Infraorbital canal uninterrupted, six to eight (usually eight) pores; breast unscaled; distance from snout to angle of gill cover equal to one-half of head length *Etheostoma gracile*
- 16b. Infraorbital canal interrupted with two to four pores in the anterior segment and usually two pores in the posterior segment; breast scaled; distance from snout to angle of gill cover greater than one-half of head length *Etheostoma fusiforme*
- 17a. One anal fin spine; body depth contained in standard length more than five times *Etheostoma chlorosomum*
- 17b. Two anal fin spines; body depth contained in standard length less than five times 18
- 18a. Pale longitudinal streak along lateral line; body in cross section nearly round *Etheostoma parvipinne*
- 18b. No pale longitudinal streak along lateral line; body cross section oval 19
- 19a. Gill membranes rather widely joined across isthmus; as black spot at upper margin of pectoral fins 20
- 19b. Gill membranes barely connected; no black spot on upper margin of pectoral fins 21
- 20a. No discrete red or yellow spots on side of body; vertical blotches on sides of body most distinct posteriorly *Etheostoma radiosum*
- 20b. Discrete red (in males) or yellow spots (in females) on side of body; vertical blotches on sides of body usually not prominent *Etheostoma artesiaie*
- 21a. Infraorbital canal complete *Etheostoma asprigene*
- 21b. Infraorbital canal interrupted below eye 22
- 22a. Eight to nine body bars; throat of males orange (lost in preservation) *Etheostoma spectabile*
- 22b. Ten to 12 body bars; throat of males blue or red (lost in preservation) 23
- 23a. Opercle naked or with only a few scales; more than 50 lateral line scales; throat blue or green in males (lost in preservation) *Etheostoma lepidum*
- 23b. Opercle heavily scaled; fewer than 50 lateral line scales; throat red in males (lost in preservation) *Etheostoma grahami*

Ammocrypta clara Jordan and Meek—western sand darter. The range of this species extends from the Neches, Sabine, and Red River basins in Texas northward through the Mississippi Valley to Wisconsin and Minnesota. Freshwater. Special Concern.

Ammocrypta vivax Hay—scaly sand darter. This species is native to the tributaries of the lower Mississippi River Basin. In Texas, it occurs from the San Jacinto to the Sabine rivers in the eastern part of the state. Freshwater.

Etheostoma artesiaie (Hay)—eastern redbfin darter. Found in streams in the southeastern United States. In Texas, this species occurs in small creeks from the San Jacinto through the Sabine basins. This darter, related to *E. whipplei* and *E. radiosum* (Retzer et al., 1986), was elevated to specific status by Page (1983). The species was originally captured in an artesian well, hence its name. Freshwater.

Etheostoma asprigene (Forbes)—mud darter. This species ranges through many of the larger mainstream Mississippi Valley streams and occurs in eastern Texas from the Red River south to the Neches Basin. Freshwater.

Etheostoma chlorosomum (Hay)—bluntnose darter. The range of this species includes streams along the Gulf Coast from the Guadalupe River eastward to Alabama and north to Illinois in the Mississippi Basin. Freshwater.

Etheostoma fonticola (Jordan and Gilbert)—fountain darter. This species is endemic to the upper San Marcos and Comal rivers in central Texas. The original population in the Comal River was extirpated in the mid-1950s when Comal Springs ceased to flow. A population from San Marcos was reintroduced into Comal Springs during the early 1970s. Freshwater. Endangered.

Etheostoma fusiforme (Girard)—swamp darter. While primarily a species of Atlantic and eastern Gulf slope drainages, this darter has been found in Cypress Creek, near Nacogdoches, in northeastern Texas at the westernmost part of its range. Freshwater.

Etheostoma gracile (Girard)—slough darter. Occurs in streams throughout the Gulf Coastal Plain and is found in Texas from the Rio Grande to the Red River. Most records for this species end at the Nueces River. The Rio Grande records are from Jordan and Evermann (1896) and from one recent collection (Chaney and Pons, 1989). Freshwater.

Etheostoma grahmi (Girard)—Rio Grande darter. This species is essentially restricted to the mainstream and spring-fed tributaries of the Rio Grande and the lower Pecos River downstream to the Devils River and Dolan, San Felipe, and Sycamore creeks. Freshwater. Threatened.

