SUMMARY OF POPULATION MONITORING OF RIO GRANDE SILVERY MINNOW
(1994-2002)

prepared by:

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Background

Analyzing population fluctuations of fishes and accessing the influence of environmental variability can lend insights to mechanisms that regulate community structure (Starrett, 1951; Schlosser, 1985). From 1986 until present, the U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, New Mexico Department of Game and Fish, and U.S. Corps of Engineers have cooperated to fund numerous such ichthyofaunal studies in the Rio Grande. Among these investigations has been the long-term monitoring of the distribution and relative abundance of the Rio Grande fish community at sites between Velarde, New Mexico and Elephant Butte Reservoir, New Mexico.

A portion of the early results of those monitoring activities (1986-1989) documented the dire conditions of the native fish fauna and the conservation status of Rio Grande silvery minnow (Bestgen and Platania, 1991). That research effort served notice of the extirpation of the Rio Grande silvery minnow from over 2,000 miles of river in the Rio Grande and Pecos River systems (ca. 95% reduction in its historic range) and delineated the range of the only remaining population of this species as occurring in a ca. 170-mile reach of the Rio Grande between Cochiti Dam and Elephant Butte Reservoir (Figure 1). With the 1994 listing of this species as federally endangered (U.S. Fish and Wildlife Service, 1994), this reach of the Rio Grande (often referred to in New Mexico as the "Middle Rio Grande") became the focus of numerous additional hydrologic and ichthyological investigations. While Rio Grande silvery minnow was the primary focus of many of the ichthyological studies, monitoring and other research activities were designed to provide information about the entire fish community.

Recent Middle Rio Grande population monitoring efforts (Dudley and Platania, 2001, 2002) provide timely data for comparative studies of trends in the temporal and spatial fluctuations of fish populations. Sampling efforts have documented changes in the ichthyofaunal community following low flow and stream drying events. The purpose of this abbreviated synthesis report is to briefly illustrate the marked decline in the abundance of Rio Grande silvery minnow during the past several years using past and current Middle Rio Grande population monitoring data (1994-2002).

1994-2002 Population Monitoring Summary

The decline in the abundance of Rio Grande silvery minnow in the Middle Rio Grande between 1994 and present has been well documented (Figure 2). There were few changes in the cumulative catch rate (number of fish per surface m^2 of water sampled) of Rio Grande silvery minnow between 1994 and 1996. However, the marked decline in Rio Grande silvery minnow cumulative catch rate between 1996 and 1997 was likely a manifestation of the massive losses incurred during spring and summer drying events of 1996. The marked decline in the cumulative catch rate of this species continued between 1999 and 2000 and remains exceedingly low today.

Rio Grande silvery minnow continue to be disproportionately distributed throughout the Middle Rio Grande. The 1994-2002 population monitoring data continue to indicate that the majority of individuals occur in the San Acacia Reach with the fewest silvery minnow being in the Angostura and Isleta reaches, respectively (Figure 2). This reach-specific longitudinal distribution (increasing numbers from up-to-downstream reaches) was predicted given the reproductive strategy of this

