

The fishes of northern and central Veracruz, Mexico

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Abstract

The northern and central part of Veracruz, México, as herein delimited, is inhabited by 121 species of fish, in 83 genera and 47 families. Four species and 3 families are Nearctic, 28 species and 6 families are Neotropical, and 1 species is circumtropical. Ecologically, 8 species and 4 families are primary, 25 species and 6 families are secondary, 30 families are peripheral, and 7 families are marine, many of them marine accidentals. A mountainous area near Punta del Morro almost reaches the sea, and acts as a filter for primary and secondary species. Its importance had not been described in detail. From the north, the following species range to Punta del Morro or less: *Astyanax mexicanus*, *Dionda ipni*, *Ictalurus* cf. *furcatus*, *I.* cf. *punctatus*, *Lucania parva*, *Cyprinodon variegatus*, *Gambusia affinis*, *G. vittata*, *Heterandria* sp., *Poecilia formosa*, *P. latipinna*, *Xiphophorus birchmani*, *X. variatus*, *Cichlasoma cyanoguttatum*, *C. labridens* and *C.* sp.. From the south, the species that approach or reach Punta del Morro are: *Astyanax aeneus*, *Hyphessobrycon compressus*, *Rhamdia guatemalensis*, *R. laticauda*, *Rivulus* cf. *robustus*, *Belonesox belizanus*, *Poeciliopsis gracilis*, *Xiphophorus andersi*, *X. maculatus*, and *Ophisternon aenigmaticum*. Eight species including one peripheral are present on both sides and constitute short penetrations across the barrier. At least nine species represent introductions, purposeful or accidental.

Gambusia regani and *G. panuco* are nominal species of the same form; by first reviser, *G. regani* is regarded as senior synonym.

Introduction

Since the beginning of this century, Meek (1904) and Regan (1906–1908) recognized in México a transitional area between the nearctic and neotropical areas. Later, De Buen (1947) pointed out three ichthyological zones: the province of the Bravo (Grande) river in the north, a transition zone comprising the Pánuco and Balsas basins, and a tropical province in the south. Currently, the recognized range of the transition zone is from

Soto La Marina river in Tamaulipas (northern limit) to the Papaloapan river in Veracruz (southern limit) (Miller, 1982). However, there is no comprehensive distributional study of continental fishes in the state of Veracruz; only partial references to the Atlantic coast or narrow areas of the state, as part of other taxonomic work, exist. Therefore, this study is the first review of the continental fish fauna of northern Veracruz. Its objectives are: 1) to update the local ichthyofaunal inventory and 2) to provide a distributional analy-

sis of species. The present work is a part of ichthyological studies in NE México made since 1964 by the Laboratorio de Ictiología, Facultad de Ciencias Biológicas, Universidad Autónoma de Nuevo León (UANL).

Historical overview

The first studies on the fish fauna of North and Central America, including Veracruz, were by Jordan & Evermann (1896), Meek (1902, 1904), Regan (1905–1906, 1906–1908), De Buen (1940, 1947), Miller (1966, 1976 & 1986), and Alvarez (1970).

Papers including specific references to Veracruz fishes are: Hubbs (1926), who described *Gambusia vittata*, *G. regani* and *G. panuco* from the Pánuco basin, and *G. nicaraguensis* (in part *G. sexradiata*) from SE México to Panama. Rosen (1960) recorded *Xiphophorus maculatus* from Jamapa, *X. variatus* from Cucharas and Tancochin estuaries, Tuxpan, Cazonas, Tecolutla and Nautla rivers and, *X. helleri* from Nautla, Antigua, Chachalacas, and Jamapa rivers. Darnell (1962) published a catalogue of fishes from the Tamesí river and mentioned species collected in Laguna del Chairel and other coastal lagoons south of Tampico. Rosen & Bailey (1963) reported 11 species of poeciliids from Veracruz. Darnell & Abramoff (1968) reported *Poecilia formosa* from S Texas to Laguna de Tampamachoco in Tuxpan river. Schultz & Miller (1971) established the differences among species of *Poecilia* with short dorsal fins from the Atlantic and Pacific basins. Menzel & Darnell (1973) revised the taxonomy and distribution of northern subspecies of *Poecilia mexicana*. *Heterandria jonesi* was reported from Pánuco river to Nautla river, Atoyac river and Valle de Orizaba, and *H. bimaculata* from S México to Misantla river (Miller, 1974). Miller (1976a) updated the list of species published by Meek (1904). Rosen & Greenwood (1976) presented the phylogeny, keys and distribution of synbranchids, and found *Ophisternon aenigmaticum* in Veracruz. *Dionda ipni* was collected in Pánuco, Tuxpan, Cazonas, Nautla and

Misantla basins (Hubbs & Miller, 1977). Rosen (1979) discussed the distribution of the genera and species of *Heterandria* and *Xiphophorus*. *Xiphophorus andersi* is endemic to a restricted part of the Atoyac river (Meyer & Schartl, 1980). *Gambusia sexradiata* has been reported from N of Nautla river to Belize (Greenfield *et al.*, 1982). Miller (1983) keyed the genus *Poecilia* and indicated *P. latipinna* from Tuxpan river to the north, *P. mexicana* for the Gulf of México coast and *P. sphenops* from approximately 50 km N of Veracruz city and south into the Río Coatzacoalcos.

Taylor & Miller (1983) revised native cichlids of the Pánuco river, and reported *Cichlasoma cyanoguttatum* and *C. labridens* for N Veracruz. *Rhamdia guatemalensis* and *R. laticauda* were found NW of Veracruz city and Jamapa river, respectively, and south (Miller, 1984). Stawikowsky & Werner (1985) dealt with all known Central American cichlids. Konings (1989) published on some aspects of cichlids of Central America, including species present in our study area.

Rauchenberger (1989) showed that *Gambusia vittata* is distributed in the Pánuco, Tamesí and Tuxpan rivers; *G. panuco* in the Pánuco and Tamesí rivers except in the head of the Sabinas river where she indicated that it is replaced by *G. regani*; *G. affinis* reaches to just S of Tampico and *G. sexradiata* is distributed from the Nautla river to the Yucatán Peninsula. Lechner & Radda (1987) described *Xiphophorus birchmanni* from headwaters of the Pánuco and Tuxpan rivers, at the limits of Veracruz and Hidalgo. Rauchenberger *et al.* (1990) described *Xiphophorus nezahualcoyotli*, *X. continens*, *X. malincheae*, and *X. multilineata* from the Pánuco basin.

