Journal Title: Texas Journal of Science

Volume: 30
Issue: 4
Month/Year: 1978
Pages:

Article Author: Hubbs, Lucier, Garett, et al

Article Title: Survival and Abundance of introduced fishes near san antonio

Note:

1/18/2012 7:45 AM
(Please update within 24 hours)

Call #: Q1 .T4

Location: evans

Not Wanted Date: 07/14/2012

Status: TAES San Antonio
Phone: 830-214-5878
E-mail: mrbandel@ag.tamu.edu

Name: Bandel, Micaela

TAES San Antonio

2632 Broadway, Suite 301 South
San Antonio, TX 78215

Suess, H. E., and H. Wanke, 1962—Radiocarbon content and terrestrial age of twelve stony meteorites and one iron meteorite. *Geochimica et Cosmochimica Acta*, 26:475.

Vegors, S. H., Jr., L. L. Marsden, and R. L. Heath, 1958—Calculated efficiencies of cylindrical radiation detectors. *AEC Report IDO-16370*, 83 pp.

SURVIVAL AND ABUNDANCE OF INTRODUCED FISHES NEAR SAN ANTONIO, TEXAS

by CLARK HUBBS, THOMAS LUCIER, GARY P. GARRETT, ROBERT J. EDWARDS, S. MICHAEL DEAN, *and* EDIE MARSH

Department of Zoology,
University of Texas at Austin,
Austin, 78712

and DENTON BELK

840 E. Mulberry Street,
San Antonio 78212

ABSTRACT

Introduced fishes comprise a substantial fraction of the fish fauna in 2 Bexar County waters: 35% in upper San Antonio River and 43% in Braunig Reservoir. Four species (*Astyanax mexicanus, Poecilia latipinna, P. formosa,* and *Cichlasoma cyanoguttatum*) are south Texas fishes displaced northward. Two species (*Cyprinodon variegatus* and *Menidia beryllina*) are recent introductions from estuarine waters. Four species (*Hypostomus plecostomus, Poecilia reticulata, Sarotherodon mossambicus,* and *S. aureus*) are exotics from South America, the Lesser Antilles, Africa, and Israel, respectively. Although *P. reticulata* is now added to the Texas fish fauna the apparent disappearance of another exotic, *Belonesox belezanus*, leaves the number of exotic poeciliids in Texas unchanged. The abundance of exotics is of substantial concern and care should be exercised to reduce the possibility of additional escapes.

INTRODUCTION

The release of exotics can have a substantial impact on the indigenous biota. Although any taxon may be affected, we have concentrated our efforts on fishes. The number of exotic fishes now available for release is of substantial concern (Lachner, *et al.*, 1970). We consider intracontinental as well as intercontinental transfers as exotics because they also have a potential impact on the native fishes (Hubbs, 1977).

Since released fishes must compete with the indigenous fishes to survive and reproduce, establishment of a breeding population would be most likely if relatively few native fishes occurred in the area (Hubbs, 1972). Two such environments occur in Bexar County: stenothermal springs (Hubbs, 1971) and power

Accepted for publication: January 26, 1978.

The Texas Journal of Science, Vol. XXX, No. 4, December, 1978.

plant reservoirs (Thompson, *et al.*, 1977). The former are of more concern as those springs have an adapted endemic biota (Minckley and Deacon, 1968) whereas the latter are newly constructed environments.

Two of the major Texas spring runs, San Marcos and San Antonio, seem to have been subjected to release of exotics. Brown (1953) documented the exotic nature of the San Marcos spring run fauna. No such summary has been made for the San Antonio spring run, although Barron (1964) reported the presence of *Hypostomus* (= *Plecostomus*) *plecostomus* and *Belonesox belezanus*. Our studies confirmed the presence of the former but the latter may well have died out. We also discovered the presence of *Sarotherodon mossambicus* and *Poecilia reticulata*.

