



# United States Department of the Interior

FISH AND WILDLIFE SERVICE  
Dexter Fishery Assistance Office  
P.O. Box 370  
Dexter, New Mexico 88230



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## MEMORANDUM

TO: COORDINATION COMMITTEE AND BIOLOGY COMMITTEE MEMBERS,  
INTERESTED PARTIES

FROM: JIM BROOKS

SUBJECT: 1994 WORK PLAN FOR SAN JUAN RIVER STUDIES

DATE: 5 OCTOBER 1993

Attached is the Work Plan for San Juan River research studies for Fiscal Year 1994 for your review.

data will include total wetted area per mile, island area, total islands per mile and sinuosity. All data will be normalized for flowrate. The change in river channel will also be computed, based on area first wet after the first comparative flight, and the area that was wet in the first flight but not in the second.

- 2) River Geometry Analysis. Complete resurvey and comparative analysis of cross sections surveyed in 1962 to determine the post-dam change in the channel. The 15 cross-sections surveyed in 1993 will be surveyed pre- and post-runoff for analysis of annual change and compared to previous surveys to determine trend. A total of 8-10 cross sections will be placed in the key detail reaches (RM 0-15, RM 83-89 and RM 129-134). These sections will be surveyed before runoff, mid-way up the ascending limb, midway down the descending limb and at the bottom of the runoff hydrograph to document the change in these detailed test reaches in response to the hydrograph. In addition, the two lower detailed reaches will be surveyed two additional times in late summer and fall to document change due to storm flows. These data will be used to verify and calibrate computed cobble entrainment flows.
  
- 3) Suspended Sediment Analysis. The sediment data collection program initiated in 1992 will continue. Sediment data collected will be compared to long term data to determine validity of data and comparative effects of test hydrographs on sediment transport during the runoff period.
  
- 4) Cobble/Gravel Entrainment Analysis. Utilizing substrate size distribution data collected in 1993 and proposed in 1994 at suspected spawning sites, other cobble bars showing similar conditions will be mapped and sampled for substrate size. GPS surveys will be completed at multiple flow-rates, in conjunction with depth surveys and boundary shear stress will be calculated through the test reaches and at key cobble bar locations. Using data on substrate size distribution, the boundary shear stress required to entrain the size cobble encountered will be determined and plotted against the available shear stress to determine flowrate at which cobble and gravel sizes found in suspected spawning locations are entrained at these locations.
  
- 5) Analyze Mechanism of Low Velocity Habitat Formation. An analysis of storm events with the associated sediment load and flowrate will be completed to understand the flow conditions that might be expected during the post-spawning period. At selected sites exhibiting low velocity habitat, pre- and post-storm runoff sampling will be completed, including mapping of the habitat, sampling sandbar grain size distribution and measuring change in sandbar shape. Channel geometry, sediment load, flow rate and water surface profiles before, during and after a storm event will be measured for later use in sediment transport modeling if it appears applicable. Primary emphasis will be on documentation of physical change and the effect on availability of low velocity habitat before, during and after the event.

Budget: (funded by BIA)

Labor	125,220
Travel: per diem	22,820
Vehicle/Equipment use	6,650
Supplies	6,560
Overhead (10%)	<u>16,074</u>
<b>TASK IV TOTAL</b>	<b>\$ 177,324</b>

Nonnative species interactions (USFWS, R2)	22,500
Videography (USBR, Denver)	30,000
Specimen identification and curation (UNM)	43,000
San Juan Arm Lake Powell Young-of year (USBR, Durango)	16,900
Program Management (USBR, Salt Lake City)	30,000
Data Management (USFWS, R2)	5,000
<b>TOTAL</b>	<b>\$ 421,700</b>
 <b>II. Other Research</b>	
Geomorphology and Hydrology (USBIA)	
San Juan River geomorphology	47,100
Channel Dynamics	177,300
Habitat Mapping	238,900
Flow/Habitat Modeling	69,100
River Operation Modeling	21,600
Water Temperature Monitoring	5,300
<b>TOTAL</b>	<b>\$ 569,300</b>
Colorado Squawfish Habitat Use (Southern Ute)	
Macro- and Microhabitat Use	
<b>TOTAL</b>	<b>\$ 59,300</b>
 <b>III. Proposed Research</b>	
Razorback Sucker Experimental Augmentation	53,850
Lake Powell Larval and Adult Razorback Surveys	10,000
 <b>IV. Contaminant Studies</b>	
Identification of Comprehensive Contaminants Research Plan	
Initiation of Synoptic Survey of Contaminants	
Initiation of Biological Effects Studies	
<b>TOTAL</b>	<b>\$ 100,000</b>

## I. CORE RESEARCH

### ADULT RARE FISH MONITORING AND RADIO TELEMETRY STUDIES

#### Background:

Studies performed before 1991 documented a native San Juan River fish fauna of eight species, including Colorado squawfish, razorback sucker, and roundtail chub and provided baseline information on distribution and abundance of native and introduced fish species in the San Juan River. Adult monitoring studies are designed to refine the above baseline data, as well as determine specific habitat usage by the above mentioned rare fish species. Information gathered in adult monitoring studies will aid in the selection of specific sites for detailed hydrologic and larval drift sampling.

Ten intensive electrofishing surveys conducted from 1991 to 1993, have expanded our baseline knowledge on the distribution and abundance of the San Juan River fish community. Future monitoring will help determine fish community response to test flows from Navajo Dam. Fourteen Colorado squawfish and seven roundtail chub were collected and PIT-tagged during these studies; eleven of the fourteen Colorado squawfish were radio-tagged. No razorback sucker were collected. Subsequent radio telemetry efforts located the primary range and probable staging and spawning areas of Colorado squawfish. Location of probable spawning aggregations of Colorado squawfish led to the placement of larval drift stations below these sites. To date no radiotelemetered fish have moved above any instream water diversion structures.

Adult monitoring will continue twice a year from 1994 through 1997, to measure fish community response to research flows from Navajo Dam. Radio telemetry studies of Colorado squawfish will continue through spring 1994 to further determine habitat use. Adult monitoring will also sample for experimentally stocked razorback suckers and allow radio tracking of the same. Roundtail chub will be equipped with six-month radio tags to determine specific habitat use, potential spawning areas, and movement patterns. Aerial searches for radio tagged fish will continue on a regular basis. Ground searches will be conducted during adult monitoring trips, razorback sucker monitoring trips, and other sampling efforts. Collection of tissue samples from rare fish for contaminants studies will continue.

#### Objectives:

- 1) Determine shifts in fish community structure, abundance and distribution, and length/weight frequencies under the research flow regime.
- 2) Refine Colorado squawfish habitat-use data and begin roundtail chub habitat-use studies (spawning and staging areas, habitat needs).
- 3) Monitor experimentally stocked razorback sucker (growth rates and habitat use).
- 4) Continue evaluation of movement data to determine the extent to which current structures (dams, weirs, etc.) are impeding endangered fish movement.

Methods:

Objectives 1-4: Adult sampling trips will take place in October and May from Hogback Diversion, New Mexico to Mexican Hat, Utah. Electrofishing will be the primary sampling technique, although seining and trammel netting may also be employed. Radio tracking will be conducted on all adult monitoring trips and during regular aerial flights, as well as being coordinated with other research efforts throughout the year.

All fish collected will be enumerated by species, weighed, measured and returned to the river. Adult Colorado squawfish, roundtail chub, and wild razorback sucker will be PIT-tagged, and surgically implanted with a radio transmitter. Tissue samples for contaminants analysis will be taken from these three species.

Radio tag implantations and tissue sampling will follow the protocols attached to the San Juan River Seven Year Research Plan. Electrofishing will follow the methods set forth in the 1991-1992 adult monitoring annual report. Seining and trammel netting will be done where suitable habitat is available at the sampling crews' discretion. The Service will have the lead for these adult monitoring trips and other cooperating agencies will provide personnel and equipment as needed.

Budget:

Personnel	
1 GM-13 Supervisor	\$ 5,000
1 GM-11/12 Fishery Biologist	2,000
1 GS-7 Fishery Biologist	12,000
1 GS-6 Secretarial/Administrative Support	3,000
Travel-Per Diem	7,000
Equipment and Supplies	<u>5,000</u>
Subtotal	34,000
Service Administrative Overhead (17.65%)	<u>6,000</u>
	TOTAL \$ 40,000
Support Services	
Utah Division of Wildlife Resources	4,000
New Mexico Department of Game and Fish	11,200
U.S. Fish and Wildlife Service Region 2	7,500
	GRAND TOTAL \$ 62,700

## EARLY LIFE STAGE RESEARCH

### Background:

This component of the research has been designed to characterize the early life stage of the ichthyofaunal community in the San Juan system. It is directed at specifically determining the annual relative abundance and distribution patterns of the larval stage of the target species over a seven year period. Research efforts have been divided into three major areas: 1) Larval Drift, 2) Larval Distribution, and 3) Over-winter Survival. Sampling begins in early-July with simultaneous larval drift netting and intensive sampling of low velocity habitats. Platania (1990) estimated that Colorado squawfish spawned in the San Juan River during the months of July and August. Larval drift sampling and intensive sampling low velocity habitats concludes in mid-August. Fall (September/October) sampling characterizes the fish community in the low velocity habitats and represents the faunal conditions as the fish community prepares to overwinter. Those fish that over winter are sampled during the March/April sampling period.