Briggs (1958) listed the secondary and marine fishes of Florida, with ecological and distributional data, indicating some species reaching Veracruz. *Centropomus poeyi* was described by Chavez (1961) with a distribution from Tampico to Frontera, Tabasco. *Belone argala* and *Strongylura marina* were reported for E México by Berry & Rivas (1962). Hildebrand (1963) published keys and descriptions of *Anchoa* and *Cetengraulis* species from the Western Atlantic, while Miller

(1963) described the species of *Dorosoma* (including keys). Ramírez (1965) included Veracruz records in his preliminary work on marine fishes. Böhlke & Chaplin (1968) reviewed the fishes of the Bahamas, some of which were said to occur in Veracruz. Böhlke & Robins (1968) studied the gobiids of the Western Atlantic. Fraser (1968), based on an osteological study, compared species of *Centropomus* recognizing *C. paralellus*, *C. undecimalis* and, *C. pectinatus* for the Atlantic coast; Dawson (1969) published keys for the gobiids from the Mississippi Sound, reporting some species from the study area. Reséndez (1970) listed 56 species from Laguna de Tamiahua. Wallis (1975) published on fishes from the Northern of Gulf of México, and Hoese & Moore (1977) on fishes from the Gulf of México (with keys). Castro-Aguirre (1978) reported numerous estuarine species and marine invaders in the continental waters of México. Chao (1978) studied the phylogenetic relation among the sciaenids from the Western Atlantic. Chernoff *et al.* (1981) indicated Laguna de Tamiahua as the southern limit of *Menidia beryllina*. Murdy (1983) published a guide to marine fishes of Texas, including the Gulf of México. Matheson & McEachran (1984) reviewed the *Eucinostomus argenteus* complex and reported *E. argenteus* and *E. gula* for Veracruz. Aguirre-León *et al.* (1982) published on the gerreids from Laguna de Términos, Campeche, indicating their general distribution. Dawson (1985) placed *Oosthetus lineatus* in *Microphis brachyurus lineatus*. Kobelkowsky (1985) listed 68 species from Laguna de Tampamachoco, Veracruz; Rivas (1986) reviewed the genus *Centropomus* and recognized 12 species with a distribution including Veracruz. Finally, Deckert & Greenfield (1987) analyzed the distribution of *Diapterus* and *Eugerres* in the Western Atlantic.

Material and methods

The area of study comprises the north and centre of Veracruz state, approximately 400 km from N to S (18°41'53" to 22°28'04" N and 96°00'00" to 98°23'32" W). It includes, according to Tamayo (1962) and INEGI (1988), the

following hydrological basins: 1. Pánuco, 2. Conjunto (Complex) No. 5 (Tamiahua, Cucharas, Tancochin, Oro Verde and San Lorenzo), 3. Tuxpan (= Pantepec), 4. Tumulco, 5. Cazonas, 6. Tenixtepec, 7. Tecolutla, 8. Conjunto (Complex) No. 8 (Arroyo Solteros), 9. Nautla, 10. Misantla, 11. Conjunto (Complex) No. 9 (Colipa, Yemantla, Juchique, Florida, Higueras, Santa Ana, Palma Sola, Paso Limón and Paso Doña Juana), 12. Laguna del Morro, 13. Actopan (= Chachalacas), 14. Antigua, 15. Jamapa (= Boca de Río), 16. Conjunto (Complex) No. 12 and, 17. Blanco (Fig. 1). Between Antigua and Jamapa basins exist the next water bodies all N of Veracruz city which we here call as Conjunto Playa Norte: Laguna 8 km, Laguna 6 km, Playa Norte creek 4 km and Playa Norte creek 2 km.

The fishes were mostly collected by the authors during expeditions from 1964 to 1988, resulting in a total of 49619 specimens. Fish specimens were collected with different methods and sampling time depending on conditions at the site. A 3 m seine (3/16" mesh), a 6 m seine (1/4" mesh) with bag, and a 20 m gillnet were the principal gears used. The material is in the Laboratorio de Ictiología, Facultad de Ciencias Biológicas, UANL. The meristic and morphometric characters were taken following the standard methods of Hubbs & Lagler (1947). The systematic arrangement is after Greenwood *et al.* (1966) with the exception of the Cyprinodontidae s.l., which are after Parenti (1981). The ecological categories follow Myers (1951) and Miller (1966, 1976 & 1986), while the zoogeographical categories follow Darlington (1957). For each species the basins of distribution are given, and the new records are indicated by the localities, numbers of catalog and number of specimens. For specific data and distributional maps of the material examined, interested readers may consult the file of Obregón-Barboza (1990) at UANL.

Annotated checklist

RAJIDAE. Peripheral

Raja texana Chandler. Tuxpan and Conjunto No. 5 (Tamiahua) (Castro-Aguirre, 1978).

DASYATIDAE. Peripheral

Dasyatis sabina (Lesueur). Conjunto No. 5 (Tami-ahua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

TORPEDINIDAE. Peripheral

Narcine brasiliensis (Olfers). Tuxpan and Con-junto No. 5 (Tamiagua) (Castro-Aguirre, 1978).

ELOPIDAE. Peripheral

Elops saurus Linnaeus. Conjunto No. 5 (Tami-ahua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978) and Pánuco.

CLUPEIDAE. Peripheral

Dorosoma anale Meek. Conjunto No. 12. Re-marks: New locality (UANL 9384(2) La Piedra,