Thermal reservoirs may have a substantial exotic component in their fauna. For example, Noble, *et al.*, (1975) reported dominance by *Sarotherodon* (= *Tilapia*) *aureus* in Trinidad Reservoir, Texas. A similar abundance of blue tilapia prevails in Braunig Reservoir. They are supplemented by substantial numbers of *Cyprinodon variegatus* and *Menidia beryllina* as well as some *Poecilia formosa*, all coastal fishes seemingly recently introduced.

COLLECTION LOCALITIES

The San Antonio River was sampled November 18, 1977. Our sampling was from 60 m north of Hildebrand Avenue in the headwaters to 30 m south of the now abandoned low water crossing connecting River Road and Avenue A (Fig. 1).

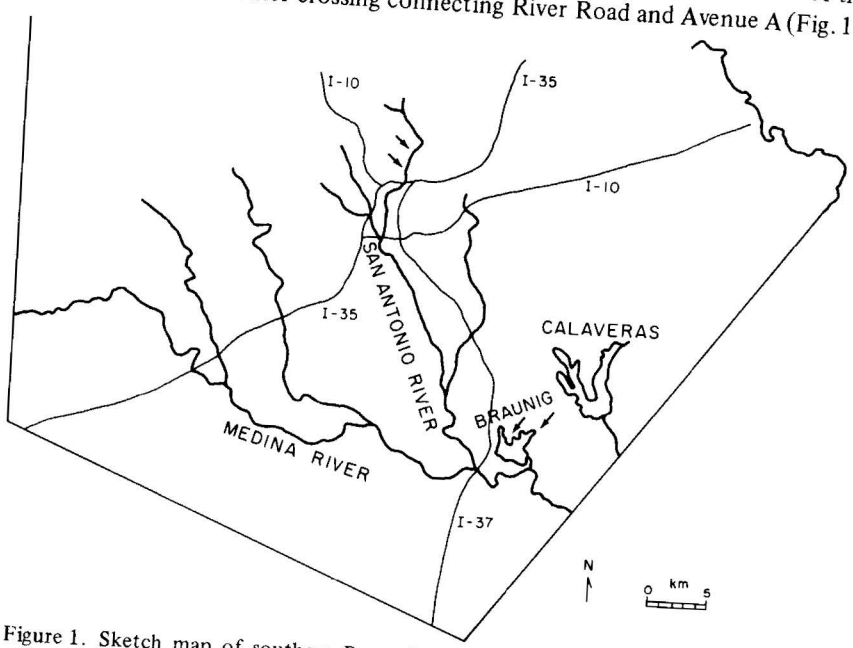

Figure 1. Sketch map of southern Bexar County showing locations of collection sites.

Measured along the main river channel, these 2 points are 3 km apart. We collected extensively at the upper and lower locations as well as between the Witte Museum and Joske Pavilion, near the horse crossing, and from Mulberry Avenue south for about 150 m. In addition to the above main channel sites, we sampled the 2 ditches draining the San Antonio Zoo's well-fed stream system into the San Antonio River, the channel connecting bends in the River just east of the Park Office, and a pool formed by damming a spring-fed headstream just north of the Park Office. We used a variety of seines from 2-10 m and mesh sizes as small as 2 mm.

Braunig Lake was sampled September 29, 1977. Our sampling was by beach seine at the power plant outlet and from the northeastern cove. Our results in many ways were similar to those obtained in a Texas Parks and Wildlife cove rotenone sample taken earlier that week.

San Antonio River

Our San Antonio River sample included 17 fish species, 11 (*Notropis lutrensis, N. amabilis, N. volucellus, Ictalurus natalis, Gambusia affinis, Micropterus salmoides, Lepomis gulosus, L. cyanellus, L. megalotis, L. punctatus,* and *L. macrochirus*) likely to be native and 6 (*Astyanax mexicanus, Hypostomus plecostomus, Poecilia reticulata, P. latipinna, Cichlasoma cyanoguttatum,* and *Sarotherodon mossambicus*) considered to be exotics. These 6 will be discussed below.