Etheostoma histrio Jordan and Gilbert—harlequin darter. This species ranges in the southern Mississippi Valley into extreme eastern Texas. It occurs in the state in small detritus-laden tributaries in the Cypress, Sabine, Neches, and Trinity basins. Freshwater.

Etheostoma lepidum (Baird and Girard)—greenthroat darter. This species inhabits Edwards Plateau streams, especially spring-influenced headwaters in the Colorado River southward to the Nueces River Basin. A disjunct series of populations inhabits tributaries of the Pecos River in New Mexico. Freshwater.

Etheostoma parvipinne Gilbert and Swain—goldstripe darter. The range of this species is in the Gulf Coastal Plain and lower Mississippi drainages westward as far as the Navasota River (Brazos River Basin) in Texas. This species occupies small first-order creeks. Freshwater.

Etheostoma proeliare (Hay)—cypress darter. The range of this species is the southern Mississippi Basin and Gulf Coastal Plain from northwestern Florida to Texas. In Texas, it is limited to streams in the extreme east, including the San Jacinto drainage north to the Red River. Freshwater.

Etheostoma radiosum (Hubbs and Black)—orangebelly darter. This species is limited to the Red River Basin in Texas. It is primarily found

in the Red River tributaries in Oklahoma and Arkansas. Freshwater. Special Concern.

Etheostoma spectabile (Agassiz)—orangethroat darter. Found through much of the central United States, especially in the Ozarks and Central Lowlands, this species occurs in Texas primarily in the Edwards Plateau region from the San Antonio River north and east to the Red River. It is absent from parts of streams flowing through the Coastal Plain. Freshwater.

Perca flavescens (Mitchill)—yellow perch. Introduced as a game species throughout much of North America, the native range includes much of the southern tier of Canada and the northern United States east of the Rocky Mountains. In Texas, this introduced species has established breeding populations only in the Rio Grande near El Paso, in Meredith Reservoir on the Canadian River, and Greenbelt Reservoir on the Salt Fork of the Red River, despite being introduced into many other waters in the state. Freshwater. Introduced.

Percina caprodes (Rafinesque)—logperch. This is a wide-ranging species found throughout much of the central United States. In Texas, it occurs only in a limited section of the middle Red River. Freshwater. Special Concern.

Percina carbonaria (Baird and Girard)—Texas logperch. This species occurs throughout the Edwards Plateau region of central Texas, north and east to the Red River (Morris and Page, 1981). Freshwater.

Percina macrolepida Stevenson—bigscale logperch. The range of this species is from the Red and Sabine basins in eastern Texas, south and west to the Devils River (Rio Grande drainage). Freshwater.

Percina maculata (Girard)—blackside darter. This is a wide-ranging species from the Great Lakes southward through the Mississippi Basin. In Texas, it is restricted to the Red River Basin in the northeastern part of the state. Freshwater. Threatened.

Percina sciera (Swain)—dusky darter. The range of this species extends from the Guadalupe River system northward and eastward through the state of Texas to Indiana, Ohio, and West Virginia. The Guadalupe Basin stocks of this species differ morphologically from those elsewhere and are designated as *P. s. apristis* (Hubbs, 1954). Freshwater.

Percina shumardi (Girard)—river darter. The range of this species includes drainages from parts of the Hudson Bay system in Canada southward in the Mississippi Basin to Texas. In the state, the river darter is limited to eastern Texas streams including the Red southward to the Neches, and a disjunct population in the Guadalupe and San Antonio river systems east of the Balcones Escarpment. Freshwater.

Stizostedion canadense (Smith)—sauger. This species is indigenous to waters from Quebec south through the Great Lakes and extending from

Montana through the Mississippi Valley to Arkansas and Tennessee. A game species, it has been introduced into a few impoundments in northern Texas. Freshwater. Introduced.

Stizostedion vitreum (Mitchill)—walleye. This species occurs naturally throughout much of northern North America east of the Rocky Mountains. It has been widely introduced elsewhere in the United States. Introduced populations have been stocked into numerous reservoirs in Texas. Freshwater. Introduced.

Family CARANGIDAE—jacks

Caranx hippos (Linnaeus)—crevalle jack. A coastal inhabitant found world-wide in temperate and tropical seas, the crevalle jack may be found in most of the bays and estuaries in Texas. Specimens also often are found in the lower reaches of coastal streams. Marine.