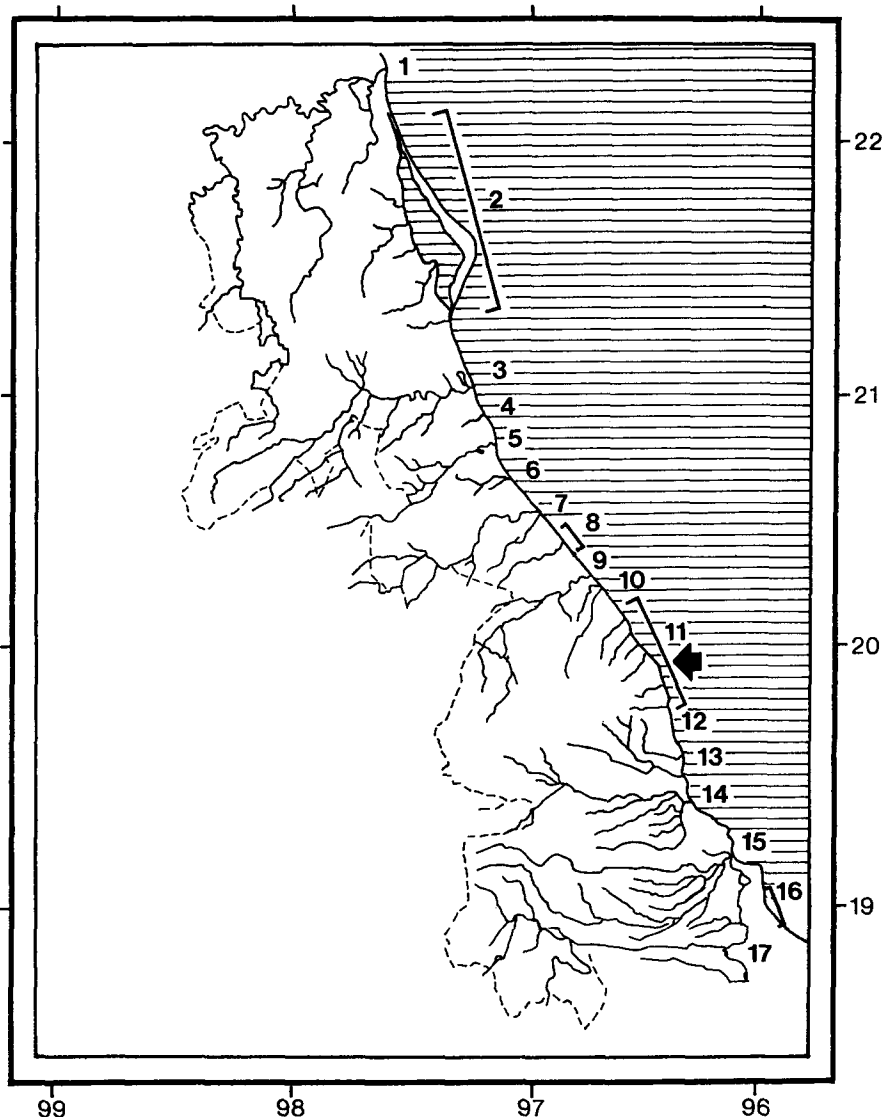


Fig. 1. Map of north and central parts of Veracruz, Mexico, showing locations of basins and hydrological groups. 1. Pánuco, 2. Conjunto (Complex) No. 5 (Tamiagua, Cucharas, Tancochin, Oro Verde and San Lorenzo), 3. Tuxpan (= Pantepec), 4. Tumilco, 5. Cazonas, 6. Tenixtepec, 7. Tecolutla, 8. Conjunto (Complex) No. 8 (Arroyo Solteros), 9. Nautla, 10. Misantla, 11. Conjunto (Complex) No. 9 (Colipa, Yemantla, Juchique, Florida, Higuera, Santa Ana, Palma Sola, Paso Limón and Paso Doña Juana), 12. Laguna del Morro, 13. Actopan (Chachalacas), 14. Antigua, 15. Jamapa (= Boca de Río), 16. Conjunto (Complex) No. 12 and 17. Blanco. The arrow shows Punta del Morro.

0.8 km NE). Formerly reported from Papaloapan basin (Meek, 1904; Alvarez, 1970; Miller, 1966, 1976 & 1986) and Laguna de Términos (Reséndez, 1981). R. R. Miller (in litt., XII:2: 1991) commented that J. W. Atz and F. G. Wood Jr., collected *Dorosoma anale* (21; 34–93 mm) from near Paso del Toro, 4.4 mi from south shore of Río Jamapa at Boca del Río, Veracruz, march, 1st., 1948. Kobelkowsky *et al.* (1989) reported this species from Laguna de Pueblo Viejo, Veracruz (Pánuco basin). However, this probably represents a misidentification because the northernmost limit of *D. anale* is the Río Jamapa, near Veracruz City. Perhaps the record should be referred to *D. cepedianum*, or if true, regarded as an introduction.

Dorosoma cepedianum (Lesueur). Pánuco (Miller, 1963; Alvarez, 1970) and Conjunto No. 5 (Tamiagua) (Reséndez, 1970).

Dorosoma petenense (Günther). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Pánuco, Conjunto No. 5 (Tancochin), Tuxpan, Cazonos, Tecolutla, Conjunto No. 8, Antigua and Conjunto No. 12. A species with a wide distribution (Briggs, 1958).

ENGRAULIDAE. *Peripheral*

Anchoa hepsetus (Linnaeus). Tuxpan, Conjunto No. 5 (Tamiagua) (Hildebrand, 1963; Castro-Aguirre, 1978) and Jamapa.

Anchoa mitchilli (Valenciennes). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan, Jamapa (Laguna Mandinga) (Hildebrand, 1963; Castro-Aguirre, 1978) and Pánuco.

Cetengraulis cf. *edentulus*. Tuxpan (Kobelkowsky, 1985). Remarks: Our specimen (UANL 2626(1) Bocana Tampamachoco) has been assigned as close to *C. edentulus* (Cuvier), but it differs from this species in some characters given as diagnostic by Hildebrand (1963) and Cervigón (1966).

SYNODONTIDAE. *Peripheral*

Synodus foetens (Linnaeus). Tuxpan (Castro-Aguirre, 1978).

CHARACIDAE. *Neotropical. Primary*

Astyanax mexicanus (Filippi). Pánuco (Alvarez,

1970), Conjunto No. 5 (Cucharas, Tancochin, Oro Verde and San Lorenzo), Tuxpan, Tumilco, Cazonos, Tenixtepec and Tecolutla.

Astyanax mexicanus × *aeneus*. Conjunto No. 8, Nautla, Misantla, Conjunto No. 9 (Colipa, Florida, Santa Ana, Palma Sola, Paso Limón and Laguna del Llano). Remarks: The material examined presents a gradation of characters from *A. mexicanus* to *A. aeneus*, as seen in the number of anal rays (Table 1). Revisionary work is needed to determine whether these two forms are taxonomically distinct from *A. fasciatus* Cuvier.

Astyanax aeneus Günther. Chachalacas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco. Remarks: Besides the ma-

Table 1. Frequency distribution of anal fin rays in different populations of *Astyanax*. *n* = number of specimens examined.

Basins and hydrological groups	<i>n</i>	Anal fin rays										
		18	19	20	21	22	23	24	25	26	27	28
Soto la Marina	30	2	10	15	2							
San Fernando	40	2	10	21	6	1						
Pánuco	31	5	11	7	6	1	1					
Cucharas	30	2	5	11	9	2	1					
San Diego	30	1	1	11	8	4	5					
Tancochin	30	1	7	8	11	2	1					
Paso del Norte	30		11	10	5	2	2					
Oro Verde	30	3	10	7	8	2						
Tuxpan	30		9	11	8	2						
Tumilco	30	1	1	6	11	8	3					
Cazonos	30	2	3	8	13	3	1					
Tecolutla	31		2	16	12	2	2					
Conj. No. 8	61	1	7	16	23	13	3					
Nautla	27	3	3	9	9	2	1					
Colipa	13		3	3	3	4						
Florida	7			5	2							
Santa Ana	8			4	2	1		1				
Palma Sola	13				1	5	5	2				
Paso Limón	12				2	5	4	1				
Laguna Llano	12					1	10	1				
Chachalacas	50		1	2	4	13	15	10	4	1		
Antigua	27				2	5	10	7	2	1		
Playa Norte	29				2	3	15	5	4			
Jamapa	40				7	8	16	4	5			
Conj. No. 12	53				2	2	20	13	11	1	1	
Blanco	29				3	7	9	6	4			
Papaloapan	46			1		8	15	10	7	3	2	
Coatzacoalcos	35			1		4	10	7	8	5		

terial from our study area, we examined specimens from Papaloapan and Coatzacoalcos basins.

Hypheobrycon compressus (Meek). Conjunto No. 12. Remarks: New record (UANL 9315(2) Salinas, 10 km N); formerly reported from Papaloapan (Miller, 1986) and Coatzacoalcos basins and to the south (Alvarez, 1970).

CYPRINIDAE. Nearctic. Primary

Dionda ipni (Alvarez & Navarro). Pánuco, Tuxpan, Cazonas, Tecolutla, Nautla and Misantla. (Hubbs & Miller, 1977) and Conjunto No. 5 (Cucharas). Remarks: New record for Conjunto No. 5 (Cucharas) (UANL 9649(1) Chontla, 1 km N) and Tecolutla (UANL 9862(81) El Frijolillo bridge, UANL 9891(12) El Puerto, UANL 9856(1) Miguel Alemán and UANL 9879(204) Poza Larga, 400 m NNE). Formerly recorded from the Tecolutla basin in the state of Puebla (Hubbs & Miller, 1977). We here record its presence in the same basin, as low as Veracruz.