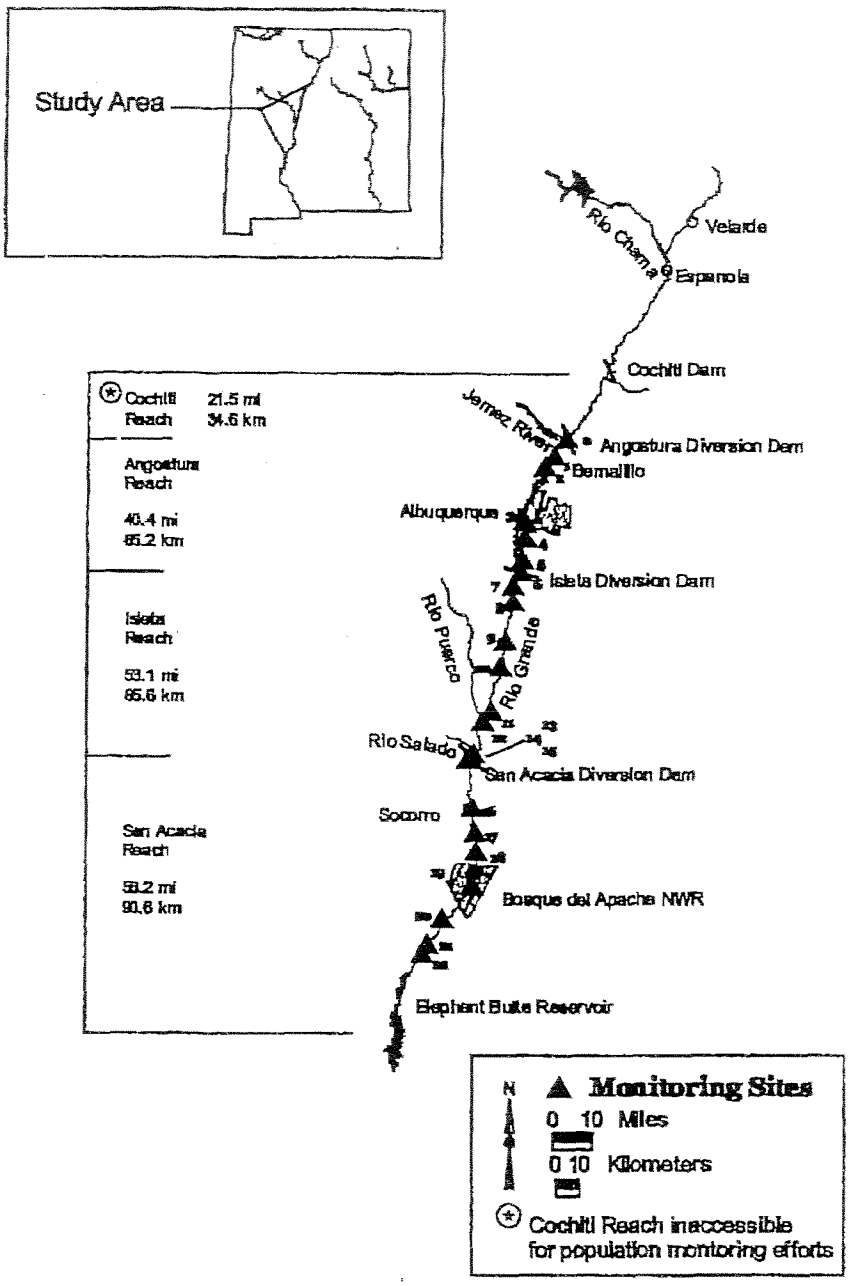

Figure 1. Population monitoring localities in the Middle Rio Grande.

species (which results in the production of large quantities of semibuoyant eggs that are released into the water column and dispersed downstream).

In 1998, over 98% of the Rio Grande silvery minnow catch, by number, was from the San Acacia Reach indicating that a significant portion of the population resides in that reach (it does not indicate that 98% of the population was in that reach). Such values are indicative of the relative importance of the San Acacia reach to the continued survival of this species. Understandably, the proportion of the silvery minnow population inhabiting the upstream two reaches (Angostura and Isleta) will increase as segments of the San Acacia Reach dry (as occurred in 2002). Regardless of the metric used to calculate or illustrate the reach specific distribution of this species, there can be little question that, since at least 1994, the vast majority of the Rio Grande silvery minnow population occurred in the San Acacia Reach. Likewise, site specific annual catch rate data provide a thorough documentation of the history of decline of Rio Grande silvery minnow (Figure 3).

2002 Population Monitoring Summary

The number of Rio Grande silvery minnow collected exhibited a steady decline throughout 2002 (Figure 4). The highest number of individuals were taken during the first 2002 sampling effort (January; n=548) while the fewest specimens were taken during the most recent 2002 sampling foray (August; n=38). These numbers of fish are extremely low and not similar with those from pre-2000 study years. The number of Rio Grande silvery minnow collected in August 2002 is one of the lowest every taken during the tenure of the 1994-2002 population monitoring study and is indicative of alarmingly small population levels.

As has been well documented over the years, catch rate (number of fish per m^2 sampled) of Rio Grande silvery minnow during 2002 continued to be highest in the San Acacia Reach (the most downstream section of river and first reach to be eliminated by lack of flow) and lowest in the Angostura Reach (the most upstream reach of the river). Absence of continued flow through the San Acacia Reach would have eliminated a disproportionately greater proportion of silvery minnow than absence of water flow in either the Angostura or Isleta reaches. The abundance of this species has decreased so markedly, however, that it is extremely rare throughout it's remaining range.

Close examination of the 2002 population monitoring efforts indicate that spawning success of Rio Grande silvery minnow (during 2002) was very poor. Collections from May-June 2002 (the period after spawning would have occurred) produced few age-0 (fish hatched during 2002) individuals. This lack of age-0 fish indicates that few larval fish survived the summer low flow conditions and river drying in the Middle Rio Grande. The low number of Rio Grande silvery minnow present in August 2002 population monitoring efforts and the lack of age-0 individuals (n=14) suggests that further declines will likely continue into 2003.