Astyanax mexicanus is an abundant midwater small fish. We encountered numerous schools throughout the area sampled. Brown (1953) reported the Mexican tetra (as *Astyanax fasciatus mexicanus*) was introduced into the Guadalupe Basin between 1908 and 1930 with the first San Antonio River record in 1940. Clearly, the fish has long been established. Presumably, the stocks came from those native to the Rio Grande or Nueces River.

Hypostomus plecostomus is an abundant bottom fish. We preserved 50 individuals and could have obtained many more. Our specimens ranged from 13-238 mm SL. All evidence suggests a long breeding season-even distribution of fish sizes, small to breeding adults, including a 182 mm female with 716 yolked eggs 3.25 mm in diameter. Our findings agree with those of Barron (1964) who reported that this exotic (listed as *Plecostomus* sp.) breeds in the San Antonio River. Our sample contained 13 mature or maturing males and 8 females. Clearly, the largest individuals were males (8 were 199 mm or longer), while the longest female was the 182 mm ripe individual. Five "maturing" males were 130-180 mm and 7 "maturing" females were 116-181 mm. Large *Hypostomus* were taken from the swiftest waters, often under large boulders. Some were seined from the tail race downstream lip of a low water crossing. Young and juveniles were often taken from heavy vegetation in slow to moderate current. Seining the armadillo del rio [a name we propose for the common name as it complies with recommendations 10, 11, and 14 of Bailey, *et al.*, (1970)] was best done by techniques normally associated with the capture of darters--adults where one would expect

Percina caprodes and young in a location similar to that inhabited by *Etheostoma fonticola*. Juveniles and adults were observed moving rapidly in the current in a manner that commonly is done by darters. It is unlikely that competition for food is involved as our specimens of *Hypostomus* had long guts filled with algae and other vegetal material whereas darters are primarily arthropod feeders. If the armadillo del rio have displaced a native fish, that displacement is most likely to involve the stoneroller (*Campostoma anomalum*) or roundnose minnow (*Dionda episcopa*), both of which are commonly very abundant in central Texas spring runs but were absent from our samples.

Poecilia reticulata is found abundantly in the north ditch draining the San Antonio Zoo. We preserved more than 100 young to breeding adult guppies and several more were maintained in a live sample. Most of the large females were gravid. Males were very colorful and on occasion females had modest coloration. Clearly, the fish are descended from aquarium stocks selected for bright colors.

Guppies have not previously been recorded as residents in natural waters in Texas. Edwards (1976) reported a sparse population in Waller Creek in Austin that failed to survive the following winter. The San Antonio stocks exist in stenothermal well waters similar to spring waters in which released guppies have survived elsewhere in the United States (Deacon, *et al.*, 1964). Although guppies were not collected from the San Antonio River itself, it is highly probable that the population will perpetuate and disperse to the river following selection for wild-type genes. Regardless of their spread, the population we sampled seemed to be surviving under somewhat natural conditions and can be construed to be an addition to the existing fish fauna of the state. Guppy abundance may have been enhanced by the relative scarcity of predacious centrarchids in that ditch. The absence of *Belonesox belezanus* in our samples suggests the failure of that release reported by Barron (1964), leaving the number of poeciliids in Texas unchanged.

Poecilia latipinna is abundant, especially in shallow waters with minimal current. Brown (1953) had reported a 1939 escape of sailfin mollies (as *Molliensia latipinna*) from a Florida stock into the San Antonio River. The first collections from the Guadalupe River System were in 1941. Brown also reported releases of a Louisiana stock and presumably releases from native Texas stocks may also have occurred. It is unknown which race (or races) now is represented in the abundant populations currently found in the Guadalupe System.

Cichlasoma cyanoguttatum is an abundant quiet water fish in much of the upper San Antonio River. The native Texas range of the Rio Grande cichlid was limited to the Nueces and Rio Grande systems (Brown, 1953). He reported that Rio Grande cichlids (as *Herichthys cyanoguttatus*) were raised in the National Fish Hatchery in San Marcos between 1928 and 1941. Presumably, the San Antonio River stocks were released in 1929 or shortly thereafter. The stocks came from near Mission, Texas.