ICTALURIDAE. Nearctic. Primary

Ictalurus cf. *punctatus*. Pánuco and Cazonas (Alvarez, 1970). Remarks: Miller (1986) pointed out that *I. australis* (Meek) and *I. punctatus* (Rafinesque) may be the same, but more studies on Mexican species of Ictaluridae are necessary.

Ictalurus cf. *furcatus*. Pánuco (Alvarez, 1970). Remarks: Revisionary study is needed for specific determination.

ARIIDAE. Peripheral

Arius felis (Linnaeus). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), and Conjunto No. 5 (Cucharas) and Jamapa.

Arius sp.. Pánuco, Conjunto No. 5 (Tamiagua), Tuxpan and Jamapa. Remarks: Miller (pers. com.) points out that *A. aguadulce* (Meek) is common on the east coast of México from Tampico to Guatemala. However, Castro-Aguirre (pers. com.) discussed with us the distinctions between that species and *A. assimilis* (Günther), and supports the presence of the latter in the area. Our specimens fit better with

A. assimilis of Castro-Aguirre. Pending further study it remains an open question.

Bagre marinus (Mitchill). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

PIMELODIDAE. Neotropical. Primary

Rhamdia guatemalensis (Günther). Conjunto No. 12 and Blanco (Miller, 1984).

Rhamdia laticauda (Heckel). Jamapa (Miller, 1984).

BATRACHOIDIDAE. Peripheral

Opsanus beta (Goode & Bean). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Nautla and Jamapa.

Porichthys plectrodon (Valenciennes). Tuxpan and Laguna La Mancha (cited as *P. porosissimus* by Castro-Aguirre, 1978). Remarks: Gilbert & Kelso (1971, in Robins *et al.*, 1980) reported *P. porosissimus* as a complex of two species: *P. porosissimus* from S Brazil to Argentina, and *P. plectrodon*, from Virginia to the central coast of Brazil.

GOBIESOCIDAE. Peripheral

Gobiesox strumosus Cope. Cazonas. Species with a wide distribution (Briggs, 1955 & Smith, 1976).

ANTENNARIDAE. Marine

Histrio histrio (Linnaeus). Marine species; accidentally present in Tuxpan, Laguna Tampamachoco (Castro-Aguirre, 1978) and Jamapa.

Antennarius scaber (Cuvier). Marine species (Briggs, 1958); accidentally present in Tuxpan and Jamapa.

OGCOCEPHALIDAE. Marine

Ogcocephalus vespertilio (Linnaeus). Marine species (Briggs, 1958); accidental presence in Tuxpan.

BELONIDAE. Peripheral

Belone argala Lesueur. Jamapa. Species with wide distribution (Berry & Rivas, 1962 and Murdy, 1983).

Strongylura marina (Walbaum). Tuxpan (Cas-

tro-Aguirre, 1978), Pánuco, Nautla, Antigua and Jamapa.

Strongylura notata (Poey). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Kobelkowsky, 1985).

RIVULIDAE. Neotropical. Secondary

Rivulus cf. *robustus*. Jamapa and Conjunto No. 12. Remarks: New record for Jamapa (UANL 9947(7) Paso del Toro, 600 m NE) and Conjunto No. 12 (UANL 9308(2) Salinas). The meristic and morphometric features are in accordance with *R. robustus* Miller & Hubbs (1974), although the color pattern is different. This form may need more study.

FUNDULIDAE. Nearctic. Secondary

Lucania parva Baird & Girard. Tuxpan (Kobelkowsky, 1985) Panuco and Conjunto No. 5 (Tamiagua).

CYPRINODONTIDAE. Cosmopolitan. Secondary
Cyprinodon variegatus Lacepède. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Tampamachoco) (Kobelkowsky, 1985) and Pánuco.

POECILIIDAE. Neotropical. Secondary

Belonesox belizanus Kner. Antigua, Jamapa, Blanco and Chachalacas (Miller, 1966). Remarks: Record for Chachalacas (Actopan basin) at UANL (UANL 2468(12) El Limoncito before Actopan, UANL 9350(5) and UANL 10075(18) 36 Km N Veracruz).

Gambusia affinis Baird & Girard. Pánuco, Conjunto No. 5 (Tamiagua) and Jamapa (introduced?). Remarks: New records for Pánuco (UANL 326(59) Highway junction 105-Higo, UANL 3144(9) and UANL 9588(2) Tamós, UANL 9618(14) Tempoal in Tempoal), Conjunto No. 5 (Tamiagua) (UANL 2619(2) Laguna Tamiagua) and Jamapa (UANL 6711(1) Estero Boca de Río). Rauchenberger (1989) indicated Tampico (Pánuco basin) as its southern range limit, however the currently known southern distribution includes Laguna de Tamiagua casually reached by invasions along the coast.

Gambusia regani Hubbs. Pánuco (Hubbs, 1926;

Rosen & Bailey, 1963; Rauchenberger, 1989), Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Kobelkowsky, 1985), Conjunto No. 5 (Cucharas, Tancochin), Tumulco, Cazonas, Tenixtepec, Tecolutla, Conjunto No. 8, Nautla and Laguna del Morro. Remarks: *Gambusia regani* Hubbs and *G. panuco* Hubbs were recorded from north and south of the Pánuco basin by Hubbs (1926), Alvarez (1970) & Rauchenberger (1989). However, our taxonomic analysis indicates that all the material collected in the present study represents only one species, which agrees well with material obtained from Tamaulipas and sent in exchange to the Laboratorio de Ictiología, Universidad Autónoma de Nuevo León, from Museum of Zoology, University of Michigan (UMMZ 164736 & 97523), all identified as the nominal form of *G. panuco* as given by Hubbs (1926) and Alvarez (1970). Previous to our results, Bailey & Rosen (1963) had already indicated that *G. regani* and *G. panuco* were probably conspecific forms. Therefore, and in agreement with R. R. Miller (pers. com.), our conclusion is that these are two names for the same species. By principle of priority *G. regani* must be retained, and *G. panuco* stays as junior synonym.

Gambusia sexradiata Hubbs. Nautla (Greenfield *et al.*, 1982), Cazonas, Tecolutla, Misantla, Conjunto No. 9 (Colipa, Santa Ana, and Boca de Ovejas), Laguna del Morro, Chachalacas, Antigua, Jamapa, Conjunto No. 12 and Blanco. Remarks: New record from Cazonas (UANL 2435(13) Bocana Rio Cazonas) and Tecolutla (UANL 9368(12) Riachuelos, 5 km S). Formerly reported from the river Nautla to Belize (Greenfield *et al.*, 1982).

Gambusia vittata Hubbs. Pánuco basin, north of Veracruz (Rosen & Bailey, 1963; Alvarez, 1970), probably until Tuxpan river (Rauchenberger, 1989). Remarks: Two females, seemingly of this species, were collected from Tumulco creek (south of Tuxpan) (UANL 9721(2) Tecoxtempán, highway 130). However, males are necessary for confirmation.

