

Rio Grande Silvery Minnow Rescue and Salvage

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Abstract:

This project relates to Reasonable and Prudent Measure (RPM) one of the “Programmatic Biological Opinion on the Effects of Actions Associated with the U.S. Bureau of Reclamation’s, U.S. Army Corps of Engineers’, and Non-Federal Entities’ Discretionary Actions Related to Water Management on the Middle Rio Grande, New Mexico” (Opinion). The U.S. Fish and Wildlife Service (Service) determined that this reasonable and prudent measure was necessary and appropriate to minimize impacts of incidental take of the silvery minnow. Minnow salvage will be necessary regardless of the requirements outlined in the Opinion and will likely be a key element in any future Biological Opinions issued by the Service. Over the last 2 years the Service has salvaged silvery minnows from isolated pools during river intermittency and translocated these fish to areas with permanent flowing water. The efficiency of these translocation efforts has improved over the last two years. The 2002 water year was one of the worst on record and has been deemed the worst in 100 years. The Service has conducted approximately 34 individual silvery minnow salvages resulting in over 3400 silvery minnows being collected and moved upstream. Approximately 44 river miles were salvaged with some sections salvaged several times due to rewetting caused by rainstorm events (“acts of nature”). The largest number of silvery minnows collected were usually during the first drying event in each section. The number of silvery minnows collected during drying events declined after July of 2002. The most recent data indicate that approximately 98 percent of the silvery minnows collected were adults and 2 percent young-of-year (YOY). The Service recorded the number of dead silvery minnows found during drying events. To date 248 silvery minnows have been documented that counted against the incidental take statement(ITS) in the Opinion. Less than 100 dead silvery minnows were found that did not count against the ITS, and were attributed to “acts of nature.” These fish were found dead in a reach of river that had already dried previously and subsequently rewetted from rainstorm events. These fish were not consider under the ITS because the rewetting and subsequent drying were not caused by the action agencies’ management.

2002 Update on Salvage Activities

The Service has performed approximately 34 individual silvery minnow salvages within the Isleta and San Acacia Reaches. The approximate number river miles (APRMs) salvaged varied depending on the magnitude of drying events, ambient conditions, and likely in some cases the river bed composition (e.g. sands, silts, etc) condition. Salvage crews noted that the river receded slower following high flow events from the Rio Puerco. After flow events from the Rio Puerco there appeared to be a higher amount of fine clays in the river bed, which may have lessened the permeability of the river channel and lowered the loss of water to the shallow water table which caused the river to dry slower. The opposite was noted after high flow events not including flows or little flow from the Rio Puerco. With these events the river bed appeared to composed mostly of sands and river drying was quicker.

During the 2002 water year, flow recessions were manageable, with approximately 3 to 4 APRMs drying per day. During a few isolated events, up to 8 APRMs were dried in a single day, but these events were rare and occurred most often within Bosque del Apache National Wildlife Refuge (BDA) and between US 60 and the Jarales Bridge crossing. Most salvages were completed within 4 to 8 hours depending on the number of fish collected and the number of available personnel to assist in salvages. In most cases, events consisting of 4 or less APRMs needed only 3 to 8 individuals to effectively salvage that section of river. In some cases, two crews were formed to work two geographically separated dry reaches. Crews worked independently of each other and a crew leader was assigned to each crew by the Rio Grande Silvery Minnow Rescue Coordinator.

Rio Grande silvery minnows were collected and handled according to the specified protocol (included in this scope of work). We determined through experience that bagging fish was the best method for reducing mortality in transport (See Protocol 2, pg 9). Generally, smaller bags containing approximately 3 liters of water and containing no more than 18 adult fish and 30 YOY fish worked best. We experienced less than 10 percent mortality on average, during transport when using this method.