Efforts to maintain flow throughout the Middle Rio Grande are critical as further losses of Rio Grande silvery minnow could result in the extirpation of this species from the wild. The barrier to upstream movement imposed by multiple diversion dams and downstream transport of silvery minnow eggs and larvae into Elephant Butte Reservoir continue to adversely impact populations of this species. The effects of these problems have been synergistic and now become especially critical

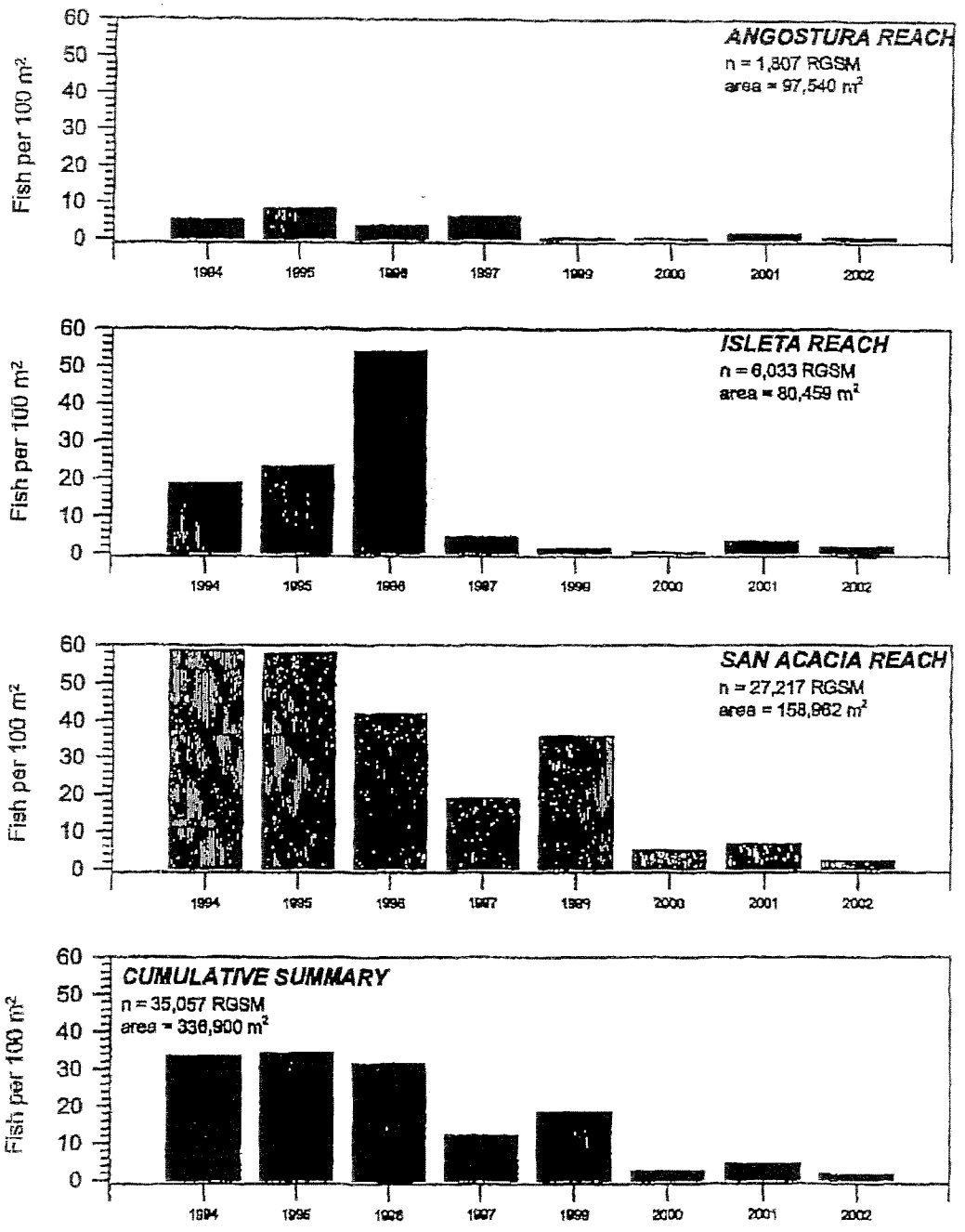

Figure 2. Reach specific annual Rio Grande silvery minnow catch rates between 1994 and 2002.