Although these protocol have been written to answer specific questions on the San Juan River, much of the standardized sampling procedures draw heavily from existing protocols used currently on other Upper Basin rivers. The design is not intended to mimic those efforts, but rather to provide a method for comparison of data collected in the two areas.

### Objectives:

- 1) To determine annual Colorado squawfish YOY recruitment (i.e., reproductive success) in relation to flow patterns in the San Juan River.
- 2) To identify timing and location of Colorado squawfish spawning in the San Juan River utilizing size and distribution of drifting larvae.
- 3) To characterize the early life stage ichthyofaunal community in low velocity habitats.
- 4) To characterize nursery habitats in the San Juan River.

### Methods:

#### Larval Drift

Drifting larval fishes will be sampled with stationary nets in the San Juan River below the mixer in New Mexico. Drift nets will be similar to those used in the Upper Basin (0.5mm mesh equipped with flow meters). The drift net station will be operated for six weeks from July 1 - August 14. At the station three nets will be fished on a daily basis during the pre-dawn/dawn hours with a target diel effort of three net-hours per station. Depending on the San Juan sediment/debris load it may be necessary to run the nets for two consecutive 0.5-hour runs to accrue this effort.

Nets should be set along an axis perpendicular to the shore, preferably on the margin of quiet shoreline habitats and a flowing channel. The drift nets equipped with steel rings attached to the mouth frame slide over steel posts (rebar) pounded securely into the substrate. Ideally the nets should be submerged an inch or two below the water surface.

Subsequent to each morning's set, drift station personnel will sort through the accumulated debris and preserve all ichthyoplankton in 10% formalin. Data sheets will accommodate:

1. the following general information: date, river mile, weather condition, water temperature at start and pull times, collectors names; and
2. information specific to each net set: sample numbers, (each net set will receive a unique sample number), start time, pull time, sampling effort (minute), flow meter reading at pull time, volume of H2O sampled, fish sampled (Y/N), NO. of bottles.

Following review of this protocol a data sheet will be drafted.

Each preserved sample (stored in vials) will be accompanied by a 100% rag paper label (placed inside vial) with the following information: sample number, date, sample times (start-pull time), collectors initials, indication if there were multiple jars per sample (of ). Sample number should be written with permanent marker on sample jar top.

Exact net set locations and duration of sets will vary throughout the six-week sample period in order to accommodate changing river stage and abundance of drifting fish.

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General Sampling Requirements:

Drift Station to be operated daily:	July 1 - August 14
Personnel/Station:	(2) Bio-Aides

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### Larval Fish Distribution

Conducted concurrently with the larval drift sampling (July 14-August 14), will be three trips to sample (with seines) the San Juan River fish community in a variety of low velocity habitats. Each trip will start at or near the Cudei Diversion in New Mexico (RM 142.0-135.0) and terminate at or near the Four Corners bridge (RM 119.2).

Within the reach all backwater (+ a variety of other low-velocity habitats) should be seined. Two types of seines will be used: 1) 15'x4' (1/16" mesh) which is of comparable dimension to those used on the Green and Colorado rivers, and 2) a one-man, 1.0 m<sup>2</sup> (1/32" mesh). It is likely YOY target species present in the seined area will be collected with the 1/16" mesh seine. The purpose of the smaller 1/32" mesh seine is two fold: 1) more accurately characterize the fish community (may collect greater numbers of non-native cyprinid larvae, which may be too small to be effectively sampled with the larger mesh), and 2) to serve as verification that we are adequately sampling target species present. In each habitat two quantified passes will be made with each of the seines, area permitting. If a habitat is too small to accommodate hauls with both types of seines, the one-man seine should be used. In addition to the three sampling trips between RM 135-119, one Fall (September/October) sampling trip will be conducted to characterize the fish community in low-velocity habitat river wide. This trip will start at the Hogback Diversion in New Mexico (RM 158.6) and terminate at Clay Hills Crossing (RM 2.9) upstream of Lake Powell. The sampling protocol will be identical to that

established for the 1992 and 1993 fall trips. This trip will be conducted concurrently with the fall nursery habitat trip.

While in the field, the contents of all seine hauls should be searched for target species. Target species should be measured to the nearest millimeter Total Length (TL) and released. All other specimens will either be 1) identified and enumerated as adults or sub-adults, or 2) preserved in a 10% buffered formalin solution in Whirlpak containers (double-bagged). A sample label (100% rag paper) will accompany the specimens, and the sample number, date, and San Juan River Mile will be inscribed with permanent marker on the outer bag.

All data collected at a habitat will be recorded on one data sheet. The following general habitat information will be collected:

1. Date,
2. Location (River Mile to nearest 0.1 mile),
3. Primary habitat type (Main Channel (MC) or Side Channel (SC)),
4. Specific Habitat Type,
5. River Lt or RT,
6. MC Temp.(°C),
7. Habitat Temp (°C),
8. Total Length of Habitat (meters),
9. With (m) @mouth; and average width,
10. Max. Depth of Habitat,
11. Collectors (initials),
12. Landmarks (that might identify particular habitat on aerial photoimagery),
13. Sketch of habitat with an indication of seine haul locations.

The following seine haul information will be collected:

1. Sample NO. (suggested starting number: 91LV001),
2. Seine used: 1/16" or 1/32",
3. Time of haul,
4. Was haul across or parallel to axis of habitat,
5. Length of haul (meters),
6. Width of haul (meters),
7. Maximum depth (Dmax) (meters),
8. 1° and 2° Substrate type at Dmax.
9. Depth at a point half the distance from Dmax to shore (D1),
10. 1° and 2° Substrate type at D1.
11. Depth at a point half distance from Dmax to other shore (D2)
12. 1° and 2° Substrate type at D2,
13. Mud Depth (a measure of the degree of difficulty seining; 0-4, with 4 indicating maximum difficulty),
14. Fish Preserved (Y/N),
15. No. of Whirlpaks.

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#### General Sampling Requirements:

No. of trips:	3
Duration of each trip:	2-4 days
No. of motorized rafts/trip	2 work boats
Personnel needed/trip	4-5

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#### Nursery Habitat

One reach in the upper portion and one reach in the lower portion of the San Juan River will be selected for intensive sampling. These reaches will be sampled in late-March/ early-April, late-August, and September/October. The two reaches include the Montezuma Creek area (RM 90-85) and the Grand Gulch area (RM 125-120, RM 15-5). Selection of these two areas was based on present availability of backwater habitats and known collection sites for YOY Colorado squawfish (Platanina 1990). Selection of the two study reaches may change or be modified if 1993 data indicate other stretches of the San Juan River are potentially important nursery habitat areas.



## YOUNG OF THE YEAR MONITORING

### Background:

While both Colorado squawfish and razorback suckers have been collected from the lower portion of the San Juan River and the upper end of the San Juan arm of Lake Powell (Platania 1990), only one adult of these two species has shown movement throughout these two habitats since 1987. While razorback suckers continue to utilize the extreme upper portion of the San Juan arm of Lake Powell as suspected spawning habitat, none of these adult fish have been collected further upstream in the San Juan River. Similarly, no adult Colorado squawfish have been collected in the lower portion of the San Juan River in the last two years. However, numerous backwaters continue to be seasonally created below Clay Hills continuing downstream to the river/lake interface. Seasonal sampling of these backwaters for small fish have shown that they provide habitat for comparatively large numbers of small fish. These backwaters provide habitat that is generally rare in upstream portions of the San Juan River. In 1987, eleven out of the 17 young-of-the-year squawfish collected from the San Juan River were seined in an area within five miles of Lake Powell.

Under the current San Juan River research program the Over the last two years 36,352 fish were seined from this portion of the San Juan River. In 1991, while no target species were collected, 17,736 fish were seined from seventeen backwater downstream of the Piute Farms area (RM 0). In 1992, 18,616 fish were collected by seine, including one YOY Colorado squawfish, the only squawfish collected from the San Juan River in 1992.

Barring new information, since no adult target species have been collected from the lower San Juan River since 1987, it is recommended this effort be dropped from the recovery effort. In 1994, young-of-the-year seining would occur twice, once in the latter part of August and a second time in the fall between September 15 and October. The area of the river sampled would be between Clay Hills (RM 4) and the confluence of Lake Powell.

### Objectives:

- 1) Seine low velocity habitats from the lower San Juan River.

### Methods:

- Objective 1. Established San Juan River seining protocols would be followed. As possible, all low velocity habitats encountered would be sampled.

### Budget:

Personnel	10,000
Travel/Per Diem	2,000
Vehicle/Equipment Use	1,500
Equipment and Supplies	<u>500</u>
Subtotal	13,500
Agency overhead (25%)	<u>3,375</u>
TOTAL	\$ 16,875

## SAN JUAN RIVER SECONDARY CHANNEL ICHTHYOLOGICAL INVESTIGATIONS

### Background:

Between Shiprock, New Mexico, and Bluff, Utah, surface flow of the San Juan River is frequently divided between the primary channel and one or more secondary channels. During initial studies (1987-1990) of the river, primary emphasis was on characterizing the fish fauna of the primary channel and low-velocity habitats. Little attention was given to secondary channels. However, during the initial studies, researchers noted that secondary channels provided a variety of habitats, some not commonly available in the primary channel, and that the size and extent of secondary channels varied considerably with river discharge. Because a major aspect of the San Juan River Seven Year Research effort is to characterize the ichthyofauna of the San Juan River system, describe community dynamics, characterize the habitats available to fishes, and relate and evaluate the effects of variable environmental conditions (particularly flows) upon fish communities, a detailed study of secondary channels was initiated in 1991.