From the beginning of June 2002 through the beginning of October 2002, the Service salvaged 3,478 silvery minnows from the Isleta and San Acacia Reaches combined (Table 1). Approximately 47 river miles were salvaged with some river miles being salvaged several times due to rewetting caused by rainstorm events (“acts of nature”), bringing the total up to approximately 100 river miles salvaged (Table 1). The largest number of silvery minnows collected were during the first drying event in each section. The overall number of silvery minnows collected during drying events declined after July of 2002. Age structure of the silvery minnows identified was 98 percent adult and 2 percent YOY. However, it is likely that more YOY silvery minnows were moved during salvage events throughout June and early July. Due to the difficulties in accurately identifying small silvery minnows this time of year all YOY fish collected were salvaged. Due to the high numbers of YOY fish during June and July, only cursory examinations were made in hopes of identifying some silvery minnows. These YOY fish were not included in the total number of minnows salvaged, but it is without doubt that some of the YOY were silvery minnows. However, it is likely that many of these small fish were fathead

minnows or other non target species. Adult and YOY silvery minnows that were identified were counted and are reported here.

Salvaged silvery minnows were released in both the Angostura and Isleta Reaches according to specific protocols set forth in this scope of work. Ninety-two percent($n = 3,195$) of the salvaged silvery minnow were released in the Angostura Reach and 8 percent($n = 283$) were release in the Isleta Reach. Within the Angostura Reach, 99.9 percent of the fish were released at Central bridge and 0.1 percent were released at Rio Bravo. In the Isleta Reach, 48 percent of the fish were released at the Los Lunas Bridge and 52 percent were released at the Belen Bridge.

The overall condition of the silvery minnows at time of release was good. We noted that some fish showed outward signs of stress such as loss of equilibrium, flaring of gills, hemorrhages, external parasites, and erratic swimming. We could not always determine what caused the silvery minnows to be stressed at time of release, but it was also noted that some silvery minnows were already stressed at the time of collection from isolated pools. Therefore, it is likely that the few fish showing signs of stress at the time of release were already feeling the effects of river intermittency at time of collection from isolated pools. In general, the fish were healthy and active at time of release. All silvery minnows were released in slow water, such as side channels and pools with available cover within 2 meters. Care was used not to release fish directly into cover (i.e., debris) where they could be entangled and possibly trapped adding to the stress of the translocation.

There is no firm evidence that the translocated silvery minnows survived after release, but in contrast there is also no evidence silvery minnows did not survive. Because of the concern over the survival of translocated fish, two silvery minnows were retained from a salvage operation in October and held in a five gallon aquarium for 13 days to assess mortality. These fish survived and appeared to be healthy. This observation is anecdotal and should be treated as such, until replicated experiments can be conducted under a variety of scenarios.

In the past, the Service has transported adult silvery minnows under varying conditions to the Albuquerque Biopark for captive propagation with little or no mortality. For example, in the spring of 2000, Service and Biopark personnel made two trips in late April and early May to collect adult silvery minnows for brood stock. The ambient conditions were warm (mid to high 70's) and flows were extremely low. In both cases, due to logistic issues, fish were collected in mid to late afternoon and were treated and bagged according to the protocol in this scope of work. During these transports mortality was estimated at 1 percent, and most of the mortality associated with these fish occurred after they were induced to spawn. Translocating fish is a very sensitive operation, it must be noted that fish in certain life stages particularly larval and YOY, are extremely fragile and more likely suffer higher mortality during transport than adults.

Table 1. Approximate river miles salvaged up to mid October 2002. The total number of fish is reflective of several salvages within these sections caused by rewetting events. The approximate river miles is reflective of the maximum amount that dried, and does not consider individual events by date.