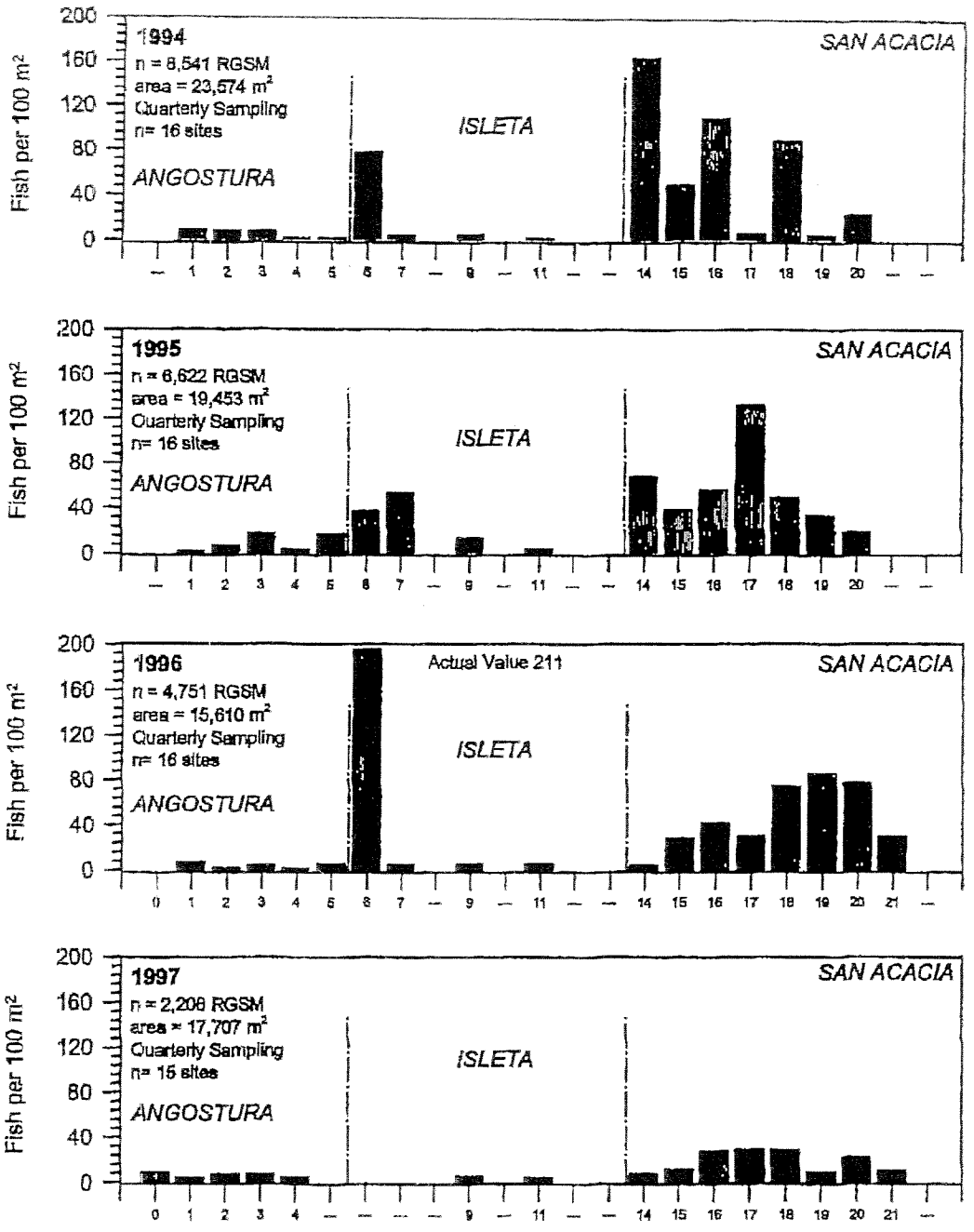

Figure 3. Cumulative annual Rio Grande silvery minnow (RGSM) catch rates by reach during the study period (*Note: High catch of RGSM at site 6 in 1996 caused by their confinement in isolated pools during April river drying events).