In 1991, preliminary investigations focused on characterizing the ichthyofauna of secondary channels during summer lowflows. During 1992, the research effort expanded to characterize the fish community of secondary channels during spring runoff and summer lowflows. Secondary channels were characterized by type (based upon volume of flow and length). Collections were segregated by macrohabitat type during 1991 and 1992 summer lowflows. A total of 13 species (3 native and 10 non-native) and one hybrid (flannelmouth x bluehead sucker) were collected, with native flannelmouth sucker, bluehead sucker, and speckled dace and non-native red shiner, common carp, and channel catfish being comparatively common in most collections. Seasonal and longitudinal changes in occurrence and abundance were noted for all commonly collected species. Sampling intensity increased in 1993 with spring runoff, summer lowflow, and autumn inventories of secondary channels between Shiprock and Bluff. Permanent study sites were established on three secondary channels and each was sampled about every three weeks from the cessation of spring runoff through early November.

Three inventory efforts (spring runoff, summer lowflow, and autumn) and intensive macrohabitat sampling at four permanent sites is planned for 1994. A fourth permanent site on a secondary channel was added because the three chosen in 1993 did not have continuous surface flow throughout the summer lowflow period.

### Objectives:

- 1) Characterize the fish communities of secondary channels in San Juan River between Shiprock, New Mexico and Bluff, Utah.
- 2) Characterize seasonal and longitudinal changes in the structure of secondary channel fish communities.
- 3) Characterize macrohabitat associations of fish species (by size-class) at permanent sites in four secondary channels.

- 4) Characterize the size-structure of species populations in secondary channels and relate to environmental changes (particularly river discharge).
- 5) Evaluate seasonal patterns of secondary channel occupancy by sub-adults and adults of Colorado squawfish, common carp, flannelmouth sucker, bluehead sucker, and channel catfish.
- 6) Evaluate relative importance of secondary channel habitats to all fishes in San Juan River, in particular native fishes (including Colorado squawfish, roundtail chub, and razorback sucker).

Methods:

- 1) Three sampling efforts (spring runoff, summer lowflow, and autumn) will be made to characterize the fish community of secondary channels. During each foray all feasibly sampled secondaries will be inventoried. Raft-mounted electrofishing gear will be the primary collection method during spring runoff and seines or backpack electrofishers will be used on smaller secondaries. Seines and backpack electrofishers will be used to collect specimens during summer lowflow and autumn efforts. All specimens captured during spring runoff will be identified, weighed, and measured. Each specimen of Colorado squawfish, roundtail chub, flannelmouth sucker, bluehead sucker, common carp, and channel catfish captured and of sufficient size (ca. 300mm TL) will receive a uniquely numbered floy tag. All non-native specimens (except tagged common carp and channel catfish) will be retained. All specimens captured during summer lowflow and autumn inventories will be retained (except tagged fishes and identifiable roundtail chub, Colorado squawfish, and razorback sucker). Water quality (temperature, dissolved oxygen, conductivity, and salinity) will be characterized in each sampled secondary and in the adjacent primary channel. Retained specimens (or subsamples of numerically large samples) will be weighed and measured in the laboratory. These data and that obtained in the field will be used to meet objectives 2 through 5.
- 2) Data obtained under Objective 1 will be used to characterize longitudinal patterns of species occurrence and abundance. Longitudinal patterns will be graphically and statistically analyzed to discern changes in species abundance and community structure. Longitudinal patterns will be compared among seasons to evaluate effects of environmental factors upon discerned patterns.
- 3) Permanent study sites were established on three secondary channels (two Type IV and one Type II) in 1993; a fourth permanent study site will be established in 1994. The relative permanency of surface flow among these is variable. Two are reduced to isolated pools by the summer lowflow period, one has discontinuous surface flow during summer lowflow, and the fourth (Type IV; to be established) has continuous surface flow throughout the summer lowflow period. Sites will be sampled about every 3 weeks between cessation of spring runoff and early November. During winter (November through March) each site will be sampled about every 6 weeks. Each permanent site is about 250 m in length and of sufficient length to include all macrohabitat types generally present in the secondary. Specimen collection will be segregated by macrohabitat type (21 types). Macrohabitats will be characterized by water velocity and depth, substrate type, proximity to shore, and cover availability and type. Seines or a backpack electrofisher will be used to collect specimens. Sampling effort will be quantified by number of seine hauls or elapsed electrofishing time.

All specimens (except tagged fishes and identifiable roundtail chub, Colorado squawfish, and razorback sucker) captured in each macrohabitat will be preserved separately. Following specimen collection, water velocity, water depth, substrate, cover, and proximity to shore of each sampled macrohabitat will be measured/characterized. Surface area of each sampled macrohabitat will also be measured. Surface discharge of each secondary will be estimated. After characterization of sampled macrohabitats, macrohabitat availability will be estimated by measuring water velocity, water depth, and substrate at 10 points along 10 equidistant transects within the sample site. Data will be compiled and analyzed (using appropriate graphical and statistical methods) to evaluate differential patterns of macrohabitat use by species and by size-classes of each species. These data will also be used to evaluate seasonal changes in macrohabitat utilization by each species.

- 4) All individuals captured in secondary channels during spring runoff and at least a subsample of all specimens of each species captured during summer lowflow and autumn will be measured to characterize the size-structure of populations of each species in each secondary channel. These data will be used to longitudinally and seasonally compare changes in size-structure of secondary channel populations. Species population size-structures will be compared to secondary channel discharge to evaluate changes in population size-structure in relation to flow regime (with consideration for season). Macrohabitat usage patterns during different flow regimes by size-class of each species will be evaluated.
- 5) During each sampling foray all adults and sub-adults of sufficient size (ca. 275 mm TL for suckers and Colorado squawfish and 175 mm TL for common carp and channel catfish) will receive uniquely numbered floy tags. Recapture (in primary or secondary channel) of tagged specimens will enable evaluation of seasonal and flow influenced patterns of secondary channel use. These data will also be used to characterize growth of these species.
- 6) Data gathered and evaluations/comparisons accomplished under the foregoing objectives will be used to evaluate the relative importance of secondary channels (by type, season, discharge volume, and macrohabitats available) to fishes of the San Juan River. Data obtained during adult monitoring efforts will be used in evaluations.

Budget: (includes Navajo Dam Tailwater Trout Studies)

Personnel	108,000
Travel/Per Diem	18,000
Aircraft (telemetry)	15,000
Equipment and Supplies	<u>4,500</u>
Subtotal	145,500
Overhead	2,000
<b>TOTAL</b>	<b>\$ 147,500</b>

## SAN JUAN RIVER TAILWATER TROUT STUDIES 1994 WORK PLAN

### Background:

The 1991 Reasonable and Prudent Alternative to the ALP included, among other things, the reoperation of Navajo Dam to mimic a natural hydrograph and a seven year research project, funded by BR, to study the needs of the fishes of the San Juan River. The alternative was based on several assumptions. One of these was that the reoperation of Navajo Dam to mimic a natural hydrograph would not negatively impact the tailwater trout fishery below the dam. Because of its popularity and economic importance to the state of New Mexico, research to test this assumption was included in the seven-year research effort.

Preliminary findings showed that prior to 1993 releases, approximately 51% of the trout sampled in the Quality water section were > 457 mm (18 inches). In the regular regulation section most of the rainbow trout collected were less than 305 mm (12 in) total length. Sampling the lower portion of the tailwater (Gobernador Arroyo to Blanco, NM) revealed that flannelmouth and bluehead suckers were the most abundant species prior to 1992 spring releases, but that trout were more abundant thereafter. Telemetry and tagging studies indicate little downstream displacement of trout as a result of the high spring flows. No extreme changes in water quality were observed as a result of the reoperation of the dam. Temperature and dissolved oxygen concentrations revealed only slight fluctuations during the spring releases. Elevated nitrogen supersaturation levels were recorded and symptoms of gas bubble disease were noticed during 1993 releases but not during 1992. Although high spring flows reduced the number of anglers using the tailwater in the spring, angling pressure data revealed that over all angler use in 1992 increased over previous years.

Tailwater trout studies to be conducted in 1994 include the continuation of fish population surveys, trout movement studies, macroinvertebrate studies, water quality monitoring and angler use and catch surveys. A trout reproduction study is being initiated and will be in progress in 1994. One population survey effort will be made in September. Data obtained will be compared with that of previous years to look for changes in the trout and native fish populations in this section of the river. If high spring releases occur again this year, radio telemetry will be used to study trout movements in response to high flows as had been planned for 1993. Water quality monitoring will concentrate on measurements of temperature, dissolved oxygen and nitrogen superaturation during the spring release period. Angler use and catch surveys will also continue throughout the year. Data collected will be compared to data from previous years as well as historic data.

### Objectives:

- 1) Characterize the fish population of the tailwater and look for changes that may be related to the reoperation of the dam.
- 2) Examine the occurrence of trout movement in response to changes in flow.
- 3) Evaluate the availability of trout reproductive habitat and the degree to which natural reproduction is important to the maintenance of the fishery.
- 4) Evaluate the effects of reoperation on the water quality of the tailwater.

- 5) Evaluate changes in the quality of the fishery due to dam reoperation using estimates of angler use and catch rate.
- 6) Evaluate the effects of high releases on the diversity and abundance of the macroinvertebrate community in the tailwater.
- 7) Evaluate the availability of trout habitat at low flows using stream modeling techniques.