Sarotherodon mossambicus is found in small numbers in the south ditch draining the San Antonio Zoo near the train station. In addition to the fish in our collections, we observed several decomposing adults in that region. Apparently they are most abundant in the deepest water (= hardest to sample with the seines we used). They have also been observed to be very abundant in canals in the adjacent San Antonio Zoo, especially the internal ditches used for duck and water bird exhibits. These locations empty into the south drainage ditch. The Mossambique tilapia was reported (as *Tilapia mossambica*) by Hubbs (1961) to have been released in the San Marcos and San Antonio springs but the source was not mentioned. Atz (1954) mentioned its extensive dissemination as an aquarium fish and the release was presumably from this provenance. The impact of the Mossambique tilapia is expected to be on the Rio Grande cichlid which also is not native to the San Antonio River.

Braunig Lake

Our Braunig Lake sample included 14 species, 7 (*Dorosoma cepedianum, D. petenense, Pimephales vigilax, Gambusia affinis, Lepomis cyanellus, L. megalotis,* and *L. macrochirus*) likely to be native, 1 (*Notemigonus crysoleucas*) possibly native, and 6 (*Cyprinodon variegatus, Poecilia latipinna, P. formosa, Menidia beryllina, Cichlasoma cyanoguttatum,* and *Sarotherodon aureus*) considered to be exotics. Four of these exotics (except *P. latipinna* and *C. cyanoguttatum* which are discussed in the San Antonio River segment of this report) will be discussed below.

Cyprinodon variegatus is found in shallow water over soft sand and mud substrates with minimal vegetation throughout Braunig Reservoir. We also observed numerous individuals breeding in shallow waters at the southwestern corner of the reservoir. The natural range of this species is in estuarine waters throughout Texas and adjacent areas. Sheepshead minnows recently have turned up at several inland localities. It is uncertain whether these Braunig Reservoir fish reflect a similar recent introduction or whether this population was introduced earlier and is the source of the existing west Texas populations (Stevenson and Buchanan, 1973; Hubbs, *et al.*, 1978). We do not expect this release will have the substantial deleterious impact that has been observed for those west Texas releases.

Poecilia formosa occurs in sparse numbers in the northeastern cove. This is the first record of the Amazon molly in Bexar County. The natural range in Texas seems limited to the lower Rio Grande tributaries and distributaries south of Raymondville, Texas. Martin (1964) documented other apparent releases (as *Molliensia formosa*) that seem to have increased the geographic range of this fish. It seems likely that Amazon mollies were only recently released in Braunig Reservoir. The heated temperatures should be favorable to the abundance and spread of this gynogenetic fish (Hubbs, 1964) and their abundance should be monitored to determine rates of population increase and/or clonal diversity.

Presumably the fish accompanied a game fish release. Lula Sams State Fish Hatchery would be a reasonable location for the stock source, as Amazon mollies are abundant in many hatchery ponds there. The impact of increased numbers will be primarily at the expense of its sexual host, *P. latipinna*, which is also exotic.

Menidia beryllina is found on sandy beaches in Braunig Reservoir. As with the sheepshead minnows, the natural range of the tidewater silversides is estuaries in Texas and adjacent areas. Tilton and White (1964) have documented their abundance inland following reservoir construction. Thus, it is not surprising to find them in another reservoir. Tidewater silversides seem able to spread far from reservoirs and have been found more than 100 km from the expected reservoir release site (Hubbs, *et al.*, 1977).

Sarotherodon aureus is present in large numbers throughout the reservoir. It may well be the dominant fish in Braunig Reservoir--even out competing gizzard shad. Noble, *et al.*, (1975) have reported the impact of a population explosion in Trinidad Reservoir. Fortunately, massive mortalities (and possible extinction) occurred when that power plant was under repair during cold weather. It is unfortunate that the stock seems to have been perpetuated elsewhere (Canadian River, Oklahoma, near a power plant, J. Pigg, personal communication, 1977). The exact source of the Braunig Lake and other Texas stocks (Hubbs, 1976) is uncertain but those releases should be restricted as much as possible to avoid problems similar to those that developed in Trinidad Reservoir. Edwards has repeatedly collected blue tilipia of various sizes from shallow weedy areas in Canyon Reservoir on the Guadalupe River. The Canyon Reservoir population may have adapted to central Texas thermal conditions or submerged springs emptying into the reservoir may provide a thermal refugium in winter.