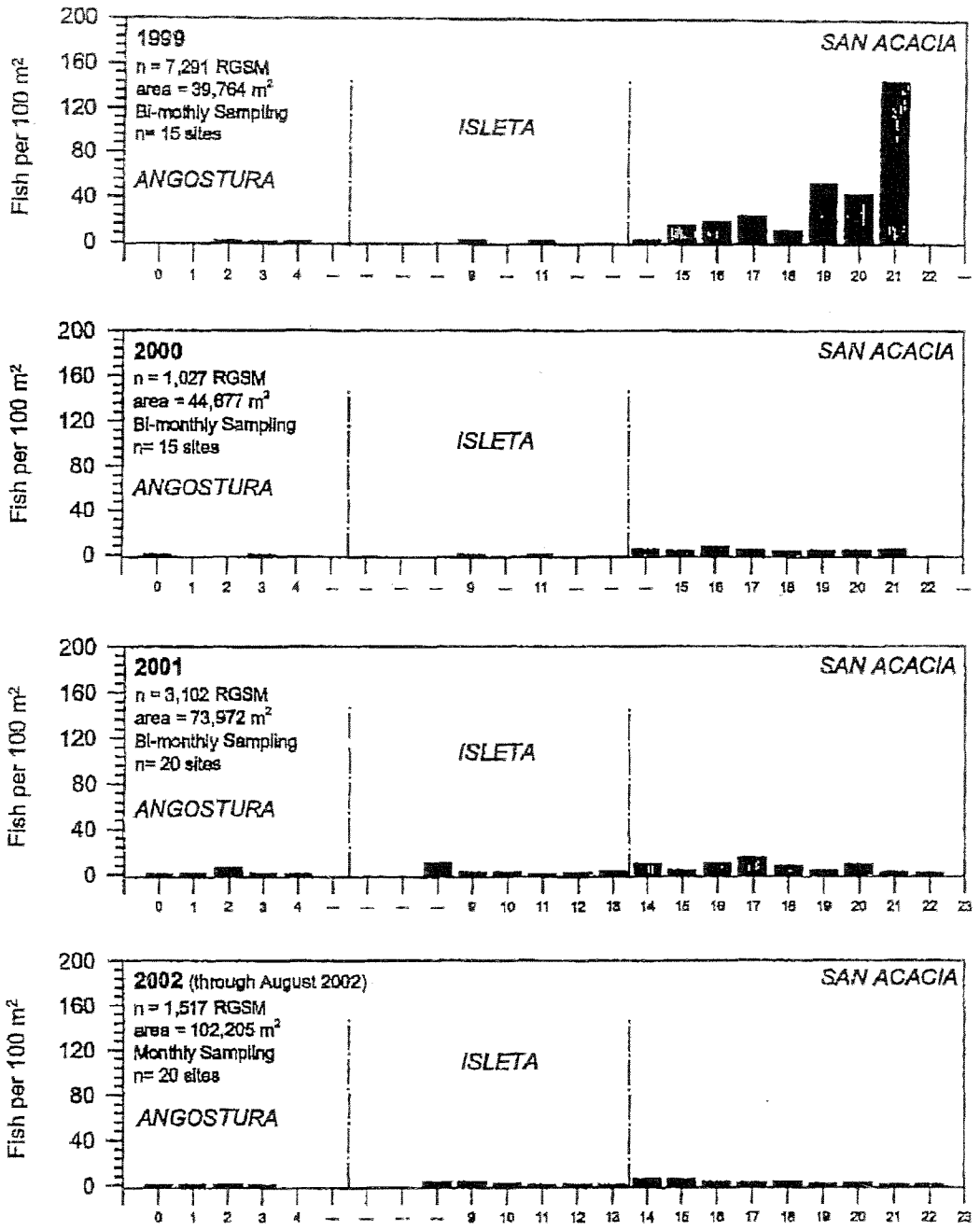

Figure 3. Cumulative annual Rio Grande silvery minnow catch rates by reach during the study period (continued).