Methods:

- 1) Fish population surveys will be conducted using a raft-mounted electrofisher. Surveys will take place in September in the Quality Water section and September-October from the Quality Water to Blanco, NM. Length, weight and species data will be recorded for previously determined reaches of the study area. In the Quality Water section all trout > 200 mm will be tagged using individually numbered Visual Implant (VI) tags. Below the Quality Water section both trout and native species will be tagged using numbered spaghetti (Floy) tags. Location and tag number of previously tagged fish will also be recorded.
- 2) If high spring flows are again experienced in 1994, several trout will be implanted with radio transmitters to study the effects of releases on trout movement. Previous telemetry studies were concentrated in an area having a broad flood plain with more than one channel. Data from these studies did not indicate significant downstream displacement of transmitted fish. If trout are implanted during this study period, it will be done in a different portion of the river having a single narrow channel. Several trout will also be implanted this winter to look at movement during low flows (500-600 cfs). Additionally, the recapture location of fish tagged previously with VI tags will be noted during surveys to examine movement from the original site of capture. This data will be compared to the results of the telemetry study.
- 3) The San Juan River tailwater salmonid fishery is maintained through stocking. Although it is thought that some natural reproduction occurs, the degree to which it provides recruitment to the trout population is not known. During this study period we will take a preliminary look at the potential for natural reproduction to occur in the tailwater and if it is contributing a significant amount to recruitment. To do this we plan to quantify the amount of spawning habitat that is available by taking measurements of areas where spawning activity is occurring. The percentage of spawning habitat compared to overall area of the tailwater fishery can then be calculated and compared to data from other waters. The study area for this work will be confined to the Quality Water section. Additionally, low velocity and shoreline habitats will be surveyed using seines and backpack electrofishing to look for YOY salmonids. All fish smaller than the length of fish stocked will be considered to be from natural reproduction (total length in mm minus 2 standard deviations of the mean of a sample of the lengths of fish stocked). Areas with concentrations of small fish will be measured in relation to the tailwater as a whole to attempt to estimate suitable nursery habitat. Additional work, such as larval fish sampling using drift nets and potential spawning/hatching failure due to angler activity may also be included. The details of these studies have not yet been worked out. If natural reproduction is determined to be significant, then further studies to examine the effects of high releases will be initiated.
- 4) Water quality monitoring will continue with collection of dissolved oxygen, temperature and

nitrogen saturation data. Measurements will be taken on a monthly basis during low flows and after each change in flow during spring releases.

- 5) Angler use (pressure counts) and catch surveys will continue. The standardized pressure count method that has been employed throughout the study will be used. Creel surveys will be conducted on randomly selected afternoons using a roving clerk.
- 6) Studies to examine changes in the structure and production of the macroinvertebrate community of the tailwater will continue through 1994. These studies have been contracted to New Mexico Highlands University under the supervision of Dr. Jerald Jacobi.
- 7) IFIM modeling to quantify trout habitat at flows below 500 cfs still needs to be done. The Bureau of Reclamation has indicated that it would help with this work. Initiation of this work will begin depending upon coordination with BR.

Budget:

The budget for the Tailwater Trout Studies is included in the budget submitted for the Secondary Channel Investigations by David Propst because of the overlap of equipment and personnel used for both studies. Approximately \$33,000 of the total \$147,500 requested by New Mexico Department of Game and Fish will go to Tailwater Trout Studies.

## NON-NATIVE SPECIES INTERACTIONS

### Background:

Introduced species have been implicated in the decline of several native fishes. In the Colorado River system, introductions occurred simultaneously with flow-related habitat alterations. These events coincided with the basinwide decline in distribution and abundance of many native species, in particular the Colorado squawfish and razorback sucker.

Various lab and field studies have demonstrated the interrelationships that occur among native and non-native species. Impacts on native fishes include resource overlap (and therefore competition) in both diet and habitat use, predation, and hybridization.

There are a few non-native species that are potential predators of adult and juvenile natives in the San Juan River; the most significant numerically is the channel catfish. The red shiner is a common, exotic, potential predator of larval native fish. Non-native species that are potential competitors of natives are many, and are dominated by common carp, red shiner, and fathead minnow. The introduced white sucker hybridizes and may also compete with the native flannelmouth sucker.

Results of 1991-1992 studies have focused on 1) abundance, distribution, and movement of channel catfish and common carp in mainstream habitats and 2) food habits of potential native fish predators. Studies were initiated during Fiscal Year 1993 to evaluate the food habits and availability relative commonality of resource use by young-of-year and juvenile native and juvenile and adult nonnative fishes. Completed during 1993 were studies regarding the food habits of potential nonnative predatory fish species, i.e. channel catfish (opportunistic sampling of other nonnative predatory species will continue as necessary).

San Juan River investigations of native and nonnative species interactions for Fiscal Year 1994 are proposed below. Research will include the commonality of resource use between native and non-native fish species (foods, primarily). In addition, trial runs of an experimental backwater fish community manipulation are proposed to directly address the effects of nonnative species on the growth and survival of native fishes. Data collection on the distribution, abundance, and movement of mainstream nonnative species (channel catfish and common carp) is also proposed for continuation.

### Objectives:

- 1) In conjunction with the adult monitoring/research element, determine distribution, abundance, and movement of channel catfish.
- 2) Determine food habits and food availability of native and non-native fishes in backwaters and secondary channels and evaluate for dietary overlap.
- 3) Compare growth and survival of YOY and juvenile native fishes in backwater habitats with and without predators and/or competition.

Methods:

Objective 1. In conjunction with other adult and juvenile fish sampling, collect non-native fish by electrofishing, seining, and gill and trammel netting. At designated river miles (every fifth river mile during mainstream adult monitoring) record length/weight/sex data, floy tag, and release sub-adult and adult carp and catfish.

Schedule, 1994

May-Jun	Adult sampling by electrofishing and netting.
Sep-Oct	Adult sampling by electrofishing/netting.

Objective 2. Collect fish by seine in low velocity habitats, lethally anesthetise in MS-222, and preserve in 10% formalin. Sample drift and substrate for invertebrates using surber samplers and Eckman dredges. Record habitat type and number of seine hauls taken. Record standard lengths of all fish, and examine stomach contents. Summarize findings according to habitat type, river location, species, and size.

Schedule, 1994

Mar-Apr	Sample collection and processing.
May-Jun	" "
Jul-Aug	" "
Sep-Oct	" "

Objective 3. Select experimental and control backwaters according to size, degree of protection from flood flows, probability of remaining wetted all summer, and suitability for temporary barrier construction. Erect 2-3 barriers, exclude non-natives, and monitor effectiveness of barriers in terms of withstanding flood events and keeping fish segregated.

Schedule, 1994

Jun-Jul	Select backwaters and erect temporary barriers.
Aug-Oct	Monitor effectiveness of barriers.

Budget:

Personnel	17,500
Travel/per diem	2,000
Equipment and Supplies	3,000
TOTAL	\$ 22,500

## SAN JUAN RIVER SPECIMEN CURATION AND LARVAL FISH IDENTIFICATION

### Background:

Personnel from the Division of Fishes, Museum of Southwestern Biology (MSB), at the University of New Mexico are responsible for two inter-related programs on the San Juan River. The Fish Division is the repository for specimens collected and retained by researchers. Fish taken under these programs are initially sorted by the principal investigator, held until they have submitted their yearly-progress report, and then received by MSB personnel. The collection is accessioned, specimens transferred from formalin to alcohol, identifications verified, individuals enumerated, length ranges recorded (largest and smallest specimen in a collection), collection data verified and written on museum cards and wet labels, and incorporated into a database. Corrections in species identifications are noted and returned to the principal investigator along with the entire dataset (listing of collection locality, collectors, date, original field number, species, number of specimens, length ranges, and museum catalog number). In addition to performing duties associated with collections curation, we are also responsible for complete processing (sorting, identifying, counting, curating, and reporting) of selected San Juan River collections (larval drift, some secondary channel and miscellaneous collections made by various San Juan River researchers [e.g. lower San Juan River collections; U.S.B.R.-Lashmet]).

In 1992, we worked through the 26 Bureau of Reclamation collections (18,215 specimens) of juvenile and larval fish from the San Juan River arm of Lake Powell and discovered the only juvenile (young-of-year) Colorado squawfish taken in 1992. In addition, we processed over 260 larval drift samples and 1,000 specimens from the three 1992 drift stations and submitted these data to the lead agency for that project (Utah Division of Wildlife Resources). We received, processed, and curated the fall 1991 samples collected during the juvenile fish surveys. No Colorado squawfish were found in those samples but we did reidentify several specimens as roundtail chub juveniles. The 1992 and summer 1991 samples from the aforementioned studies were received in August 1993 and have begun being processed. Three larval fish drift stations were established for a period of about six weeks (July-mid-August) in 1993. We anticipate completing the first sort on those samples and reporting to the principal research agency by the end of October 1993. Work on the 1992 and summer 1991 non-drift samples will begin immediately upon completion of the larval drift phase of analysis.

We will continue our work sorting, identifying, and curating samples collected during 1994 research activities. While the number of samples and specimens appears to be increasing (especially in reference to juvenile sampling), the current level of funding has been adequate to allow us to complete our work, purchase needed supplies, and offset costs of attending San Juan River researchers meetings.

### Objectives:

- 1) Provide a permanent repository for San Juan River fish collections, field notes, and associated data.
- 2) Assist principal investigators with collection sorting and identifications.
- 3) Sort, identify, enumerate, and report on larval fish drift collections.