Family GERREIDAE—mojarra

- 1a. Preopercle strongly serrate; 12 or more gill rakers on lower limb of first gill arch *Diapterus auratus*
 1b. Preopercle entire (or with only a few small serrations at angle); nine or fewer gill rakers on lower limb of first gill arch 2
 2a. Nine gill rakers on lower limb of first gill arch; spinous dorsal fin distinctly tricolored (dusky at base, clear in middle, jet black at tip) *Eucinostomus melanopterus*
 2b. Eight gill rakers on lower limb of first gill arch; spinous dorsal fin not tricolored *Eucinostomus argenteus*

Diapterus auratus Ranzani—Irish pompano. Native to coastal environments from northeastern Florida through the Gulf of Mexico and the Caribbean to Brazil. This species may be found inhabiting most of the bays and estuaries in Texas. Specimens are also often found in the lower reaches of coastal streams. Marine.

Eucinostomus argenteus Baird and Girard—spotfin mojarra. This species inhabits coastal waters from New Jersey south through Bermuda, the Gulf of Mexico and the Caribbean to Brazil. The spotfin mojarra inhabits most of the bays and estuaries in Texas. Specimens frequently are found in the lower reaches of coastal streams. Estuarine.

Eucinostomus melanopterus (Bleeker)—flagfin mojarra. A coastal species found throughout the Gulf of Mexico, the flagfin mojarra may be found in most of the bays and estuaries in Texas. Specimens also are found in the lower reaches of coastal streams. Marine.

Family HAEMULIDAE—grunts

- 1a. Preopercle strongly serrate, with anteriorly directed serrations on the lower margins; two enlarged spines at angle; 12 dorsal fin spines *Conodon nobilis*
 1b. Preopercle moderately, or not at all, serrate, with no anterior pointing serrations; 13 dorsal fin spines *Pomadasys crocro*

Conodon nobilis (Linnaeus)—barred grunt. Barred grunts inhabit coastal waters from Mississippi to the Yucatan in Mexico, and this species often is found in the lower reaches of coastal streams, especially in southern Texas. Marine.

Pomadasys crocro (Cuvier)—burro grunt. A coastal inhabitant ranging from southern Florida through the Gulf of Mexico and the Caribbean to Brazil, this grunt often is found in the lower reaches of coastal streams, especially in southern Texas. Marine.

Family SPARIDAE—porgies

- 1a. More than 60 lateral line scales; a dark shoulder spot *Lagodon rhomboides*
 1b. Fewer than 50 lateral line scales; no shoulder spot *Archosargus probatocephalus*

Archosargus probatocephalus (Walbaum)—sheepshead. A coastal fish ranging from Massachusetts to the Yucatan Peninsula, this species may be found inhabiting most of the bays and estuaries in Texas. Specimens also often are taken in the lower reaches of coastal streams. Estuarine.

Lagodon rhomboides (Linnaeus)—pinfish. This species inhabits coastal waters from Massachusetts south through the entire Gulf of Mexico. It may be found in most of the bays and estuaries in Texas, and individuals also are found in the lower reaches of coastal streams. Estuarine.

Family SCIAENIDAE—drums

- 1a. Lower jaw projecting; one pair of enlarged canine teeth on upper jaw 2
 1b. Upper jaw projecting or mouth terminal; no enlarged teeth 3
 2a. Upper sides with well-defined spots; third and fourth dorsal fin spines the longest; membrane between soft dorsal and anal rays not scaled *Cynoscion nebulosus*
 2b. Upper sides without spots; first and second dorsal fin spines the longest; membrane between soft dorsal and anal rays scaled *Cynoscion arenarius*
 3a. Lower jaw with one or more barbels 4
 3b. Lower jaw without barbels 5
 4a. Pectoral fin length about equal to distance from front of the eye to opercular membrane *Micropogonias undulatus*
 4b. Pectoral fin length about equal to head length *Pogonias cromis*
 5a. Mouth terminal; distance from origin of anal fin to hypural plate much less than distance from origin of anal fin to origin of pelvic fin *Bairdiella chrysoura*
 5b. Mouth inferior; distance from origin of anal fin to hypural plate equal to distance from origin of anal fin to origin of pelvic fin 6
 6a. Dark shoulder spot; more than 60 lateral line scales *Leiostomus xanthurus*
 6b. No dark shoulder spot; fewer than 60 lateral line scales 7
 7a. Dark spot on caudal peduncle above lateral line; upper jaw extends posterior to eye *Sciaenops ocellatus*
 7b. No dark spot on caudal peduncle; upper jaw extends to below middle of eye *Aplodinotus grunniens*