Isleta Reach		
Section	Approximate River Miles Dry	Number of silvery minnows salvaged
5.4 miles downstream of NM 49 (Los Lunas) downstream and 1.5 miles upstream of NM 6 (Belen)	8	49
0.5 miles downstream of US 60 to 0.3 miles downstream of Jarales Bridge	10.2	462
Total	18.2	511
San Acacia Reach		
6 miles downstream of Escondida bridge and 2.9 miles upstream of US 380	8	867
US 380 downstream to the south boundary of BDA	13	2077
San Marcial to Ft. Craig Pumping station	4	23
Total	25	2967

Introduction:

This project relates to Reasonable and Prudent Measure (RPM) one of the “Programmatic Biological Opinion on the Effects of Actions Associated with the U.S. Bureau of Reclamation’s, U.S. Army Corps of Engineers’, and Non-Federal Entities’ Discretionary Actions Related to Water Management on the Middle Rio Grande, New Mexico” (Opinion). The Service determined that this reasonable and prudent measure was necessary and appropriate to minimize impacts of incidental take of the silvery minnow. This action will likely be required under any Biological Opinion issued within the next couple years.

The fate of fish trapped in isolated pools has been studied in the Rio Grande and other drainages to determine the effects of river drying on the fish community. These studies have determined that the fish community is stressed from crowding, increasing water temperatures, increasing ambient temperatures, decreasing dissolved oxygen, aquatic predation, terrestrial predation, interspecific competition, and intraspecific competition (Trammer 1977, Capone and Kushlan 1991, Smith and Hoagstrom 1997, Smith 1998, Ostrand and Marks 2000, and McClinton et al. 2000). All these potential factors make survival of fish in isolated pools questionable.

Given the available information on fish survival in isolated pools, it was determined that silvery minnows should be salvaged from these pools during intermittent river conditions. This decision was based on the endangered status of the silvery minnow and the declining minnow population throughout the middle Rio Grande.

The first silvery minnow salvage was performed in 1996 and salvages have continued to some degree each year. Prior to 2001, one attempt was usually made to collect as many silvery minnows stranded in isolated pools as possible. This usually consisted of one crew going to easy access points on the Rio Grande, collecting silvery minnows, and translocating them upstream to flowing water. These salvages were usually conducted only once a year, and in most cases no attempts were made to collect silvery minnows from isolated pools in remote and inaccessible portions of the Rio Grande.

Starting with the issuance of the Opinion on June 29, 2001, a Rio Grande Silvery Minnow Rescue Coordinator (Coordinator) was appointed by Service. The Coordinator is responsible for directing and coordinating all efforts pertaining to the salvage of silvery minnows from isolated pools. The Coordinator will insure that silvery minnows are collected from isolated pools and placed back into the river where continuous flows are guaranteed (e.g., Isleta or Angostura Reaches) or into a propagation facility. The Coordinator is also responsible for documenting all take associated with the ITS issued in the Opinion. During the 2001 salvage season, 380 silvery minnows were salvaged and translocated to flowing water and three silvery minnows were found dead. These dead fish were considered take under the ITS.

Description of Study Area:

The study area for this project extends from Cochiti Dam to the headwaters of Elephant Butte Reservoir in New Mexico.

Purpose:

The purpose of this project is to relocate stranded silvery minnows from isolated pools to flowing portions of the river or to a propagation facility. This action will reduce the mortality of silvery minnows in isolated pools. However, the location, magnitude, and duration of the intermittent events are dependent on many environmental events such as spring runoff, summer thunderstorms, amount of supplemental water stored and released in upstream reservoirs, and other general climatic conditions. Regardless of recent water management, the Rio Grande has become intermittent yearly since 1996 (Reclamation 2001). This project is not designed to collect silvery minnows for propagation; however, if appropriate and feasible propagation facilities will be contacted to determine if brood stock is needed.

Objectives:

1. Document the number of miles of river drying for each intermittent event.
2. Document the duration of each intermittent event.
3. Document the number of isolated pools during each intermittent event.
4. Document the number of silvery minnows salvaged from isolated pools for each intermittent event.
5. Document the number of silvery minnows found dead during each intermittent event.
6. Document where salvaged silvery minnows were released.
7. Document qualitative conditions of the Rio Grande during each low flow event regardless of river intermittency. This documentation will be in the form of photographs and/or hand written notes.
8. Provide a weekly update on the previous weeks activity to the appropriate entities.