- 4) Provide identification assistance to all researchers on an "as-needed" basis.
- 5) Provide brief annual report of specimen sorting, identification, and curation activities.

Methods:

- 1) Samples from projects are received after the principal investigator has completed their work and prepared the necessary annual report. This means that there will be a lag of one year in reference collection of specimens and processing of those samples. All collections are matched with the appropriate data-sheet, transferred from formalin to alcohol, stored in museum quality jars, re-identified, counted, measured (range), labeled, and catalogued into the permanent fish division collection.
- 2) We have assisted principal investigators by taking on the responsibility for processing unsorted collections. Specimens are sorted, identified, counted, measured, catalogued, and data submitted to the principal investigator for inclusion in reports.
- 3) Larval drift collections are received unsorted and processed as stated above. In addition to recording the length ranges for each species in each collection, beginning in 1993 we will also note the presence of larval, juvenile, and adult specimens in the samples. These data are submitted to the principal investigator for inclusion in their annual report. All specimens are curated in the Museum of Southwestern Biology, University of New Mexico.
- 4) Database of each incorporated collection with collection and curation information is provided to principal investigators.

Budget:

Personnel	29,500
Travel and Per Diem	2,890
Equipment & Supplies	<u>5,000</u>
Subtotal	37,390
Overhead (15%)	<u>5,610</u>
TOTAL	\$ 43,000

## INSTREAM HABITAT QUANTIFICATION USING AIRBORNE VIDEOGRAPHY

### Background:

This study utilizes airborne videography to quantify endangered fish habitat versus flow on the San Juan River. This study examines the Navajo Dam test flow re-operation relationship between flow and the number and area of backwaters/side channels and other fluvial morphologic habitat categories on the San Juan River in New Mexico and Utah. Video interpretation provides whole river information about number, size, and location of surface fluvial habitat features as observed from an airborne camera. The objective is to collect and interpret several years of videographic data from different flow scenarios and establish a database to assist in determining the optimal San Juan River flows needed to maximize critical fluvial habitat categories. Interpretation of a series of different flows provides information about changes in quantity and longitudinal locations as flow changes.

The 1992 video data preliminary findings show the same general trend that was found from the 1991 data. At spring peak flow secondary channel habitat was maximized and trended lower as flow descended. The less abundant backwater habitat was maximized at the low base flow level (Spring flows also produced a peak in backwater habitat due to overbanking and secondary channel activation).

FY94 activities will serve as a further but limited validation of the previous data collections, as well as compilation of the results of all previous habitat quantifications done with videography.

### Objectives:

- 1) Interpretation and analysis of the 1993 peak video data.
- 2) Acquire videography of spring peak flow and base flow. This video will be archived to record and capture unique flow events.
- 3) Acquire videography only, during spawning for BIA consultant intensive field mapping (BIA consultant to provide funding for acquisition costs).

### Methods:

- 1) The 1993 spring flow caused extensive overbank flooding due to the run-off from the Animas River and the coincident maximum release from Navajo Dam. The amount and extent of flooded bottomland as well as the other instream habitat features will be quantified by river mile using PC-based image processing software as in the past. Calibrated and interpreted river mile mosaics will be saved for future reference.
- 2) This objective would serve as an archiving mechanism by collecting videographic data from spring run-off and from base flow. The videography of the full river would be acquired, stored, and available for copying for various researcher activities, such as base images for field habitat mapping. The timing of these two videography acquisitions would be determined by the San Juan researchers so as to be of optimum biological significance.

- 3) As in 1993, collect and deliver videography of the desired portion of the San Juan River as determined by BIA consultant. The videography mission will be flown on the instructed date and video tapes immediately delivered for printing and field mapping.

Budget:

Interpret 1993 peak flow video data	15,000
Collect video - 3 flights (full river ea.)	15,000
Draft & Final report	5,000
	TOTAL \$ 35,000
Minus one video collection paid by BIA	- 5,000
	TOTAL USBR COST 30,000

## PROGRAM MANAGEMENT

### Background:

Program Management funds are not used to support a specific study or project. Funds reserved for Program Management are used to provide staff time to support individual studies as requested, administer funding agreements and participate in and support Program committees. The bulk of these funds are allocated to Reclamation's Grants and Cooperative Agreements staff and the Biological Support Branch. During FY 1993 activities conducted by Reclamation included participation in the ad hoc research group/Biology Committee, staff support for adult monitoring research, coordination of water operations and research activities, printing of annual reports and administration of agreements with cooperating agencies. Management funds are vital to insure that Reclamation's contributions to the program are properly administered and that funds are transferred in a timely and efficient manner.

### Objectives:

- 1) Administer and modify as needed existing Intra-agency agreements with USFWS - Region 6 and USFWS - Region 2.
- 2) Administer and modify as needed existing Cooperative Agreements with the states of New Mexico, Utah, Colorado, and the University of New Mexico at Albuquerque.
- 3) Coordinate transfer of funds for Reclamation videography and photographic studies and support and BIA contributions to research program.
- 4) Implement additional Cooperative Agreements or Interagency Acquisitions as needed.
- 5) Provide staff support as needed to field studies.

Methods: Not applicable

### Budget:

Personnel <sup>1</sup>	24,000
Travel/Per Diem	5,000
Equipment/Supplies	<u>1,000</u>
TOTAL	\$ 30,000

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<sup>1</sup>includes agency overhead

## DATA MANAGEMENT

### Background:

Large-scale research programs require intensive data management capabilities. Numerous types and relatively large amounts of data are collected as a part of this program. In order to facilitate and enable synthesis of large data sets generated by the biological studies it is necessary to maintain a centralized data base for such information.

A centralized data base has been maintained throughout this Research Program. As part of the data management function, historic biological data (primarily those collected during 1987-1990) have been obtained and are being included in the overall San Juan River data management system.

Data management capabilities for biological studies will continue during Fiscal Year 1994 and will ensure continuity of data storage and retrieval capabilities.

### Methods:

Biological data collected during all fisheries-related studies will be stored at a centralized location (USFWS, R2, Dexter, New Mexico) in a computerized format. Data are made available to appropriate requestors for appropriate uses upon request.

### Budget:

Personnel	4,000
Travel/per diem	-0-
Equipment and supplies	1,000
TOTAL	\$ 5,000

## II. OTHER RESEARCH

### GEOMORPHIC CHARACTERIZATION OF THE SAN JUAN AND LOWER ANIMAS RIVERS

#### Background:

Characterizing the general geomorphology of a river is basic to the design of a hydrologic or structural management plan to achieve desired conditions in the river with time. In 1992 an attempt was made to characterize geomorphically similar reaches in the San Juan River to allow subsampling of test reaches with extrapolation to the whole. From data collected in 1992, no geomorphically similar reaches could be identified. What was found, is that there appeared to be mechanisms that caused a particular reach of river to respond differently than other reaches. Habitat mapping in 1993 appears to confirm this conclusion. Further geomorphic characterization will allow definition of these reaches, aiding in development of management plans for specific reaches.

The range of geomorphic characterization will be from Navajo Dam to Lake Powell plus the Animas River from the Colorado-New Mexico state line to the confluence with the San Juan.

#### Objectives:

- 1) Determine River Valley Geometry. River valley geometry (valley width, shape and slope to the river) varies significantly along the reaches of interest. These conditions will be characterized by river mile to identify major changes that may affect channel geomorphology.
- 2) Map General Surficial Geology. Location of major bedrock contact with the stream channel controls geomorphology by restricting lateral and vertical movement at the point of contact. In addition, pleistocene cobble is extensive in the basin and is a major component of the river channel.
- 3) Determine Channel Gradient. Channel gradient influences channel pattern, width, depth and sediment transport capacity and will be used in defining river reaches.
- 4) Identify Channel Patterns. Sinuosity and channel braiding are two measures of channel pattern that will be tabulated and used in definition of channel reaches.
- 5) Tributary Influence. In the San Juan, sediment input from large, ephemeral tributaries markedly influences channel geomorphology. The location and size (drainage area) of these tributaries will be used in channel reach definition.
- 6) Mapping Man's influence. Channel modification in terms of dike construction, diversion dams and irrigation of the adjacent valley with associated return flow influence the river channel. These structural features and locations of irrigation return flow with their inherent effect on riparian vegetation, will be used in channel reach definition.
- 7) Identification of River Reaches. The San Juan and Animas Rivers within the study area will be subdivided in to reaches that are geomorphically distinctive based on data collected under objectives 1-6 as well as habitat data collected in 1993.