Heterandria bimaculata (Heckel). Misantla, Chachalacas and Jamapa (Miller, 1974 & Rosen, 1979), Conjunto No. 9 (Colipa, Juchique, Florida

and Santa Ana), Antigua, Conjunto Playa Norte, Conjunto No. 12 and Blanco. Remarks: Miller (1974) reported *H. bimaculata* and *H. jonesii* as sympatric in the Atoyac river. We found these species together in the Colipa river (UANL 10157(5) Yecuatla, 1 km SW) (Conjunto No. 9), south of the Misantla basin.

Heterandria jonesii (Regan). Cazonas, Tecolutla, Nautla, Jamapa (Atoyac) and Valle de Orizaba (Miller, 1974), Tenixtepec, Conjunto No. 8, Conjunto No. 9 (Colipa) and Blanco.

Heterandria sp.. Pánuco (Miller, 1974), Conjunto No. 5 (Cucharas and Tancochin) and Tuxpan. Remarks: We agree with R. R. Miller (1986) that the species living in the Río Pánuco basin S at least to Río Tuxpan is an undescribed species, formerly referred to *H. jonesii*.

Poecilia formosa (Girard). Conjunto No. 5 (Tamiagua) and Tuxpan (Tampamachoco) (Darnell & Abramoff, 1968; Miller, 1983).

Poecilia latipinna (Lesueur). Pánuco, Tuxpan (Tampamachoco) (Miller, 1983) and Conjunto No. 5 (Tamiagua).

Poecilia mexicana (Steindachner). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Panuco, Conjunto No. 5 (Cucharas, Tancochin, Oro Verde and San Lorenzo), Tuxpan, Tumilco, Cazonas, Tenixtepec, Tecolutla, Conjunto No. 8, Nautla, Misantla, Conjunto No. 9 (Colipa, Juchique, Florida, Santa Ana, Paso de Ovejas, Palma Sola, Paso Limón and Laguna del Llano), Laguna del Morro, Chachalacas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12, and Blanco. Remarks: Species with wide distribution, Atlantic slope from Río San Juan (in Río Grande basin), Nuevo León, México to Guatemala (Miller, 1983).

Poecilia sphenops Valenciennes. Conjunto No. 9 (Santa Ana, Palma Sola, Paso Limón and Laguna del Llano), Chachalacas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12, Blanco (Miller, 1983), Tecolutla and Misantla. Remarks: New records of the species in the basins of Tecolutla (UANL 9806(41) Tlahuanapa bridge, UANL 9813(7) Agua Dulce springs, and UANL 9816(42) Poza Don Hermilo) and Misantla (UANL 10175(6) Boca de Palmas), should per-

haps be regarded as introductions. Formerly reported from 50 km N Cd. Veracruz (Miller, 1983).

Poeciliopsis gracilis (Heckel). Chachalacas (Rosen & Bailey, 1963), Antigua, Jamapa and Blanco.

Xiphophorus andersi Meyer & Schartl. Jamapa (Meyer & Schartl, 1980). Remarks: Meyer & Schartl (1980) reported this species as endemic to a spring near Finca Santa Anita, in the Río Atoyac basin, E of Córdoba, Veracruz coexisting with *Heterandria bimaculata*, *Xiphophorus 'variatus'*, *X. helleri* and a characid. We collected in Ojo de Agua Grande spring, 15 km SE of Córdoba, Veracruz, that seems to be the same locality. Our material assigned to *X. andersi* consists of immature males. They were coexisting with *Heterandria bimaculata*, *H. jonesii*, *Poecilia mexicana*, *Xiphophorus helleri* and *Astyanax aeneus*. The presence of *X. 'variatus'* reported for this area (Meyer & Schartl, 1980) is to be discussed (see remarks in *X. variatus*).

Xiphophorus birchmanni Lechner & Radda. Pánuco (Calabozo) and Tuxpan (Viñazco) (Rauchenberg *et al.*, 1990). Remarks: Record taken from literature.

Xiphophorus helleri Heckel. Nautla, Chachalacas, Antigua, Jamapa and Blanco (Rosen, 1960 & 1979; Rosen & Bailey, 1963).

Xiphophorus maculatus (Günther). Jamapa (Rosen, 1960 & 1979; Rosen & Bailey, 1963), Antigua and Blanco. Remarks: The presence of this species in the Antigua basin (Laguna de San Julian, UANL 10044(1)) could best be considered as an introduction, as is the case of *Cichlasoma urophthalmus* and *Petenia splendida*.

Xiphophorus variatus (Meek). Pánuco, Conjunto No. 5 (Cucharas and Tancochin), Tuxpan, Cazonas, Tecolutla and Nautla (Rosen, 1960 & 1979), Tumilco, Tenixtepec, Conjunto No. 8, Misantla and Conjunto No. 9 (Colipa). Remarks: New record of the species in Misantla (UANL 10164(69) Misantla) and Conjunto No. 9 (UANL 10154(1) Colipa, 2 km S). Rosen (1960 & 1979) had listed the Nautla river as its southern range limit. Meyer & Schartl (1980) reported a hybrid of this species and *X. andersi*, from a spring near Córdoba, Veracruz, in the Atoyac basin. Our ma-

terial from Córdoba does not include *X. variatus* (see remarks under *X. andersi*), and Kallman (pers. comm. to R. R. Miller) did not get it with *X. andersi*; thus Meyer & Scharl's report probably represents an error.

ATHERINIDAE. Peripheral

Menidia beryllina Cope. Pánuco and Conjunto No. 5 (Tamiagua) (Chernoff *et al.*, 1981).

SYNGNATHIDAE. Peripheral

Microphis brachyurus lineatus (Kaup). Tuxpan and Jamapa (Castro-Aguirre, 1978), Pánuco, Misantla, Conjunto No. 9 (Santa Ana), Antigua and Conjunto Playa Norte.

Syngnathus louisianae Günther. Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Laguna La Mancha (Castro-Aguirre, 1978).

Syngnathus scovelli (Evermann & Kendall). Tuxpan (Castro-Aguirre, 1978) and Jamapa.

SYNBRANCHIDAE. Neotropical. Secondary

Ophisternon aenigmaticum Rosen & Greenwood. Chachalacas and Jamapa. Remarks: New record for Chachalacas (UANL 10024(1) Paso de La Milpa, UANL 10080(1) 36 km N Veracruz) and Jamapa (UANL) 9470(1) El Aluvi6n, and 9473(2) Peñas Blancas). The northern range limits of *Ophisternon aenigmaticum* are not fully verified. Rosen & Rumney (1972) reported this species (mentioned as *Symbranchus marmoratus*) from the localities 108 (Santa María 21 N, 98 W) and 109 (San Lorenzon on Río Chiquita ... Potrero Nuevo 22 30' N, 98 W), which were considered as coming from the state of Veracruz. The coordinates of the locality 108 fall near Cerro Azul, in north central Veracruz (just NW of Tuxpan), but the locality 109, if its coordinates are correct, would fall in Tamaulipas, not in Veracruz. The Fig. 27 of Rosen & Rumney (1972) shows the spots with the right coordinates, but we think these localities are wrong, as no specimens of the species are known so far north. On the other hand, in the description of another fish, *Rivulus robustus*, Hubbs & Miller (1974) gave as two of the paratype localities Río Chiquito (*ca.* 15 km S of Acayucan), and Laguna Potrero Nuevo, near San Lorenzo...

on Río Chiquito. Both localities are on the Río Coatzacoalcos. The coincidence of names is too obvious, and the region is well within the general region where *O. aenigmaticum* lives. Therefore, we regard the published records mentioned above as erroneous, and correct the distribution as Río Chiquito (Coatzacoalcos) and south, reaching no further north than Punta del Morro (Chachalacas), where we found it uncommonly.