Materials and Methods:

The Coordinator will be responsible for determining when silvery minnow salvage is necessary. It will be the responsibility of Coordinator to assign crew leaders and contact cooperating agencies for assistance. The Coordinator will form a “call list” of individuals from cooperating agencies. Contact for assistance with cooperating agencies will be at the discretion of the Coordinator. The Coordinator will evaluate river conditions and contact cooperating agencies based on the need and expertise of the individuals from the cooperating agency. If possible the most qualified and experienced individuals will be selected from the cooperating agencies.

The Coordinator will be responsible for hiring four temporary technicians to assist in silvery minnow salvages. These technicians will be employed by the Service's New Mexico Ecological Services Field Office and will be under the direction of the Coordinator. These technicians will work in teams of two during non-salvage situations seven days a week with teams alternating on weekends. During non-salvage situations these technicians will assist in "river eyes assessment," which will include qualitative descriptions of general river conditions throughout the San Acacia and Isleta Reaches. The technicians will be available to assist in other biological studies or surveys as river conditions allow. During salvage operations, these technicians will be on hand to serve as crew leaders and/or to assist as a crew member.

A crew of three to 10 individuals will be formed to perform silvery minnow salvages dependent on location, magnitude, and duration of drying events. The crew will consist of biologists from the Service and cooperating agencies as necessary. The crew leader will be familiar with the Rio Grande silvery minnow, and will be able to identify them quickly. In some cases, when more than one reach of river is intermittent, a second or third field crew may be necessary to adequately salvage silvery minnows. This will require that a leader be assigned to each crew by the Coordinator. It will be the designated crew leader(s) responsibility to coordinate each crew's activities and report to the Coordinator daily. The crew leader(s) will insure that all needed equipment is available and in working order for each salvage. The crew leader(s) will report, as soon as possible, any damaged equipment to the Coordinator for repair or replacement.

Rio Grande silvery minnows will be collected from isolated pools using beach seines of varying sizes. Rio Grande silvery minnows collected from isolated pools will be placed into 5 gallon buckets. Members of the crew will handle Rio Grande silvery minnows with wet hands only. Rio Grande silvery minnows will be held in 5 gallon buckets containing at least 2.5 gallons of water during collection from isolated pools. Ice chests attached to ATVs or amphibious vehicles(ARGO) will be used to hold and transport silvery minnows to flowing water or a distribution truck. Ice chests will contain no less than one half their capacity in water. Both buckets and ice chests will be checked for leaks before use, and if a leak exists, they will not be used.

There are three possible methods to be used for transport and distribution of silvery minnows. The crew leader and Coordinator will determine the appropriate method or methods for each salvage. The method and procedure may vary given field conditions. These methods will be approved upon with each salvage.

1) Handling Protocol for distribution truck.

Handling and transportation of Rio Grande silvery minnow after reaching the distribution truck will follow the proposed protocol set forth by Dr. Gary Carmichael of the Service's Mora National Fish Hatchery.

The protocol is as follows:

9. Temperature (determined with thermometers) should be about 5°F lower in the hauling

truck than in the river.