Aplodinotus grunniens Rafinesque—freshwater drum. Ranges from Hudson Bay region of Canada south to Guatemala east of the Rocky

Mountains, excluding the Atlantic slope drainages. In Texas, this species occurs nearly statewide except in the Panhandle region. Freshwater.

Bairdiella chrysoura (Lacépède)—silver perch. A coastal species ranging from New York to Mexico. Silver perch may be found inhabiting most of the bays and estuaries in Texas. Specimens also may be found in the lower reaches of coastal streams. Estuarine.

Cynoscion arenarius Ginsburg—sand seatrout. A coastal species from the Gulf of Mexico. It may be found inhabiting most of the bays and estuaries in Texas. Some individuals are found in the lower reaches of coastal streams as well. Marine.

Cynoscion nebulosus (Cuvier)—spotted seatrout. This species ranges in coastal waters from New York to Tampico, Mexico. It may be found inhabiting most of the bays and estuaries in Texas, and often is found in the lower reaches of coastal streams. Estuarine.

Leiostomus xanthurus Lacépède—spot. Known from Massachusetts to Mexico, this coastal species may be found inhabiting most of the bays and estuaries in Texas. It also is found in the lower reaches of coastal streams. Estuarine.

Micropogonias undulatus (Linnaeus)—Atlantic croaker. Known from Massachusetts to Mexico, this coastal species may be found inhabiting most of the bays and estuaries in Texas. Individuals frequently are taken also in the lower reaches of coastal streams. Estuarine.

Pogonias cromis (Linnaeus)—black drum. This species inhabits coastal waters from Massachusetts to Argentina and may be found in most of the bays and estuaries in Texas. It often is found also in the lower reaches of coastal streams. Marine.

Sciaenops ocellatus (Linnaeus)—red drum. This popular coastal sportfish occurs from Massachusetts to Mexico and may be found inhabiting most of the bays and estuaries in Texas. This drum often is taken also in the lower reaches of coastal streams. Estuarine.

Family CICHLIDAE—cichlids

- 1a. Five or six anal fin spines *Cichlasoma cyanoguttatum*
- 1b. Fewer than five anal fin spines (usually three) 2
- 2a. Eight to 10 gill rakers on lower part of first gill arch; transverse bands present on sides; dorsal fin with yellow spots *Tilapia zilli*
- 2b. Fourteen or more gill rakers on lower part of first gill arch; color pattern other than that above 3
- 3a. Fourteen to 20 (usually 17 to 18) gill rakers on lower part of first gill arch; most teeth in outer row are unicuspid in adults; sides with three or four dark blotches or with no markings; no yellow on dorsal fin; caudal fin without distinct vertical stripes *Tilapia mossambica*
- 3b. Eighteen to 26 gill rakers on lower part of first gill arch; outer row of teeth bicuspid in adults; sides unmarked or with vague, irregular dark markings; caudal fin often with a broad, red distal margin; young often with vertical bands on caudal fin *Tilapia aurea*

Cichlasoma cyanoguttatum (Baird and Girard)—Rio Grande cichlid. Native to the United States and Texas only in the Rio Grande and Pecos drainages, this species is also native to northeastern Mexico. Widely introduced; established populations exist as far north in Texas as the San Gabriel River (Brazos River system). Freshwater.

Tilapia aurea (Steindachner)—blue tilapia. Native to the Middle East and along the Mediterranean Coast of North Africa, this aquacultural species has been introduced into Texas and has become established in the Rio Grande, San Antonio, Guadalupe, and parts of the Colorado River drainages. Numerous other introductions also have occurred. Most successful establishments are in areas without extremely cold winter water temperatures (the lower Rio Grande Basin and reservoirs heated by power plant effluents, for example). Freshwater. Introduced.