Methods:

- 1) Determine River Valley Geometry. Valley width and shape will be determined utilizing 7.5 minute USGS quadrangle maps and stereo aerial photography. The valley boundaries will be digitized into the GIS system and the geometry computed and exported to a database on a river-mile basis. Valley slope to the river will be computed and input into the database for analysis.
- 2) Map General Surficial Geology. In 1992, generalized geology maps were used in initial characterization. The detail will be increased to include bedrock contact through major formation changes as well as locations where bedrock controls lateral movement. The generalized locations of pleistocene cobble sources, showing distribution along the river, will be mapped. All data will be included in the GIS system for analysis.
- 3) Determine Channel Gradient. Channel gradient data extracted from USGS Quad sheets were plotted against river mile in 1992. These data will be compiled in a database, giving elevation by river-mile, and used to compute average reach gradient for any reach identified. These data will be augmented by geo-positioning satellite surveys in the detailed survey reaches. If comparison of the GPS survey with quad sheet data extraction shows a significant improvement in data, then the GPS survey will be extended to other areas of the river.
- 4) Identify Channel Patterns. Sinuosity and channel braiding will be assessed from 1988 aerial photography and compared to 1993 habitat base maps to assess change in sinuosity or braiding. Braiding will be assessed in terms of island area, number of islands and total length of channels per river mile.
- 5) Tributary Influence. Tributaries that are important to channel morphology will be identified on the basis of the effect on the channel at the point of confluence. Tributaries that have an observable effect will be mapped and the drainage area computed. The frequency of occurrence and size will be used in channel reach definition.
- 6) Mapping Man's Influence. Channel modification in terms of dike construction, diversion dams and irrigation of the adjacent valley will be mapped using aerial photography and field inspection. The data will be entered in the GIS system and data extracted by river-mile.
- 7) Identification of River Reaches. Identification of river reaches will be based on unique characterization in terms of a combination of factors identified in objectives 1-6. Various multivariate and regression statistical analysis will be used to establish changes in geomorphology that are significant in determining break points between reaches. The number of reaches identified initially may require refining with subsequent data collection.

Budget: (funded by BIA)

Labor	34,850
Travel: per diem	4,040
Vehicle/Equipment use	2,280
Supplies	1,640
Overhead (10%)	<u>4,280</u>

TOTAL \$ 47,090

## RIVER CHANNEL DYNAMICS

### Background:

An understanding of river channel dynamics is the second step in development of a river management plan. Understanding the history of channel change in relation to hydrologic events, precipitation patterns, construction of dams, etc. is important to the understanding of the system in which the endangered fishes have existed over the past 100 years as well as an understanding of the effects of man's modification and conceptualization of the expected response of the channel to management changes in the future. Predictive modeling of river response to selected management actions allows formulation of a management plan to achieve desired objectives. Measurement of channel response to management actions during the research period allows determination of the empirical relationship of channel response to flow and calibration of any modeling efforts to predict effects of river management in the future.

In addition to measurement of cross section change, an understanding of the hydraulic conditions necessary to entrain (and thereby clean) cobble and gravel to prepare spawning sites and the transport mechanisms that are at work forming low velocity habitat suitable for y-o-y nursery are critical to the development of a river management plan to maximize these two important habitat types.

Data collection and preliminary analysis was initiated in 1992 and has continued through 1993. Many of the data collection tasks will continue for the duration of the research period.

### Objectives:

- 1) Complete Historical Analysis. This includes completion of a detailed literature review, analysis of historic hydrographs and completion of aerial photography interpretation.
- 2) River Geometry Analysis. Determine short term and long term change in river cross sections at key locations.
- 3) Suspended Sediment Analysis. Determine short term sediment transport and compare to long term record.
- 4) Cobble/Gravel Entrainment Analysis. Determine flowrate at which cobble and gravel sizes found in suspected spawning locations are entrained at key locations.
- 5) Analyze Mechanism of Low Velocity Habitat Formation. Collect data and begin analysis of formation of low velocity habitat in the lower river (below RM129).

### Methods:

- 1) Complete Historical Analysis. The literature search started in 1992 will be expanded to a more detailed level, including any photography that might be available. In addition, the aerial photography analysis started in 1992 and continued into 1993 would be completed, with overlays of 1934-1937 photos (three years required for full coverage) with 1948-1950, 1962, 1988 and 1993 photography. These overlays will be georeferenced to USGS 7.5 minute quadrangle maps, digitized and analyzed in a geographic information system. Comparative

**SAN JUAN RIVER SEVEN YEAR RESEARCH PROGRAM  
WORK PLAN  
FISCAL YEAR 1994**

Overview - The San Juan River Seven Year Research Plan is designed to determine and evaluate the inter-relationships among native and nonnative species biology, habitat use, limiting factors, individual fish species status, and fish community dynamics with patterns of river discharge, contaminant loads, and habitat dynamics. This information will ultimately be used for the conservation and recovery of its native fish fauna, in part the Federally Threatened and Endangered species, in making various decisions concerning the management and use of the water resources of the San Juan River.

The 1994 annual work plan is organized similarly to the 1991-1992 annual report. The background for each research element is briefly described and the objectives, methods, and budget outlined.

While each research element is presented as a discrete element, all are inter-related and inter-dependent. To affect economies of personnel and project funds, many individual field efforts include work over two or more research elements. Data gathered under each research element are utilized in the analyses and interpretation of data gathered in companion studies.

Research activities are centered around core elements of identified informational needs. Core research (mainly biological studies) is funded primarily by the U.S. Bureau of Reclamation. Each state (New Mexico and Utah) makes significant in-kind contributions to these research elements for which it has lead responsibility as well as to other research activities in which they provide support. Within this research segment, U.S. Fish and Wildlife Service (USFWS, Regions 2 and 6), U.S. Bureau of Reclamation (USBR), New Mexico Department of Game and Fish (NMDGF), Utah Division of Wildlife Resources (UDWR), and University of New Mexico (UNM) are responsible for various research projects. Other research includes that funded by the U.S. Bureau of Indian Affairs (USBIA) for various geomorphological studies and specific fish habitat use studies funded by the Southern Ute Indian Tribe.

Funds to support Proposed Research (Part III) detailed below derive from modification of currently funded Core Research activities. Additional support for recommended research is provided with in-kind contributions from the U.S. National Park Service (USNPS) and Utah Division of Wildlife Resources.

A summary of the annual work plan is presented below and grouped according to each of the four categories: 1) core research, 2) other research, 3) proposed research activities (currently unfunded), and 4) contaminant studies (other funding sources or proposed for funding under the Seven Year Research Program).

**I. Core Research**

Adult Monitoring and Radio Telemetry (USFWS, R6)	62,700
Early Life History (UDWR)	86,600
Secondary Channel Biological Characterzation (NMDGF)	91,500
Navajo Tailwater Trout Fishery (NMDGF)	33,500

## HABITAT MAPPING AND RESOURCE UTILIZATION

### Background:

The documentation of habitat types within the San Juan River from RM 158 to RM 0 will be continued during FY94. Three separate videographic flights will be mapped as part of this year's effort. As in 1993, one flight will correspond to peak runoff, one during the spawning season for squawfish, and one flight during baseflow. During three additional flow periods, the intensive study reaches will also be mapped for habitat types.

Habitat utilization information collected during the squawfish radio tracking studies in 1993 will be correlated with the habitat distribution data. In a similar manner, y-o-y captures will also be correlated with habitat data.

Because of excellent visibility, specific locations of spawning squawfish were observed during 1993. After the completion of spawning, the physical conditions within the spawning bar were investigated in detail. During FY94, these conditions will be verified, and the potential for additional spawning locations investigated.

### Objectives:

- 1) Main River Habitat Mapping. Map San Juan River habitat from RM 158 to RM 0. This objective is a continuation of the 1993 work.
- 2) Intensive Mapping of Study Reaches. Map intensive study reaches (RM 0-15, RM 83-89 and RM 129-134). This objective is a continuation of 1993 work.
- 3) Digitize and process data utilizing GIS. Habitat mapping data will be digitized and entered into the ArcCAD system.
- 4) Determine Habitat Quality. Determine habitat quality for each habitat mapping unit utilized in Objectives 1 and 2. Habitat quality will quantify specific physical features of each habitat type mapped.
- 5) Correlate Habitat Utilization to Availability. Correlate and compare detailed radio tracking data and y-o-y captures (habitat utilization) to habitat availability. Due to excellent observational data, specific habitat utilization data can be cross-referenced to overall habitat availability.
- 6) Verify Spawning Bar Conditions. Verify physical habitat conditions and complexities within the documented squawfish spawning bar and identify other potential spawning locations. Knowing the specific physical conditions within the cobble bar utilized in spawning, will allow a more generalized survey of other potential sites.

### Methods:

- 1) Main River Habitat Mapping. Habitat mapping will be accomplished by directly delineating habitat boundaries in the field utilizing color prints from airborne videography taken a few

days prior to the field investigation.

- 2) Intensive Mapping of Study Reaches. Detailed habitat mapping will be done at three locations utilizing color aerial photography at a scale of one inch to 200 feet.
- 3) Digitize and process data utilizing GIS. Upon completion of each habitat mapping program (Objectives 1 and 2), the field maps will be rectified and digitized into ArcCAD.
- 4) Determine Habitat Quality. For each habitat type mapped, depth, velocity and substrate will be determined for a wide distribution of habitat locations.
- 5) Correlate Habitat Utilization to Availability. Detailed habitat maps will be developed for each radio tracked fish during each observation utilizing the most current aerial photos or videography. Habitat utilization will be compared with habitat availability utilizing ArcCAD.
- 6) Verify Spawning Bar Conditions. Physical habitat conditions (substrate size, depth to embeddedness, and interstitial volumes) within the spawning bar complex will be measured utilizing replicate grab samples taken from a known surface area (0.3 m<sup>2</sup>). All cobble bars between RM 158 and RM 0 will be evaluated for substrate conditions and adjacent habitat complexity.

Budget: (funded by BIA)

Labor	187,350
Travel: per diem	12,870
Vehicle/Equipment use	10,390
Supplies	6,560
Overhead (10%)	<u>21,735</u>

TOTAL        \$        238,905

## FLOW/HABITAT MODELING

### Background:

With the accumulation of three additional habitat mapping data sets for the entire river, preliminary model development will be undertaken in FY94. This will involve a preliminary correlation of habitat distribution, abundance and complexity with flow. This task will also review other mapping and modeling efforts within the Colorado River. During this preliminary modeling effort, the USBR data collected during 1991-1992 will be incorporated into the database.