10. Drivers must be informed of and follow a specific route.
11. Hauling water will contain 0.5 percent NaCl (18.9 grams/gallon) and 0.26ml/L stress coat (1 ml/gallon).
12. Oxygen levels will be >6.0 mg/L as determined with an oxygen meter.
13. Nets must be functional. Aeration equipment must be in place and must be used. A fish holding container will be at least 5 gallons in size and fish densities will not exceed 10 grams of fish per liter of water. Small Delta mesh (1/16") nets will be present to transfer the fish from one container to another, although it is preferred to have water to water transfer. Oxygenation/aeration equipment will be in place and working.
14. Prior to loading and after the fish are concentrated, they should be quickly placed in the transport tank. When using nets to place fish in the transfer buckets, nets should not be overloaded or the fish on the bottom could be crushed. Using a "wet transfer" with buckets or other containers which contain water is preferable. When emptying the nets and buckets, care will be taken to avoid adding algae and mud to the transport tank. Before loading, dissolved oxygen levels should be at saturation.
15. Immediately after loading, all equipment on the transport vehicle should be re-checked and then the vehicle should depart. Oxygen concentrations and temperatures should be monitored at a minimum of every 30 minutes.
16. During unloading, a tempering water pump should be present and functional, and thermometers should be used to match water temperatures. Hauling water temperature should be equal to receiving water temperature.
17. Dead specimens will be preserved and given to the University of New Mexico or disposed of properly.

2) *Hauling Protocol when transporting silvery minnows in bags.*

This protocol is modified and similar to that of the protocol for the distribution truck. In some instances, it may be more feasible to transport silvery minnows in aerated plastic bags rather than a distribution truck. This determination will be made by the designated crew leader with concurrence from the Coordinator.

The Protocol is as follows:

1. Only plastic bags designed for fish transport will be used.
2. Plastic bags will contain no less than half their capacity in water.

3. Ice chests of sufficient size to hold 1 to 3 bags will be used to protect bags from ambient conditions.
4. Temperature (determined with thermometers) should be about 5°C lower in the bags than in the river.
5. Water in the bags will contain approximately 0.5 percent salt (18.9 grams/gallon) and 0.26ml/L stress coat (1 ml/gallon). This will be measured by scales and graduated cylinders.
6. Oxygen levels will be >6.0 mg/L as determined with an oxygen meter.
7. Fish densities should not exceed 10 grams of fish per liter of water.
8. Small Delta mesh (1/16") nets will be present to transfer the fish from one container to another. Using a "wet transfer" with buckets to bags containing water is preferable.
9. When emptying the nets and buckets, care will be taken to avoid adding algae and mud to the transport bag.
10. Dead specimens will be preserved and given to the University of New Mexico or disposed of properly.

3) *Transporting of silvery minnows in the field and distribution to flowing water.*

This will occur when it is feasible to distribute fish to flowing water near a dry reach. This method will be used when the crew leader and Coordinator determine that transporting fish to distribution trucks will cause undue stress to the silvery minnows. This will reduce silvery minnow mortality in some cases.

The protocol is as follows:

11. Each ATV and/or amphibious craft (ARGO) will be outfitted with an ice chest with a water capacity of greater than 10 gallons.
12. Temperature (determined with thermometers) should be equal or lower in the ice chests than in the river.
13. Water in the ice chest will contain approximately 0.5 percent salt (18.9 grams/gallon) and 0.26ml/L stress coat (1 ml/gallon). This will be measured by scales and graduated cylinders.
14. Fresh water will be added to the ice chest every 15 minutes if available. If water is not available, then existing water will be agitated within the ice chest using a bucket. This

will ensure some level of dissolved oxygen within the ice chest during transport.

15. Fish densities should not exceed 10 grams of fish per liter of water. When estimated densities exceed this concentration, fish should be transported to the distribution truck, then placed in plastic bags at the truck, or released into flowing portions of the river.
 16. Small Delta mesh (1/16") nets will be present to transfer the fish from one container to another. Using a "wet transfer" with buckets to ice chest containing water is preferable.
 17. When emptying the nets and buckets, care will be taken to avoid adding algae and mud to the ice chest.
 18. Before fish are released into flowing river, water temperatures will be within 1°C of each other.
- 4) General Distribution and Release

The following protocol will be used for distribution and release of silvery minnows. This will insure that the silvery minnows are not subjected to any undue stress during transport and release.