Tilapia mossambica (Peters)—Mozambique tilapia. Native to Africa, this aquacultural species has been introduced into Texas and has become established primarily in the San Marcos, Guadalupe, and San Antonio rivers along the Balcones fault zone. Freshwater. Introduced.

Tilapia zilli (Gervais)—redbelly tilapia. Originally ranging from north-central Africa to Jordan, this introduced species has been established in the headwaters of the San Antonio River. Freshwater. Introduced.

Family MUGILIDAE—mullet

- 1a. Lower jaw rounded, without a symphyseal knob; lower limb of first gill arch with 17 to 20 gillrakers; no adipose eyelid; scales ctenoid *Agonostomus monticola*
- 1b. Lower jaw angular, with a prominent symphyseal knob; lower limb of first gill arch with 25 to 60 gillrakers; adipose eyelid well developed in adults; scales cycloid 2
- 2a. Soft dorsal and anal fins with few scales; sides with longitudinal dark stripes along the scale rows; usually eight (rarely seven or nine) anal fin soft rays; usually 41 lateral line scales *Mugil cephalus*
- 2b. Soft dorsal and anal fins with many scales; sides without longitudinal dark stripes along the scale rows; usually nine anal fin soft rays; usually 38 lateral line scales *Mugil curema*

Agonostomus monticola (Bancroft)—mountain mullet. Generally found along the Atlantic and Gulf coasts through the Caribbean to Columbia and Venezuela in South America, this species has been found considerable distances upstream in various Texas streams from the Trinity to the Rio Grande; it is a common inhabitant of the lower Rio Grande. Estuarine.

Mugil cephalus Linnaeus—striped mullet. This species has a worldwide circumtropical distribution and occurs in all of the major bays and estuaries of Texas. Striped mullet also may migrate considerable distances inland. Estuarine.

Mugil curema Valenciennes—white mullet. A coastal species in

temperate and tropical seas of the Western Hemisphere, white mullet inhabit most of the bays and estuaries in Texas. Individuals also may be found in the lower reaches of coastal streams. Estuarine.

Family POLYNEMIDAE—threadfins

Polydactylus octonemus (Girard)—Atlantic threadfin. This species inhabits coastal waters from Massachusetts south through the Gulf of Mexico and the Caribbean. It may be found in most of the bays and estuaries in Texas, especially at night in spring and early summer. Specimens frequently are taken in the lower reaches of coastal streams. Marine.

Family ELEOTRIDAE—sleepers

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|--|----------------------------|
| 1a. Fewer than 40 scale rows; maxillary reaching anterior margin of orbit | <i>Dormitor maculatus</i> |
| 1b. More than 50 scale rows; maxillary reaching posterior margin of pupil | 2 |
| 2a. Teeth on vomer | <i>Gobiomorus dormitor</i> |
| 2b. No teeth on vomer; preopercle with a postero-ventrally directed spine | 3 |
| 3a. Twelve dorsal fin soft rays; 10 anal fin soft rays; scales cycloid; about 100 lateral scale rows | <i>Erotelis smaragdus</i> |
| 3b. Nine dorsal fin soft rays; nine anal fin soft rays; ctenoid scales posteriorly; fewer than about 70 lateral scale rows | <i>Eleotris pisonis</i> |

Dormitor maculatus (Bloch)—fat sleeper. Fat sleepers range in coastal waters from North Carolina south to Florida, throughout the Gulf of Mexico and the Caribbean to Brazil. They may be found inhabiting most of the bays and estuaries in Texas. Individuals also inhabit the lower reaches of coastal streams. Estuarine.

Eleotris pisonis (Gmelin)—spinycheek sleeper. Ranges in coastal habitats from South Carolina and the Bermudas, throughout the Gulf of Mexico, and the Caribbean to Brazil, including most of the bays and estuaries in Texas. This species also is found in the lower reaches of coastal streams. Estuarine.

Erotelis smaragdus (Valenciennes)—emerald sleeper. A coastal species ranging from the northern Gulf of Mexico to Brazil, emerald sleepers may be found inhabiting most of the bays and estuaries in Texas. Specimens also often are found in the lower reaches of coastal streams. Marine.

Gobiomorus dormitor Lacépède—bigmouth sleeper. Found in southern Florida and Texas, and south through the Gulf of Mexico and the Caribbean to South America, this species inhabits the coastal regions of southern Texas. It is quite common in the lower reaches of the Rio Grande. Estuarine.