DISCUSSION

Exotic fishes currently abound in the vicinity of San Antonio, Texas. In our 2 samples exotics accounted for 35 and 43% of the species collected. Some such as *Cichlasoma cyanoguttatum, Poecilia latipinna,* and *Astyanax mexicanus* also occurred more than 3 decades ago. The impact of those releases is uncertain as the prior fauna was too little known. Recent releases such as *Poecilia formosa, Sarotherodon aureus,* and *S. mossambicus* are likely to be impacting previously released exotics. Other "new" releases may affect native fishes but the absence of a substantial prior population study makes any conclusions quite tentative. We are most concerned about the impact of releases into the San Antonio spring run as the negative impact is likely to include depleting the abundance of native fishes adapted to that stream.

We recovered an equivalent abundance of exotics in Braunig Reservoir but if the exotics remain restricted within the confines of that artificial impoundment (current and thermal), environmental problems may be manageable. Escape into natural waters and adaptation to environmental factors could produce an added

threat to the native fauna of Bexar County. The estuarine fishes (*Menidia beryllina, Poecilia formosa, P. latipinna, Cyprinodon variegatus*) may have accompanied marine fishes released for sport fishing purposes. For example, red drum (*Sciaenops ocellata*) are taken from Braunig Lake by sport fishermen. It is likely that red drum do not reproduce in Braunig and their presence there depends upon periodic stocking of young individuals. We urge extreme care to accompany such transport to avoid unintentional releases.

ACKNOWLEDGEMENTS

We are grateful to Wilfred J. Dean, Jr., and Robert J. Kemp, Texas Parks and Wildlife for collection permits and collecting equipment for our Braunig Lake samples. Robert W. Zerr and John P. Wray aided in those collections. We are indebted to Don Maddox, Assistant Director of Parks and Recreation, San Antonio, for a special permit to collect fish within Brackenridge Park. Robert D. Bodenhamer, Deborah C. Edwards, and David S. Marsh assisted in those collections.

LITERATURE CITED

Atz, J.W., 1954–The peregrinated *Tilapia. Animal Kingdom*, 57:148.

Bailey, R.M., J.E. Fitch, E.S. Herald, E.A. Lachner, C.C. Lindsey, C.R. Robins, and W.B. Scott, 1970–A list of common and scientific names of fishes from the United States and Canada, 3rd edition. *Sp. Publ. 6, Amer. Fish. Soc.*, 150 p.

Barron, J.C., 1964–Reproduction and apparent over-winter survival of the sucker-mouth armored catfish, *Plecostomus* sp., in the headwaters of the San Antonio River. *Tex. J. Sci.*, 16:449.

Brown, W.H., 1953–Introduced fish species of the Guadalupe River Basin. *Tex. J. Sci.*, 5:245.

Deacon, J.E., C. Hubbs, and B.J. Zahuranec, 1964–Some effects of introduced fishes on the native fish fauna of southern Nevada. *Copeia*, 1964:384.

Edwards, R.J., 1976–Relative and seasonal abundances of the fish fauna in an urban creek ecosystem. Unpubl. M.A. thesis, University of Texas, Austin, 84 p.

Hubbs, C., 1961–A checklist of Texas fresh-water fishes. *Texas Game and Fish Commission I.F. series, 3(revised)*, 14 p.

———, 1964–Interactions between a bisexual fish species and its gynogenetic sexual parasite. *Bull. Tex. Mem. Museum*, 8, 72 p.

———, 1971–Competition and isolation mechanisms in the *Gambusia affinis* x *G. heterochir* hybrid swarm. *Bull. Tex. Mem. Museum*, 19, 47 p.

———, 1972–The impact of fish introductions on aquatic communities. *Tropical Fish Hobbyist*, 20(8):22.