1. Drivers must be informed of and follow a specific route.
2. Immediately after loading, all equipment on the transport vehicle should be re-checked and then the vehicle should depart. Oxygen concentrations and temperatures should be monitored at a minimum of every 30 minutes.
3. During unloading, a tempering water pump should be present and functional, and thermometers should be used to match water temperatures. Hauling water should be equal to receiving water. Bags should be set in the receiving waters until temperatures within the bags are equal or within 1° C of receiving water.

5) *Collection of marked silvery minnows during salvage operations.*

1. If marked silvery minnows are collected during salvage operations, the collection point of these minnows will be recorded.
2. Their condition will be recorded (alive or dead).
3. Their deposition will be recorded.
4. All information pertaining to marked fish will be relayed to the University of New Mexico.

Other Activities:

The following outline is potential work the temporary technicians may pursue when salvage activities are not occurring.

1. Assist with flycatcher surveys in the San Acacia Reach. (if they complete the survey course)
2. Assist with yellow-billed cuckoo surveys in the San Acacia Reach.
3. Assist other agencies in biological studies.
4. Conduct biological studies on the silvery minnow.

Permitting

Salvage activities for the New Mexico Ecological Services Field Office are covered by a Section 10(a)1(a) scientific research and recovery permit (# PRT-676811) issued by the U.S. Fish and Wildlife Service, Region 2. These activities are also covered under a scientific and education permit issued by the New Mexico Department of Game and Fish (#3094).

Principal Investigator:

Jude R. Smith has a Bachelor of Science Degree in Wildlife Management and a Masters of Science Degree in Biology from Eastern New Mexico University. He has 10 years of experience with fisheries in New Mexico. Jude was employed with U.S. Fish and Wildlife Service's New Mexico Fisheries Resources(FRO) between August 8, 1993 and June 16, 2000. During his tenure with FRO he conducted biological studies on the Rio Grande silvery minnow in the main stem river and the low flow conveyance channel. He also conducted studies on the non-native fish and native fish interactions on the San Juan River. Jude was Rio Grande Silvery Minnow Rescue Coordinator during the 2001 and 2002 irrigation seasons.

Accomplishments

a. Title of previously funded proposal- Rio Grande Silvery Minnow Rescue and Salvage Fiscal Year 2002 Project Proposal

b. Year funded-2002

c. Dollar amount funded, by year-\$175,000

d. Funds expended by September, 2002- ca. \$94276.90

e. See update section on page 3 to 5 for a complete update.

1. Salvage of a approximately 3500 silvery minnows.
2. Quantification of ITS and minnows.
3. Record number of river miles drying per day.
4. Assist with river assessments in the Isleta reach and San Acacia reach 6 days a week on average depending on river conditions.
5. Provide assistance to other agencies as need with flow measurements and equipment.
6. Stocking of approximately 3500 silvery minnows in the upper reaches.
7. Improved methods for hauling and transporting fish during salvage operations.

F. Products-An update has been given on minnow salvage at each of the Interim Steering Committee meetings as well as on the water operation conference calls.

G. Subcontracts and/or agreements, and associated dollar amounts- There has been no real

subcontracts associated with project. Service employees from other divisions were reimbursed for their time and flights of the river were paid through this account. All flights were made by Service pilots and aircraft at approximately \$125/hrs.

H. Limiting factors affecting progress-There were no real limiting factors this year associated with this project affecting success. I had numerous volunteers when needed. New Mexico Department of Game and Fish were very supportive of the Service throughout the summer and contributed much to this projects success. The Bureau of Reclamation ,Army Corps of Engineers, Interstate Stream Commission, Middle Rio Grande Conservancy District, and many others have assisted throughout the year when needed.

I attest that this document is complete and has been approved by the appropriate supervising officials.

Jude /sig/
Jude R. Smith, Fish and Wildlife Biologist

10/24/02
Date

Joy /sig/
Joy E. Nicholopoulos, New Mexico Ecological Service
Field Supervisor

10/24/02
Date

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