### Objectives:

- 1) Coordination and Review of Other Studies. Review other ongoing mapping and modeling projects within the Colorado River.
- 2) Comparative Analysis with USBR Video Mapping. Incorporate USBR video mapping results into the habitat database and compare results.
- 3) Develop Habitat/Flow Relationships. Develop preliminary correlations between the distribution, abundance, and complexity of habitats in the San Juan River and flows.

### Methods:

- 1) Coordination and Review of Other Studies. Interact with other researchers doing similar habitat mapping activities, and coordinate habitat types, definitions, and methodologies.
- 2) Comparative Analysis with USBR Video Mapping. Obtain USBR habitat mapping data and incorporate into habitat database. Once incorporated, it will be compared to the habitat data collected as a part of these studies and utilized in extrapolating data to other flows and previous conditions, if the correlation is good.
- 3) Develop Habitat/Flow Relationships. Utilizing data files developed within ArcCAD, analyze the spatial distribution of habitat types within the San Juan River. Based upon the river segments where mapping and flows were constant, develop correlations between habitat abundance and complexity with flow. Hysteresis (pre- versus post-runoff habitat conditions) will be analyzed to determine year to year effects.

### Budget:

Labor	50,570
Travel: per diem	4,720
Vehicle/Equipment use	5,300
Supplies	2,190
Overhead (10%)	<u>6,296</u>

TASK IV TOTAL \$ 69,076

## RIVER OPERATION MODELING

### Background:

The river operation model development is to be completed under the 1993 work plan. The remaining tasks include testing and operation. The model will allow analysis of the capability of the river system to supply a hypothetical hydrograph and meet the other water demands in the system. A full description of the model capabilities appears in the Seven Year Research Plan.

### Objectives:

- 1) Test Model
- 2) Operate Model

### Methods:

- 1) Test Model. The model operation will be tested against present river operation to calibrate the model. The model will also be tested on Animas-LaPlata, San Juan-Chama and Navajo Indian Irrigation Project Operations and reviewed with USBR and the states to assure proper water accounting and implementation of operating rules.
- 2) Operate Model. Once calibrated, the model will be used to test hydrographs for deliverability as a part of the research program. Operation will be for the full period of available natural flow data supplied from the Colorado River Storage Project.

### Budget: (funded by BIA)

Labor	17,230
Travel: per diem	-0-
Vehicle/Equipment use	1,820
Supplies	550
Overhead (10%)	<u>1,977</u>
TOTAL	\$ 21,577

## WATER TEMPERATURE MONITORING

### Background:

Water temperature recorders were installed in 1992. This work element is a continuation of the original work, with station servicing and data extraction.

### Objective:

- 1) Collect Water Temperature Data at 9 locations.

### Methods:

- 1) Collect Water Temperature Data at 9 locations. Temperature recorders are installed at Cedar Hill and Farmington on the Animas, and at Blanco, Bloomfield, Lee Acres, Farmington, Four Corners and Montezuma Creek on the San Juan. These recorders will be serviced twice and the data extracted and plotted for the annual report.

### Budget: (funded by BIA)

Labor	3,780
Travel: per diem	320
Vehicle/Equipment use	470
Supplies	220
Overhead (10%)	<u>478</u>
TOTAL	\$ 5,268

## ADULT COLORADO SQUAWFISH HABITAT USAGE IN THE SAN JUAN RIVER

### Background:

One element of the San Juan River Seven Year Research Plan is to determine the habitat requirements of the endangered species in the San Juan River. Determining habitat use is key to understanding the relationship between habitat availability and discharge at various times of the year. This relationship is critical in the recovery process for the endangered species. Understanding that relationship will help to determine if habitat is limiting the endangered species in the river. This work element is a continuation of the 1993 habitat use study. The study will consist of radio tracking implanted fish to determine both the location within a reach of river and the habitat use by those fish. Habitat studies are listed as one component of the adult monitoring studies. As such there will be interaction between the adult monitoring studies and the squawfish habitat studies. There also is direct interaction required between the physical habitat studies and the squawfish habitat use studies. The habitat use information collected in this study and the physical habitat study information will aid in the determination of habitat-flow relationships for the river. Links to these other research elements will require integration of the research findings between the researchers.

Several key habitat use factors were documented during the 1993 study. This included locating male and female radio tagged fish simultaneously on a suspected spawning bar. One of these locations included a visual observation of the female being closely attended by the male as they exited the suspected spawning chute. Other key data include the observation of habitat use during and after a flash flood event. The 1993 data included over 120 hours of direct contact with the four radio tagged fish over an eight week period.

The 1994 activities will include limited monitoring during winter and additional monitoring during the spawning period. The radio tracking will be conducted for one week in winter and four weeks during summer of 1994. The methods will be the same as those used in the 1993 study.

### Objectives:

The objective of the habitat study proposed here is to describe the habitat use of macro and micro habitats by Colorado squawfish (*Ptychocheilus lucius*) in the San Juan River. This study will use radio telemetry to determine habitat use in the San Juan River during winter and summer.

### Methods:

The methods used in this study will be similar to those in previous habitat suitability studies. It will follow the procedures in Tyus (1988) and Wick and Hawkins (1989). We plan to use radio telemetry on fish that have been previously implanted during the adult monitoring research of the San Juan River Seven Year Research Plan. No additional fish will be captured or implanted during this study.

This study would monitor the fish for four weeks during the spawning season. It is most beneficial to gain the maximum amount of habitat use data during the spawning period. This study would have a

sufficient number of observations on habitat usage to summarize the data with descriptive statistical techniques but probably not for any hypothesis testing. This study would provide much needed information on location and use of specific habitat types within the river by squawfish. The additional work in 1994 on winter habitat use will provide further insight into the habitat requirements for Colorado squawfish in the San Juan River.

#### Daily observations

An observation schedule will be completed before field data collection begins. Each day scheduled for observation will be divided into four observation periods. The observation periods will be for six hours each and be determined by sunrise and sunset times. The two most important time periods are those near sunrise and sunset. Time periods will be numbered as follows: Period 1 - three hours before to three hours after sunrise; Period 2 - Three hours after sunrise to three hours before sunset; Period 3 - three hours before sunset to three hours after sunset; and Period 4 - three hours after sunset to three hours before sunrise.

Observations will be made during Periods 1 and 3 everyday of a scheduled observation week. A random selection process will be used to determine which fish will be observed during Period 1. That fish will be located and tracked for a two hour period. Any locations where the fish spends more than 30 minutes will be marked, and later measured for habitat variables. To gain data on habitat characteristics near the fish location, 10 random locations within a 10 to 50 meters radius of the fish location also will be mapped. This will allow some limited statistical testing of habitat usage.

Observations will be made during Period 2 based on a random selection by day and by fish number. Limited observations will be made during Period 4. The only observations made during Period 4 will be made at locations where the observers can safely move along the shoreline.

The habitat usage data will include a sketch of the habitat where the fish is located with the position of the fish marked on the map. The data collected at the fish location will include date, time of day, weather conditions, time spent at each location, and any notes on movement during the observation period. The habitat data collected at each fish location will include total water depth, water velocity (mean column and bottom), substrate type, proximity to cover, description of cover at the location, general description of the site, measurements of the habitat type including length, width, bank features, shoreline vegetation, dominant substrate and cover for the habitat type. The same habitat descriptions taken at the fish location will be repeated at the 10 randomly chosen locations surrounding the fish location. Other parameters measured will include water and ambient temperature, dissolved oxygen, conductivity, pH. Discharge will be obtained from the nearest USGS gaging station.

#### Data analysis

All observation data sheets will be entered into microcomputer for summary analysis. Data will be entered after each weekly observation period. The data will be analyzed using the SAS statistical package. Procedures will include descriptive statistics of each habitat variable. Other exploratory statistical techniques such as principal components or cluster analysis will be run on the complete data set to determine if the habitat variables are independent or dependent components of the habitat. A Chi square analysis will be run on the data in the randomly measured sites and the fish location sites to test if they are correlated. Habitat suitability values will be derived from the results of the statistical analysis.

**Report**

The annual report for the study will include a detailed description of all methods used, data summary and analysis and a description of the habitat usage by Colorado squawfish. This report will be presented at the annual meeting of the San Juan River Researchers. A final report will be prepared that includes both the 1993 and 1994 data in a combined data analysis and presentation format. This will be prepared and a draft presented to the annual research meeting.

**Personnel:**

The study would be conducted by W.J. Miller and Associates (Miller) with assistance, as available, from the other San Juan River researchers. Miller would be responsible for all personnel and equipment to complete the study, with the exception being the fish that are radio tagged by the USFWS.

The principal investigator for the study will be Dr. William J. Miller. Dr. Miller will be responsible for final study design, directing the data collection and analysis, and the final report. Dr. Miller will be assisted on the study by a field biologist whose primary responsibilities will be leading the field crew gathering the habitat data and be responsible for data analysis. The field biologist will be assisted by one field technician. This crew with assistance from Dr. Miller will gather the habitat use data.

**Budget:**

The costs are listed below. The costs include the estimates for time and expenses for each study task. All costs for equipment and direct expenses are included in the cost estimate.