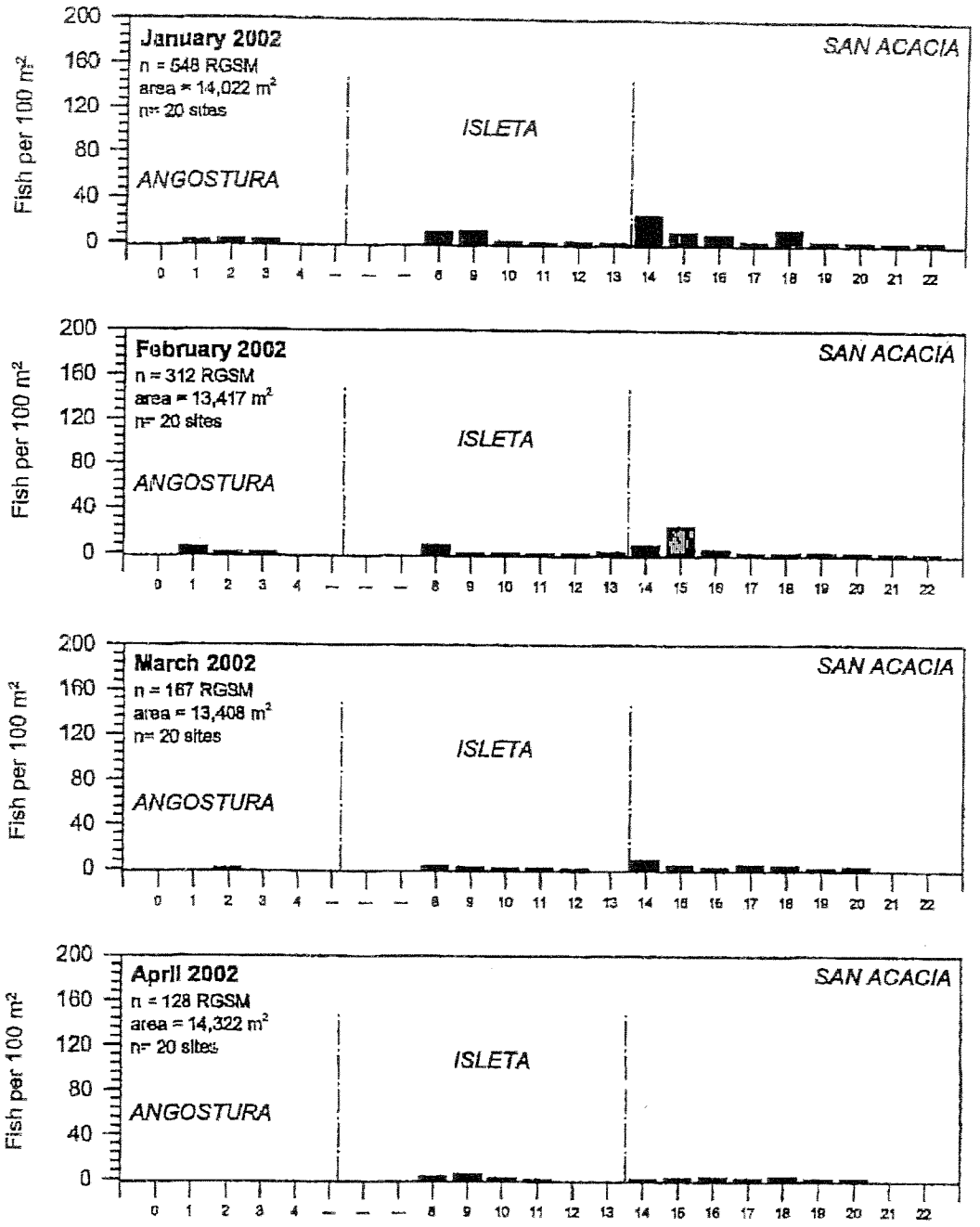

Figure 4. Rio Grande silvery minnow catch rates by month and reach during 2002.

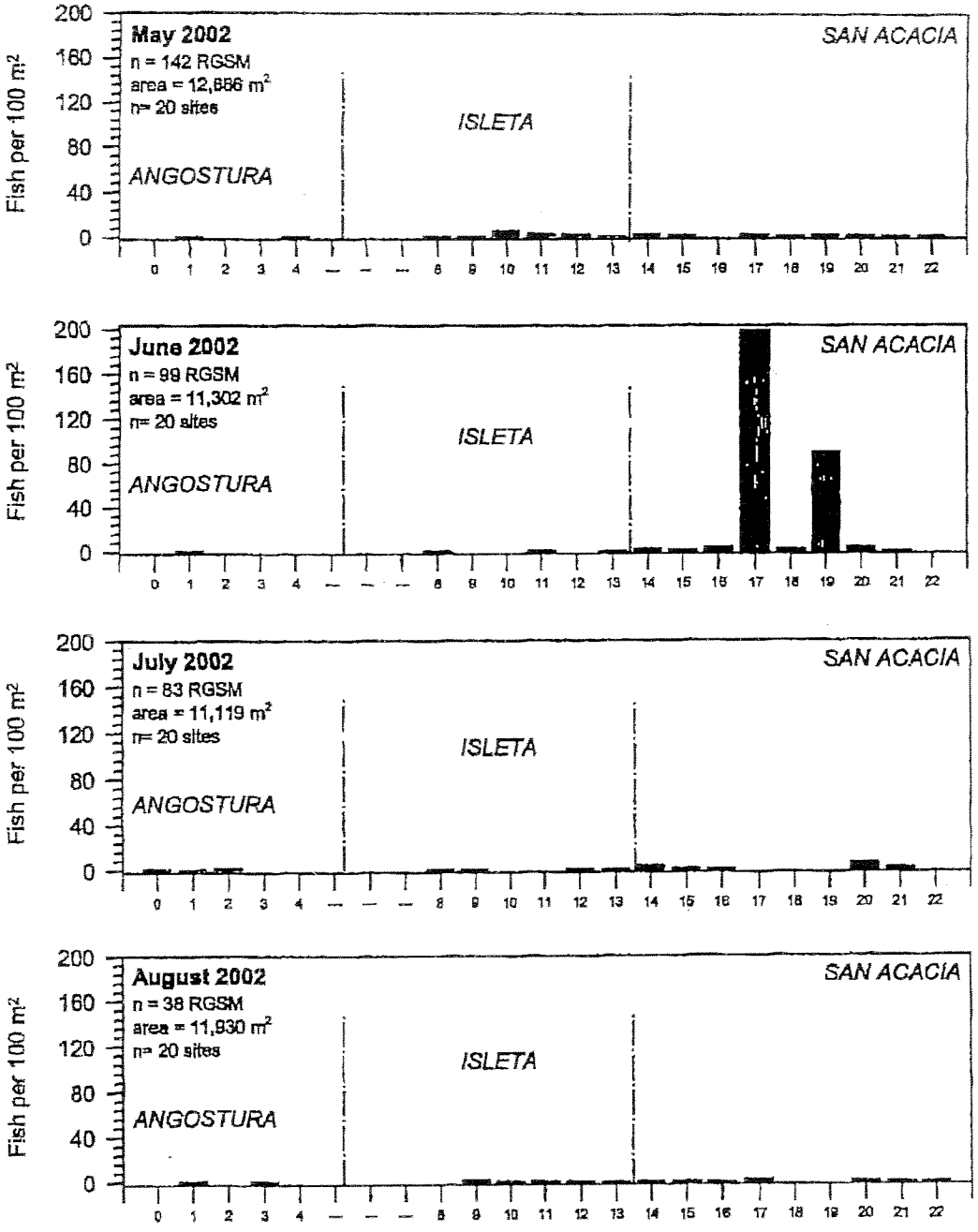

Figure 4. Rio Grande silvery minnow catch rates by month and reach during 2002 (continued) (*Note: High RGSM catch at sites 17 and 19 in June 2002 caused by their confinement in isolated pools; these habitats dried by July 2002).

as densities of individuals for calendar year 2002 (are to date) and will likely remain the lowest ever recorded.