SCORPAENIDAE. Peripheral

Scorpaena plumieri Bloch. Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

CENTROPOMIDAE. Peripheral

Centropomus ensiferus Poey. Nautla and Jamapa. Species with wide distribution (Castro-Aguirre, 1978; Rivas, 1986).

Centropomus mexicanus Bocourt. Pánuco, Conjunto No. 5 (Tamiagua), Tuxpan, Nautla and Jamapa. Species with wide distribution (Rivas, 1986).

SERRANIDAE. Peripheral

Epinephelus itajara (Lichtenstein). Tuxpan. Species with wide distribution (Hoese & Moore, 1977).

CARANGIDAE. Peripheral

Caranx latus Agassiz. Tuxpan (Castro-Aguirre, 1978), Conjunto No. 5 (Tamiagua), Nautla, Conjunto No. 9 (Santa Ana), Chachalacas, Antigua and Jamapa.

Chloroscombrus chrysurus (Linnaeus). Conjunto No. 5 (Tamiagua) and Tuxpan (Castro-Aguirre, 1978).

Hemicaranx amblyrhynchus (Cuvier). Tuxpan (Castro-Aguirre, 1978).

Selene setapinnis (Mitchill). Tuxpan (Castro-Aguirre, 1978).

Selene vomer (Linnaeus). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978) and Conjunto No. 5 (Cucharas).

LUTJANIDAE. Peripheral

Lutjanus apodus (Walbaum). Jamapa. Widely distributed (Castro-Aguirre, 1978).

Lutjanus griseus (Linnaeus). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978) and Jamapa.

GERREIDAE. Peripheral

Diapterus auratus Ranzani. Conjunto No. 5 (Tamiagua) and Tuxpan (Castro-Aguirre, 1978), Nautla, Antigua and Jamapa.

Diapterus rhombeus (Cuvier). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan, Laguna La Mancha (Castro-Aguirre, 1978) and Nautla.

Eucinostomus gula (Cuvier). Tuxpan. Species with wide distribution (Castro-Aguirre, 1978; Aguirre-León *et al.*, 1982; Matheson & McEachran, 1984).

Eucinostomus melanopterus (Bleeker). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Nautla, Antigua and Jamapa.

Eugerres plumieri (Cuvier). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), and Antigua.

Ulaema lefroyi (Goode). Cazonas and Jamapa. Species with wide distribution (Castro-Aguirre, 1978).

HAEMULIDAE. Peripheral

Conodon nobilis (Linnaeus). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978) and Jamapa.

Pomadasys crocro (Cuvier). Antigua and Jamapa. Species with wide distribution (Castro-Aguirre, 1978).

SPARIDAE. Peripheral

Archosargus probatocephalus (Walbaum). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978) and Jamapa.

SCIAENIDAE. Peripheral

Bairdiella chrysoura (Lacepède). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978) and Jamapa.

Bairdiella ronchus (Cuvier). Conjunto No. 5

(Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

Cynoscion arenarius Ginsburg. Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

Cynoscion nebulosus (Cuvier). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

Cynoscion nothus (Holbrook). Tuxpan. Species with wide distribution (Castro-Aguirre, 1978; Chao, 1978).

Larimus fasciatus Holbrook. Tuxpan. Species with wide distribution (Chao, 1978).

Micropogonias undulatus (Linnaeus). Conjunto No. 5 (Tamiagua) and Tuxpan (Castro-Aguirre, 1978).

Stellifer lanceolatus (Holbrook). Conjunto No. 5 (Tamiagua) (Castro-Aguirre, 1978) and Tuxpan (Kobelkowsky, 1985).

Umbrina coroides Cuvier. Tuxpan (Castro-Aguirre, 1978).

EPHIPPIDAE. Marine

Chaetodipterus faber (Broussonet). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978). Remark: Probably an accidental invasion.

CICHLIDAE. Neotropical. Secondary

Cichlasoma cyanoguttatum (Baird & Girard). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Pánuco and Conjunto No. 5 (Cucharas and Tancochin) (Taylor & Miller, 1983).

Cichlasoma sp. Tuxpan, Tumilco, Cazonas, Tenixtepec, Tecolutla, Conjunto No. 8, Nautla, Misantla and Conjunto No. 9 (Colipa and Juchique). Remarks: Our material corresponds to the group *Herichthys*. However, since the specimens were juveniles, the identification remains pendant. Labounty (1974) mentioned the form from Pánuco basin as *C. cyanoguttatum carpintis*, the cichlids from Tancochin and Cucharas (Conjunto No. 5), Pantepec (= Tuxpan) and Cazonas basins as undescribed forms, and the cichlid from Nautla basin as a different species. It has been mentioned that, *C. cyanoguttatum* may be present from the Río Bravo (Grande) to the Río Misantla

(Taylor & Miller, 1983; Miller, 1986), and that *Herichthys* from Río Nautla is a species different from *C. cyanoguttatum* (Miller, com. pers.).

Cichlasoma ellioti (Meek). Tecolutla, Chachalacas, Antigua, Jamapa, Conjunto No. 12 and Blanco. Remarks: All new introductions: Tecolutla (UANL 9804(4) Tlahuanapa bridge), Chachalacas (UANL 2472(4) El Limoncito before Actopan, UANL 9431(6) Actopan at Río Frio, UANL 10091(2) Cardel, 20 km N, UANL 10025(1) Paso de La Milpa, UANL 10032(2) El Aguaje, UANL 10082(12) 36 km N Veracruz), Antigua (UANL 1181(14) Puente Nacional, UANL 9327(1) and UANL 10065(13) La Antigua, UANL 10073(2) Cardel, 4 km N, UANL 6700(4) San Francisco, 500 m S and UANL 10046(18) Laguna San Julián), Jamapa (UANL 9953(1) Paso del Toro, 600 m NE), Conjunto No. 12 (UANL 9320(5) Salinas, 10 km N) and Blanco (UANL 6732(3) Ejido Otapa, 3 km S). Formerly reported only from Río Tonto, Papaloapan basin (Miller, 1966; Alvarez, 1970).