———, 1976–A checklist of Texas freshwater fishes. *Texas Parks and Wildlife Tech. Ser.* 11:12.

———, 1977–Possible rationale and protocol for faunal supplementations. *Fisheries*, 2(2):12.

———, T. Lucier, E. Marsh, G.P. Garrett, R.J. Edwards, and E. Milstead, 1978–Results of an eradication program on the ecological relationships of fishes in Leon Creek, Texas. *Southwestern Nat.*, 23:487.

———, R.R. Miller, R.J. Edwards, K.W. Thompson, E. Marsh, G.P. Garrett, G.L. Powell, D.J. Morris, and R.W. Zerr, 1977–Fishes inhabiting the Rio Grande, Texas-Mexico, between El Paso and the Pecos confluence. *In* R. Roy Johnson and Dale A. Jones (Eds.), *Importance, Preservation and Management of Riparian Habitat: A Symposium. USDA Forest Serv., General Tech. Report*, RM-43:91.

Lachner, E.A., C.R. Robins, and W.R. Courtenay, Jr., 1970–Exotic fishes and other aquatic organisms introduced into North America. *Smithsonian Contr. Zool.*, 59:29.

Martin, F.D., 1964–The occurrence of *Molliensia formosa* in the lower Nueces River of Texas. *Tex. J. Sci.*, 16:453.

Minckley, W.J., and J.E. Deacon, 1968–Southwestern fishes and the enigma of "endangered species". *Science*, 159:1424.

Noble, R.L., R.B. Germany, and C.R. Hall, 1975–Interactions of blue tilapia and largemouth bass in a power plant cooling reservoir. *Proc. 29th Conf. S.E. Assn. Game and Fish. Comm.*, 5 p.

Stevenson, M.M., and T.M. Buchanan, 1973–An analysis of hybridization between the cyprinodont fishes *Cyprinodon variegatus* and *C. elegans*. *Copeia*, 1973:682.

Thompson, K.W., C. Hubbs, and B.W. Lyons, 1977–An analysis of the potential environmental factors, especially thermal, which would influence the survivorship of exotic Nile perch if introduced into artificially heated reservoirs in Texas. *Texas Parks and Wildlife Tech. Series*, 22:37.

Tilton, J.E., and R.L. White, 1964–*Menidia beryllina* from several central Texas impoundments. *Tex. J. Sci.*, 16:120.

A STUDY OF PHYTOPLANKTON PRIMARY PRODUCTIVITY AND NUTRIENT CONCENTRATIONS IN LIVINGSTON RESERVOIR, TEXAS

by JACK D. McCULLOUGH

Department of Biology,
Stephen F. Austin State University,
Nacogdoches 75962

ABSTRACT

A 7-month study of phytoplankton primary productivity using a carbon-14 technique was conducted at Livingston Reservoir, Texas. The reservoir was found to be eutrophic with hypereutrophic conditions in the riverine portion. The lacustrine region was most productive during the spring and early fall, but the riverine region had the highest rates during the summer. Regression analysis indicated turbidity was a major factor limiting production rates. Water hyacinth populations appear to be causing a significant reduction in nitrate and phosphate concentrations in the riverine portion of the reservoir.

INTRODUCTION

An assessment of primary productivity is essential in management of inland waters. Although extensive chemical water quality data on Livingston Reservoir can be found in U.S.G.S. reports (1975), Texas Water Quality Board publications (1973) and Trinity River Authority studies (1976), no primary productivity data for the reservoir have been found in the literature. The purpose of this study was to determine the rates of phytoplankton primary productivity and its relationship with certain physico-chemical parameters at Livingston Reservoir from April 5, 1975 through October 25, 1975.

DESCRIPTION OF THE RESERVOIR

Livingston Reservoir is located on the Trinity River in Polk and San Jacinto Counties, 9.6 km southwest of Livingston, Texas. Completed in 1968, the reservoir is owned jointly by the Trinity River Authority and the city of Houston

[1]This paper was presented at the annual meeting of The Texas Academy of Science, Baylor University, March 12, 1977.

Accepted for publication: April 20, 1978.