Family GOBIIDAE—gobies

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|---|--------------------------------|
| 1a. Body long and slender; body depth contained about seven times in standard length | <i>Gobioides broussoneti</i> |
| 1b. Body short and stout; body depth contained fewer than seven times in standard length | 2 |
| 2a. Upper pectoral fin rays free from membrane; tongue notched | <i>Bathygobius soporator</i> |
| 2b. Upper pectoral fin rays joined to membrane; tongue indented but not notched | 3 |
| 3a. Body naked | 4 |
| 3b. Body mostly scaled | 5 |
| 4a. Usually 12 (11 to 13) second dorsal fin rays; usually 10 (nine to 11) anal fin rays; pelvic length contained 1.2 to 1.5 times in distance from base of pelvic fin to origin of anal fin | <i>Gobiosoma robustum</i> |
| 4b. Usually 13 (12 to 14) second dorsal fin rays; usually 11 (10 to 12) anal fin rays; pelvic length contained 1.6 to 2.0 times in distance from base of pelvic fin to origin of anal fin | <i>Gobiosoma bosc</i> |
| 5a. Fifteen to 16 second dorsal fin rays; 16 to 17 anal fin rays; dark brown spots on body; two or three dark vertical bars below second dorsal fin | <i>Microgobius gulosus</i> |
| 5b. Eleven to 14 second dorsal fin rays; 11 to 16 anal fin rays | 6 |
| 6a. Fourteen second dorsal fin rays; 15 anal fin rays; more than 60 scales rows in lateral series | <i>Gobionellus oceanicus</i> |
| 6b. Eleven to 12 second dorsal fin rays; 11 to 13 anal fin rays | 7 |
| 7a. Scales small, more than 70 rows in lateral series | <i>Awaous tajasica</i> |
| 7b. Scales large, about 29 to 40 rows in lateral series | 8 |
| 8a. Patch of scales on upper margin of opercle; two dark spots on caudal fin base | <i>Evorthodus lyricus</i> |
| 8b. No patch of scales on upper margin of opercle | 9 |
| 9a. Eleven second dorsal fin rays; 12 anal fin rays | <i>Gobionellus boleosoma</i> |
| 9b. Twelve second dorsal fin rays; 13 anal fin rays | 10 |
| 10a. Upper membranes of dorsal fins clear or dusky but without distinct blackened margins | 11 |
| 10b. Upper membranes of dorsal fins with distinct blackened margins | <i>Gobionellus atripinnis</i> |
| 11a. Canine present on lower jaw | <i>Gobionellus stigmaticus</i> |
| 11b. No canines present on lower jaw | <i>Gobionellus shufeldti</i> |

Awaous tajasica (Lichtenstein)—river goby. This species is known from the Atlantic and Gulf coasts of the United States south through the West Indies and Central America. In Texas, this species is known only from the Rio Grande in Hidalgo and Willacy counties (Edwards et al., 1986). Estuarine. Special Concern.

Bathygobius soporator (Valenciennes)—frillfin goby. This coastal species ranges from North Carolina to Florida and through the Gulf of Mexico. It may be found inhabiting most of the bays and estuaries in southern Texas. Specimens also are found frequently in the lower reaches of coastal streams, especially in the lower Rio Grande. Marine.

Evorthodus lyricus (Girard)—lyre goby. This species is indigenous to coastal waters from Maryland to Surinam and the West Indies. It

probably inhabits most of the bays and estuaries in Texas. Individuals also are taken in the lower reaches of coastal streams. Marine.

Gobioides broussonneti Lacépède—violet goby. A coastal inhabitant ranging along the Atlantic and Gulf coasts from Georgia to Brazil, violet gobies may be found inhabiting most of the bays and estuaries in Texas. Estuarine.

Gobionellus atripinnis Gilbert and Randall—blackfin goby. A coastal species, the blackfin goby is known only from a few records in southern Texas and northern Mexico (Gilbert and Randall, 1979). It was originally described from the lower Rio Grande. Estuarine. Endangered.