Cichlasoma fenestratum (Günther). Chachalacas (Miller, 1966; Alvarez, 1970), Conjunto No. 9 (Santa Ana and Palma Sola), Laguna del Morro, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco. Remarks: All new introductions: Conjunto No. 9 (UANL 9363(6) Paso de Santa Ana, UANL 10121(11) Palma Sola near the Veinticuatro), Laguna del Morro (UANL 10100(7) Laguna interior Estación INIREB), Antigua (UANL 10066(1) Puente Nacional and UANL 9342(1) 21 km N Veracruz), Conjunto Playa Norte (UANL 10038(1) Laguna, 8 km N Veracruz), Jamapa (UANL 9967(21) Laguna Medellin, UANL 9402(12) Mandinga, UANL 9299(2) and 1205(2) Estero Boca de Río), Conjunto No. 12 (UANL 9390(3) La Piedra, 0.8 km NW) and Blanco (UANL 9982(1) Puente Otapa). Formerly reported from Chachalacas, Papaloapan, Usumacinta and Champoton (Miller, 1966; Alvarez, 1970).

Cichlasoma labridens (Pellegrin). Pánuco (Taylor & Miller, 1983), Conjunto No. 5 (Cucharas and Tancochin).

Cichlasoma octofasciatum (Regan). Chachala-

cas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco. Remarks: New introductions; Chachalacas (UANL 10090(4) Cardel, 20 km N), Antigua (UANL 9328(8) Puente Nacional, UANL 10047(1) Laguna San Julián), Conjunto Playa Norte (UANL 10033(4) Laguna, 6 km N Veracruz and UANL 1192(1) Playa Norte, 4 km N Veracruz), Jamapa (UANL 9952(1) Paso del Toro, 600 m NE), Conjunto No. 12 (UANL 9312(12) Salinas and UANL 9391(1) La Piedra, 0.8 km NW) and Blanco (UANL 9455(3) Ejido Otapa). Formerly reported from Atlantic slope from Río Paso San Juan, Veracruz, México to Honduras; also in Yucatán Peninsula (Miller, 1966; Alvarez, 1970).

Cichlasoma urophthalmus (Günther). Antigua, Conjunto Playa Norte and Jamapa. Remarks: New introductions: Antigua (UANL 10045(9) Laguna San Julián), Conjunto Playa Norte (UANL 1191(1) Playa Norte, 4 km N Veracruz) and Jamapa (UANL 9421(1) Canales Isla del Amor). Formerly reported erroneously from the Usumacinta River, Isla Mujeres and Yucatán (Alvarez, 1970). We collected this species in the Laguna San Julián (Antigua basin) with *X. maculatus* and *Petenia splendida*. This suggests that they were probably introduced, either with commercial purposes or incidentally.

Petenia splendida Günther. Antigua. Remarks: A species exotic to the area (UANL 10048(35) Laguna San Julián). Originally native to the Río Grijalva basin to the Río Usumacinta (Miller, 1966; Alvarez, 1970) and Yucatán (Miller, 1986).

Tilapia aurea (Steindachner). Pánuco, Nautla, Conjunto No. 9 (Palma Sola), Laguna del Morro, Chachalacas, Antigua and Conjunto Playa Norte. Remarks: African species introduced into Texas, Florida and México (Lee *et al.*, 1980). Pánuco (UANL 9602(1) creek between Pánuco and El Higo, UANL 9624(1) Tempoal in Tempoal), Nautla (UANL 9437(1) Pancho Poza), Conjunto No. 9 (UANL 10122(1) Palma Sola near the Veinticuatro), Laguna del Morro (UANL 10101(2) Laguna interior Estación INIREB), Chachalacas (UANL 10013(1) Miradores del

Mar), Antigua (UANL 10057 (3) 21 km N Veracruz) and Conjunto Playa Norte (UANL 10035(5) Laguna, 6 km N Veracruz and UANL 10039(5) Laguna, 8 km N Veracruz).

MUGILIDAE. Peripheral

Agonostomus monticola (Bancroft). Conjunto No. 5 (Tancochin), Tuxpan, Cazonas, Tecolutla, Nautla, Misantla, Conjunto No. 9 (Colipa, Juchique, Florida, Santa Ana, Palma Sola, Paso Limón and Laguna del Llano), Chachalacas, Antigua, Conjunto Playa Norte and Jamapa. Species with wide distribution (Briggs, 1958).

Joturus pichardi Poey. Jamapa (Meek, 1904). Remarks: Our specimens (collected by Felipe Margil) present two anal spines, which is in agreement with Meek & Hildebrand (1916) and Murdy (1983), although originally it was mentioned as bearing three anal spines (Poey, 1891, after Meek, 1904 and Alvarez, 1970). The species is scarcely represented in collections, but it may be widely distributed.

Mugil cephalus Linnaeus. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Pánuco, Conjunto No. 9 (Colipa, Paso Limón and Laguna del Llano) Conjunto Playa Norte and Jamapa.

Mugil curema Valenciennes. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Cazonas, Misantla, Conjunto No. 9 (Colipa, Juchique, Florida, Paso Limón and Laguna del Llano), Conjunto Playa Norte and Jamapa.

POLYNEMIDAE. Peripheral

Polydactylus octonemus (Girard). Conjunto No. 5 (Tamiagua) (Reséndez, 1970) and Tuxpan (Castro-Aguirre, 1978).

SCARIDAE. Marine

Sparisoma rubripinne (Valenciennes). Jamapa. Remark: Its presence is probably accidental.

BLENNIIDAE. Marine

Scartella cristata (Linnaeus). Laguna La Mancha (Castro-Aguirre, 1978) and Cazonas. Remark: Its presence is probably accidental.

CLINIDAE. Marine

Labrisomus nuchipinnis (Quoy & Gaimard). Tuxpan and Laguna La Mancha (Castro-Aguirre, 1978) and Jamapa. Remark: Its presence is probably accidental.

GOBIIDAE. Peripheral

Awaous tajasica (Lichtenstein). Antigua (Castro-Aguirre, 1978), Panuco, Tecolutla, Nautla, Conjunto No. 9 (Santa Ana), Chachalacas and Conjunto Playa Norte.

Bathygobius soporator (Valenciennes). Tuxpan (Castro-Aguirre, 1978), Conjunto No. 5 (Tamiagua), Misantla, Conjunto No. 9 (Colipa, and Juchique) and Jamapa.

Evorthodus lyricus (Girard). Tuxpan (Kobelkowsky, 1985), Pánuco, Cazonas, Antigua and Jamapa. Species with wide distribution (Dawson, 1969; Castro-Aguirre, 1978).

Gobioides broussoneti Lacepède. Tuxpan (Kobelkowsky, 1985), Pánuco, Antigua and Jamapa. Species with wide distribution (Dawson, 1969; Castro-Aguirre, 1978).

Gobionellus boleosoma (Jordan & Gilbert). Antigua and Jamapa (Castro-Aguirre, 1978).

Gobionellus hastatus Girard. Conjunto No. 5 (Tamiagua), Tuxpan (Castro-Aguirre, 1978), Pánuco, Nautla, Antigua and Jamapa.

Gobionellus shufeldti (Jordan & Eigenmann). Antigua, Jamapa (Castro-Aguirre, 1978) and Conjunto No. 9 (Boca de Ovejas).

Gobiosoma bosci (Lacepède). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Kobelkowsky, 1985) and Jamapa. Species with wide distribution (Dawson, 1969).