Summary

There are different types, degrees, and levels of confidence that can be ascribed to information gleaned from Rio Grande silvery minnow population monitoring samples. These data are most valuable and informative when viewed collectively and in sequence rather than individually. Interpretation of individual samples often obscures the broad and more relevant (and important) understanding of the data and may be quite different than that of the collective suite.

The decline of Rio Grande silvery minnow is the result of the cumulative effects of years of river drying, downstream displacement, and habitat degradation. The removal of instream barriers that prevent Rio Grande silvery minnow from reaching upstream reaches, the need to maintain flow throughout downstream reaches, and restoration and re-connection of the historical floodplain are paramount issues that need to be resolved to assure the continued persistence of this species. However, ensuring the continued long-term existence of viable, self-sustaining wild populations must be the overriding goal prior to the initiation of a myriad of recovery efforts. Failure to do so will result in the loss of the fourth endemic Rio Grande cyprinid species and incur financial costs far beyond those currently projected for recovery efforts for this species.

Literature Cited

Bestgen, K.R. and S. P. Platania. 1991. Status and conservation of the Rio Grande silvery minnow, *Hybognathus amarus*. Southwestern Naturalist 36:225-232.

Dudley, R. K. and S. P. Platania. 2001. 2000 population monitoring of Rio Grande silvery minnow. Final report to the U.S. Bureau of Reclamation, Albuquerque and to the U.S. Army Corps of Engineers, Albuquerque, New Mexico. 86 pp.

Dudley, R. K. and S. P. Platania. 2002. 2001 population monitoring of Rio Grande silvery minnow. Final report to the U.S. Bureau of Reclamation, Albuquerque, New Mexico. 88 pp.

Schlosser, I. J. 1985. Flow regime, juvenile abundance, and the assemblage structure of stream fishes. Ecology 66:1484-1490.

Starrett, W. C. 1951. Some factors affecting the abundance of minnows in the Des Moines River, Iowa. Ecology 32:13-27.

U.S. Department of the Interior. 1994. Endangered and threatened wildlife and plants: final rule to list the Rio Grande silvery minnow as an endangered species. Federal Register 59: 36988-36995.

Appendix I: Sampling Site Information

Sampling Site Information

The U.S. Bureau of Reclamation funded Rio Grande silvery minnow population study was designed to monitor population levels of this federally endangered species and the associated fish community at selected sites throughout the Middle Rio Grande, New Mexico. Sampling efforts between 1994 and 2002 were adjusted as necessary based on site accessibility and the informational needs of the resource agencies. The number, location, and frequency at which sites were sampled between 1994 and 2002 allowed for determination of general reach specific spatial and temporal changes in population structure and fish species densities.

Reach names used in this document and the annual Rio Grande silvery minnow population monitoring reports were derived from the name of the diversion structure at the upstream boundary of that fragmented portion of the river. Sampling was not conducted in the Cochiti Reach under this monitoring program as this reach of the Rio Grande is under tribal control (Cochiti, Santo Domingo, and San Felipe pueblos) and access is often unavailable. There were a total of six sampling localities in the Angostura Reach (Angostura Diversion Dam to Isleta Diversion Dam), eight in the Isleta Reach (Isleta Diversion Dam to San Acacia Diversion Dam), and nine sampling localities in the San Acacia Reach (San Acacia Diversion Dam to Elephant Butte Reservoir). One Angostura Reach sampling site (Site 5: Interstate 25 Bridge) and two Isleta Reach sites (Site 6: Isleta Diversion Dam and Site 7:4.8 miles downstream of Isleta Diversion Dam) were eliminated from the sampling regime in 1997 because of a lack of assess.

Quarterly fish sampling was conducted from 1994 through 1997 (February, May, June, and October). Unfortunately, sampling could not be conducted during 1998. Changes in federal endangered species collection permitting procedures, instituted in 1998, resulted in a profusion of permit applications which overwhelmed the already limited resources of the U.S. Fish and Wildlife Service's Regional Permitting Office. A consequence of this situation was that a federal collecting permit for Rio Grande silvery minnow population monitoring was not available until late 1998 precluding fish monitoring activities for that year (1998).