Gobionellus boleosoma (Jordan and Gilbert)—darter goby. Occurs from North Carolina south through the Gulf of Mexico and Caribbean to Brazil. This coastal species may be found inhabiting most of the bays and estuaries in Texas as well as the lower reaches of coastal streams. Estuarine.

Gobionellus oceanicus (Pallas)—highfin goby. This species is found in coastal waters from North Carolina to Campeche, Mexico. Highfin gobies inhabit most of the bays and estuaries in Texas, and occur also in the lower reaches of coastal streams. Marine.

Gobioellus shufeldti (Jordan and Eigenmann)—freshwater goby. Coastal, may be found inhabiting most of the bays and estuaries from Galveston Bay north and east to about North Carolina. Individuals may occur in the lower reaches of coastal streams. Estuarine.

Gobionellus stigmaticus (Poey)—marked goby. This species ranges from North Carolina south along the Atlantic and Gulf coasts and the Caribbean to Brazil. Marine.

Gobiosoma bosc Lacépède—naked goby. Coastal, ranges from Long Island Sound to Campeche, Mexico. Naked gobies may be found inhabiting most of the bays and estuaries in Texas, and these gobies often are found in the lower reaches of coastal streams, especially in the southern part of the state. Estuarine.

Gobiosoma robustum Ginsburg—code goby. The range of this species includes coastal waters from Chesapeake Bay south to Florida and through the Gulf of Mexico to the Yucatan Peninsula. These gobies also are found in most of the bays and estuaries in Texas, and in the lower reaches of coastal streams. Estuarine.

Microgobius gulosus (Girard)—clown goby. A coastal inhabiting species, known in Texas from the Corpus Christi Bay system north through the northern Gulf of Mexico and along the Atlantic Coast to Chesapeake Bay. Estuarine.

Family BOTHIDAE—lefteye flounders

- 1a. Lateral line without a high arch over the pectoral fin on the ocular side 2

- 1b. Lateral line highly arched over the pectoral fin on the ocular side *Paralichthys lethostigma*
- 2a. Upper jaw reaching to below level of middle of eye; jaws equal; greatest body depth one-half or less standard length *Citharichthys spilopterus*
- 2b. Upper jaw reaches to below level of front of eye; jaw on blind side larger than jaw in eyed side; greatest body depth greater than one-half standard length *Etropus crossotus*

Citharichthys spilopterus Gunther—bay whiff. Bay whiffs are coastal inhabitants ranging from New Jersey to Brazil, and may be found inhabiting most of the bays and estuaries in Texas. They also often are found in the lower reaches of coastal streams. Estuarine.

Etropus crossotus Jordan and Gilbert—fringed flounder. A coastal species found from Chesapeake Bay south through the Gulf of Mexico and the Caribbean to South America, this flounder may inhabit most of the bays and estuaries in Texas. It also may be found in the lower reaches of coastal streams. Marine.

Paralichthys lethostigma Jordan and Gilbert—southern flounder. Ranges in coastal habitats from North Carolina south through Florida and west along the Gulf Coast to northern Mexico. Southern flounders probably inhabit most of the bays and estuaries in Texas, and occur also in the lower reaches of coastal streams. Estuarine.

Family SOLEIDAE—soles

- 1a. Right pectoral fin absent; 66 to 75 lateral line scales *Trinectes maculatus*
- 1b. Right pectoral fin present; 75 to 85 lateral line scales *Achirus lineatus*

Achirus lineatus (Linnaeus)—lined sole. Coastal, ranging from South Carolina south through the Gulf of Mexico and the Caribbean to Uruguay, this species may be found inhabiting most of the bays and estuaries in Texas. Specimens also often are found in the lower reaches of coastal streams. Estuarine.

Trinectes maculatus (Bloch and Schneider)—hogchoker. A coastal species known from Massachusetts south along the Atlantic Coast, and throughout the Gulf of Mexico to about Panama, hogchokers may be found inhabiting most of the bays and estuaries in the state. Individuals frequently are found in the lower reaches of coastal streams as well. Estuarine.

Family TETRAODONTIDAE—puffers

Sphoeroides parvus Shipp and Yerger—least puffer. Known from the Gulf of Mexico from Apalachicola Bay, Florida, west along the Gulf coast to the Yucatan Peninsula. This species occurs in many of the bays and estuaries along the Texas coast, and also is found in the lower reaches of coastal streams. Marine.

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