ELEOTRIDAE. Peripheral

Dormitator maculatus (Bloch). Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Kobelkowsky, 1985), Tecolutla (Castro-Aguirre, 1978), Conjunto No. 5 (Oro Verde), Cazonas, Nautla, Laguna del Morro, Chachalacas, Conjunto Playa Norte, Jamapa and Conjunto No. 12.

Eleotris pisonis (Gmelin). Jamapa (Castro-Aguirre, 1978), Pánuco, Conjunto No. 5 (Tamiagua), Tuxpan, Conjunto No. 9 (Santa Ana, Boca

de Ovejas and Laguna del Llano), Antigua and Conjunto Playa Norte.

Erotelis smaragdus (Valenciennes). Tuxpan and Nautla. Species with wide distribution (Hoese & Moore, 1977).

Gobiomorus dormitor Lacepède. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Kobelkowsky, 1985), Pánuco, Conjunto No. 5 (San Lorenzo & Oro Verde), Cazonas, Nautla, Misantla, Conjunto No. 9 (Juchique, Boca de Ovejas, Palma Sola, Paso Limón and Laguna del Llano), Chachalacas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco. Species with wide distribution (Castro-Aguirre, 1978).

TRICHIURIDAE. *Peripheral*

Trichiurus lepturus Linnaeus. Tuxpan (Castro-Aguirre, 1978).

STROMATEIDAE. *Marine*

Peprilus paru Linnaeus. Tuxpan (Castro-Aguirre, 1978). Remark: Its presence is probably accidental.

BOTHIDAE. *Peripheral*

Citharichthys spilopterus Günther. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Antigua and Jamapa.

SOLEIDAE. *Peripheral*

Achirus lineatus Linnaeus. Conjunto No. 5 (Tamiagua) (Reséndez, 1970), Tuxpan (Castro-Aguirre, 1978), Conjunto No. 5 (Cucharas) and Jamapa.

CYNOGLOSSIDAE. *Peripheral*

Symphurus civittatus Ginsburg. Tuxpan. Species with wide distribution (Briggs, 1958).

Discussion and conclusions

The continental fish fauna of north and central Veracruz is composed of 47 families, 83 genera and 121 species. Two families are primary Nearctic, the Cyprinidae and Ictaluridae; one is secondary Nearctic, the Fundulidae; the Characidae

and Pimelodidae are primary Neotropical; four, the Rivulidae, Poeciliidae, Synbranchidae and Cichlidae, are secondary Neotropical; one, the Cyprinodontidae is circumtropical; thirty are peripheral, and seven marine.

As stated by Meek (1904), Regan (1906–1908), De Buen (1947) and Miller (1982), a mixture of Nearctic and Neotropical fishes are present along north-central part of Veracruz, with dominance of poeciliids. Our results indicate that a mountainous area near Punta del Morro may be operating as a distributional barrier or filter for primary and secondary species (Table 2). The importance of this barrier had not been described in detail. Regan (1906–1908) pointed out the faunal break between the Pánuco and Papaloapan fish faunas by mapping the former in the Rio Grande Province and the Papaloapan in the Guatemala Province which dividing line lies close to Punta del Morro. Hubbs & Miller (1977) commented that ‘the high Mexican Plateau closely approaches...(in part) due to a lava flow...(to) the vicinity of Punta del Morro... with no significant streams... (and) marks the extreme southern limit... for any cyprinid...’. Posteriorly, Miller & Smith (1986) indicated that ‘the Coastal Lowland Track of fishes extends from Río Soto la Marina to Río Papaloapan... changing from 75% North American to 95% Middle American... a... basal-t...(around Punta Delgado)... forms a barrier’ (their Punta Delgado is locally known as Punta Delgada, which lies 2 km NW of Punta del Morro, both being NE of Jalapa).

From the north, the following species range to Punta del Morro or less: *Astyanax mexicanus*, *Dionda ipni*, *Ictalurus* cf. *furcatus*, *I.* cf. *punctatus*, *Lucania parva*, *Cyprinodon variegatus*, *Gambusia affinis*, *G. vittata*, *Heterandria* sp., *Poecilia formosa*, *P. latipinna*, *Xiphophorus birchmanni*, *X. variatus*, *Cichlasoma cyanoguttatum*, *C. labridens*, and *Cichlasoma* sp. From the south, species that approach or reach Punta del Morro are: *Astyanax aeneus*, *Hyphessobrycon compressus*, *Rhamdia guatemalensis*, *R. laticauda*, *Rivulus* cf. *robustus*, *Belonesox belizanus*, *Poeciliopsis gracilis*, *Xiphophorus andersi*, *X. maculatus*, and *Ophisternon aenigmatium*. The species present on both sides of Punta

del Morro are: The predominantly northern *Gambusia regani*, the predominantly southern, *Gambusia sexradiata*, *Heterandria bimaculata*, *H. jonesii*, *Poecilia sphenops*, *Xiphophorus helleri*, and the equally common on both sides *Poecilia mexicana*, and *Joturus pichardi*.

New records and range extensions include: *Dorosoma anale* in Conjunto No. 12 basin. *Astyanax mexicanus* × *A. aeneus* intergrade between Conjunto No. 8 and Conjunto No. 9 basins. *Hypessobrycon compressus* in Conjunto No. 12 basin. *Dionda ipni* in Conjunto No. 5 (Cucharas) and Tecolutla basins. *Rivulus* cf. *robustus* in Jamapa and Conjunto No. 12 basins. *Gambusia affinis* occurs in Conjunto No. 5 (Tamiahua), *G. sexradiata* in Cazonas and Tecolutla basins, *Heterandria bimaculata* in Conjunto No. 9 basin, and *Poecilia sphenops* in Misantla basin. The Chachalacas basin is the northern limit of *Ophisternon aenigmaticum*; the coordinates of the localities Santa María and Potrero Nuevo indicated by Rosen & Rummney (1972) for this species, are considered erroneous.

New introductions: *Gambusia affinis* in Jamapa basin; *Poecilia sphenops* in Tecolutla basin and *Xiphophorus maculatus* in Antigua basin; the presence of *Xiphophorus variatus* in Misantla and Conjunto No. 9 (Colipa creek) basins may indicate a new introduction of the species in this area; *Cichlasoma ellioti* in the basins of Tecolutla, Chachalacas, Antigua, Jamapa, Conjunto No. 12 and Blanco; *C. fenestratum* in Conjunto No. 9, Laguna del Morro, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco; *C. octofasciatum* in Chachalacas, Antigua, Conjunto Playa Norte, Jamapa, Conjunto No. 12 and Blanco; *C. urophthalmus* in Antigua, Conjunto Playa Norte and Jamapa. *Petenia splendida* and *Tilapia aurea* are new exotic species in the area.

More studies are necessary for a good definition of *Ictalurus* cf. *punctatus*, *I.* cf. *furcatus*, *Arius* sp., *Rivulus* cf. *robustus* and *Cichlasoma* sp. We add the Colipa creek (Conjunto No. 9) as a new locality of sympatry of *Heterandria bimaculata* and *H. jonesii*.

Gambusia regani and *G. panuco* are nominal species of the same form; by first reviser, *G. regani*

is regarded as senior synonym and most convenient, given that *G. panuco* has lost its geographic meaning with such a wide-ranging species.

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