The Rio Grande silvery minnow population monitoring program was reinitiated in 1999 with bi-monthly sampling regime (February, April, June, August, October, and December). The increase in collecting effort between 1997 and 1999 was in part a response to the 1998 sampling hiatus and also because of concerns related to the effects of 1996 -1998 river drying events on Rio Grande silvery minnow populations. The bi-monthly sampling regime remained in effect until 2002 when a monthly monitoring protocol was initiated. Again, the increased sampling effort (from 2001 to 2002) was precipitated by marked declines in the catch rate of Rio Grande silvery minnow.

Table 1. Collection localities for population monitoring of Rio Grande silvery minnow between 1994 and 2002.

Site #	Site Locality (years sampled)
ANGOSTURA REACH SITES	
0	New Mexico, Sandoval County, Rio Grande, below Angostura Diversion Dam, Algodones. River Mile 209.7. (1996-2002).
1	New Mexico, Sandoval County, Rio Grande, at NM State Highway 44 bridge crossing, Bernalillo. River Mile 203.8. (1994-2002).
2	New Mexico, Sandoval County, Rio Grande, ca. 4 miles downstream of NM State Highway 44 bridge crossing at Rio Rancho Wastewater Treatment Plant, Rio Rancho. River Mile 200.0. (1994-2002).
3	New Mexico, Bernalillo County, Rio Grande, at Central Avenue (US Highway 66) bridge crossing, Albuquerque. River Mile 183.4. (1994-2002).
4	New Mexico, Bernalillo County, Rio Grande, at Rio Bravo Boulevard bridge crossing, Albuquerque. River Mile 178.3. (1994-2002)
5	New Mexico, Bernalillo County, Rio Grande, at US Interstate 25 bridge crossing, Albuquerque. River Mile 172.6. (1994-1996).
ISLETA REACH SITES	
6	New Mexico, Bernalillo County, Rio Grande, directly below Isleta Diversion Dam, Isleta Pueblo. River Mile 169.3. (1994-1996).
7	New Mexico, Bernalillo County, Rio Grande, ca. 4.8 miles downstream of Isleta Diversion Dam, Isleta Pueblo. River Mile 165.2. (1994-1996).
8	New Mexico, Valencia County, Rio Grande, at Los Lunas (NM State Highway 49) bridge crossing, Los Lunas. River Mile 161.4. (2001-2002).
9	New Mexico, Valencia County, Rio Grande, ca. 1.0 miles upstream of NM State Highway 309/6 bridge crossing, Belen. River Mile 151.5. (1994-2002)
10	New Mexico, Valencia County, Rio Grande, ca. 2.2 miles upstream of NM State Highway 346 bridge at Transwestern Pipeline crossing, Jarales. River Mile 143.2. (2001-2002).
11	New Mexico, Socorro County, Rio Grande, at US Highway 60 bridge crossing, Bernardo. River Mile 130.6. (1994-2002)
12	New Mexico, Socorro County, Rio Grande, ca. 3.5 miles downstream of US Highway 60 bridge crossing, La Joya. River Mile 127.0. (2001-2002).

Table 1. Collection localities for population monitoring of Rio Grande silvery minnow between 1994 and 2002 (continued).

Site #	Site Locality (years sampled)
ISLETA REACH SITES (continued)	
13	New Mexico, Socorro County, Rio Grande, ca. 0.6 miles upstream of San Acacia Diversion Dam, San Acacia. River Mile 116.8. (2001-2002).
SAN ACACIA REACH SITES	
14	New Mexico, Socorro County, Rio Grande, directly below San Acacia Diversion Dam, San Acacia. River Mile 116.2. (1994-2002).
15	New Mexico, Socorro County, Rio Grande, ca. 1.5 miles downstream of San Acacia Diversion Dam, San Acacia. River Mile 114.6. (1994-2002).
16	New Mexico, Socorro County, Rio Grande, 0.5 miles upstream of the Low Flow Conveyance Channel bridge, east and upstream of Socorro Wastewater Treatment Plant, Socorro. River Mile 99.5. (1994-2002).
17	New Mexico, Socorro County, Rio Grande, ca. 4.0 miles upstream of US Highway 380 bridge crossing, San Antonio. River Mile 91.7. (1994-2002).
18	New Mexico, Socorro County, Rio Grande, at US Highway 380 bridge crossing, San Antonio. River Mile 87.1. (1994-2002).
19	New Mexico, Socorro County, Rio Grande, directly east of Bosque del Apache National Wildlife Refuge headquarters, San Antonio. River Mile 79.1. (1994-2002).
20	New Mexico, Socorro County, Rio Grande, at the San Marcial railroad crossing, San Marcial. River Mile 68.6. (1994-2002).
21	New Mexico, Socorro County, Rio Grande, at its former confluence with the Low Flow Conveyance Channel and 16 miles downstream of the southern end of the Bosque del Apache National Wildlife Refuge, San Marcial. River Mile 60.5. (1996-2002).
22	New Mexico, Socorro County, Rio Grande, ca. 19 miles downstream of the southern end of Bosque del Apache National Wildlife Refuge, San Marcial. River Mile 57.7. (2001-2002).

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