Winter field observation	7,010
Summer field observation	27,040
Data analysis	13,065
Draft report	6,540
Final report	<u>5,610</u>
<b>TOTAL</b>	<b>\$ 59,265</b>

### III. PROPOSED RESEARCH

#### EXPERIMENTAL STOCKING OF RAZORBACK SUCKER

##### Background:

Razorback sucker are native to the San Juan River. At present this species is extremely rare in the San Juan. In order to gain information on habitat use, possible spawning areas, and survival and growth rates of hatchery-reared razorback sucker in the wild, it will be necessary to experimentally stock a small number of fish. The information obtained from this effort should help provide recommendations to guide future augmentation efforts.

Eight adult razorback sucker from the San Juan River arm of Lake Powell were spawned at Ouray National Fish Hatchery in the spring of 1992. Most of the offspring from those paired matings were kept as refugia stock. The excess offspring, above and beyond refugia needs, are proposed to be experimentally stocked in the spring of 1994. Currently 625 of these fish are being reared at Wahweap ponds (Utah Division of Wildlife Resources) near Lake Powell. Present growth rates indicate that these fish should be approximately 300 mm total length and 300 grams by December 31, 1993.

The experimental stock will be PIT-tagged in early 1994. Fifteen razorback suckers will be surgically implanted with six-month AVM radio tags in March 1994. Several options are available for stocking razorback sucker. All options call for stocking thirty radio-tagged fish, ten at each of three experimental stocking sites. Our recommended option calls for fifteen razorback sucker currently being reared at Wahweap Warmwater Hatchery to be surgically implanted with six-month AVM radio tags and stocked in March 1994. An additional fifteen fish would be reared to a size of 500 grams. In the fall of 1994 these fish would be implanted with two-year AVM radio tags and stocked, ten per site. The three experimental stocking sites along the San Juan River are all between Shiprock, New Mexico and Bluff, Utah (approximate river miles 136, 112, and 79). Follow-up monitoring will take place on adult sampling trips, aerial flights, and two summer monitoring trips, and two summer monitoring trips in June and August, and one monitoring trip the following winter. Radio-tracking will also be done during other research trips throughout the year. The possibility of spawning the San Juan River arm of Lake Powell adults and producing another year class of F1 progeny will be discussed. We also recommend that an attempt to capture further razorback sucker from the San Juan River arm of Lake Powell for broodstock purposes be made.

##### Objectives:

- 1) Determine habitat use, possible spawning areas, survival, and growth rates for hatchery-reared razorback sucker in the wild.
- 2) Determine if hatchery-reared razorback sucker can lead researchers to wild fish.
- 3) Determine feasibility of using hatchery-reared razorback sucker to augment wild populations or repopulate historic habitat.

Methods:

- 1) Electrofishing, seining, trammel netting and radio telemetry will be used to determine what types of habitats stocked razorback sucker are using. Detailed habitat information on substrate, depth, cover, velocity, and relation of this habitat to other habitats (riffle, pools, main and secondary channels, backwaters, shore, etc.) will be recorded. Water quality parameters including dissolved oxygen, water and ambient temperatures, conductivity, and pH will be measured at each location. Growth, reproductive status, and health information will be collected as well. General movement patterns will be determined through radio telemetry.
- 2) If wild fish are collected during sampling, they will be PIT-tagged, weighed, measured, and radio-tagged if appropriate. Tissue samples for contaminants analysis will be taken.
- 3) Displacement, general health, and survival rates of stocked fish will be examined to determine if using hatchery-reared razorback sucker for augmentation of wild populations is a feasible option.

The Service will have the lead for the razorback sucker experimental stocking and monitoring and other cooperating agencies will provide personnel and equipment as needed.

Budget:

Personnel

1 GM-13 Supervisor	3,000
1 GS-7 Fishery Biologist	10,000
1 GS-6 Secretarial/Administrative Support	2,000

Travel-Per Diem 4,000

Equipment and Supplies

Miscellaneous	3,000
15 Six-month AVM Radio Tags @ \$190 each	2,850
15 Twenty four-month AVM Radio Tags @ \$260 each	<u>3,900</u>

Subtotal 28,750

Service Administrative Overhead (17.65%) 5,100

TOTAL 33,850

Support Services (Utah Division Of Wildlife Resources) 20,000

GRAND TOTAL \$ 53, 850

INVESTIGATION OF HABITAT SUITABILITY, FOOD AVAILABILITY, AND UTILIZATION  
BY ADULT AND LARVAL ENDANGERED FISH IN THE UPPER SAN JUAN ARM OF LAKE  
POWELL

(FY 1994 Workplan Proposal)  
(Submitted by E. Wick and S. Dodson- NPS)

Background:

Lake Powell inflow reach on the San Juan Arm varies year to year, depending upon lake elevation and spring runoff. The flowing river and resulting sediment depositional delta can extend from above the Piute Farms Area to Copper Canyon, Zahn Bay, Spencer Camp or into the Great Bend Area. Endangered fish, including the Razorback Sucker and Colorado Squawfish, have been collected from some of these areas. The importance of the river inflow/upper lake interface zone as a habitat for native fish has yet to be determined. Recent studies on the Upper Colorado inflow reach of Lake Powell revealed larvae of both razorback suckers and Colorado squawfish, and healthy young-of-year squawfish. Critical habitat designation for these endangered fish includes inflow reaches of both the Colorado and San Juan Rivers, including the upper San Juan Arm of Lake Powell to Neskahai canyon (USFWS, 9/15/93). The Bureau of Reclamation (BR) reported collecting seventeen young of the year squawfish from the San Juan in 1987. Eleven of these fish were within five miles of Lake Powell, in the boundary of Glen Canyon NRA at river miles 4 to -11. In 1992, only one Colorado squawfish was collected within this reach (Lashmett). Razorback suckers were collected by Utah Department of Wildlife Resources and the Bureau of Reclamation in 1987 and 1991 in the Piute Farms area. These fish were taken to a holding facility and spawned at Ouray, UT. Some of the progeny of these fish were used in a caging study this summer to determine trace element accumulation, survival and growth on the Upper San Juan Arm of Lake Powell. Although substantial mortality of experimental fish occurred after trauma associated with translocation, the cages worked well as holding/rearing and experimental enclosures. Tissues from experimental fish were collected initially, after 21 days in situ, and sacrificed after six weeks. Samples are currently at laboratories for analyses under a FWS catalog contract, and results are pending.

The National Park Service at Glen Canyon is responsible for managing resources within the boundaries of the Recreation Area. Glen Canyon National Recreation Area encompasses approximately 40 miles of flowing river (RM 0-40) upstream from the waterfall, to Goosenecks State Park, as well as 100 miles of the San Juan Arm of Lake Powell. Interagency coordination of research activities and permit issuance for surveys and fish collections within park boundaries are important functions of park staff. U.S. Fish and Wildlife Service (FWS) has collected contaminant data on fish and corbicula tissues from Lake Powell for metals and PAHs (Waddell). Preliminary results indicate a potential elevation of selenium, mercury, and PAHs in the San Juan Arm. The Bureau of Reclamation (BR) (Vernieu, Flagstaff) conducts quarterly water quality monitoring lake-wide, including the San Juan Arm. Additionally, BR conducts fishery surveys of the lower San Juan River and Upper Arm of Lake Powell (Lashmett, Durango). Utah DWR conducted early life history investigations of fish in the San Juan River (Bunter, Chart, Lentsch), however only as far downstream as Clay Hills. Research has documented the presence of young of year, and adult endangered fish utilizing the lacustrine habitats of Lake Powell, although most intensive survey work is upstream in the San Juan River. With the development of a natural barrier, a waterfall, free movements of fish upstream from the lake is prevented, and young fish may ultimately be swept into the lake by currents. The need exists to investigate the presence, abundance, survival and distribution of larval fishes in the Upper San Juan Arm of Lake Powell.

Habitat suitability and food availability in the Lake Powell/San Juan River inflow reaches for these endangered fish species during various life stages has not been well investigated. Nutrient and trace element cycling from suspended sediments into water and the food web during various seasons and flow conditions needs assessment. Survival, growth, competition for food, and predation are all factors that have not been well studied in the San Juan Arm of Lake Powell. Factors affecting survival and recruitment of these species in the San Juan Arm of Lake Powell must be determined.

Glen Canyon NRA plans to continue with the development/expansion, coordination, and implementation of water quality and fishery monitoring programs with park boundaries. The National Park Service hopes to become an active participant in the San Juan River Basin Recovery Implementation Program, by obtaining membership on both the Biology Committee and the Coordinating Committee. In 1994, NPS staff proposes to conduct/coordinate adult and larval fish surveys in the Upper San Juan Arm of Lake Powell. Larval fish will be surveyed utilizing light traps at times corresponding to spawning and larval drift. This time frame is during spring inflows and sediment import and deposition. Comparisons with Colorado River inflow larval results obtained in spring 1993 will be useful in determining if suitable conditions exist for larvae survival in the upper San Juan Arm. Light traps have proven to be a valuable method by which larval fish are attracted and can be collected alive, without the damage associated with drift nets and small mesh seines. Additionally, coordination with other research, such as water quality monitoring, sediment/trace element dynamics, and plankton studies, will be incorporated to optimize data collection and interpretation.

#### Objectives:

- 1) Survey populations of larval fish in San Juan Arm Lake Powell for the presence, distribution and timing of endangered fish.
- 2) Survey and map available habitats for suitability of use by native and non-native fish species.
- 3) Investigate food availability in conjunction with larval fish presence as well as determine trace element cycling in plankton, from water and sediments.
- 4) Comparison of larval fish results from utilization of light traps in the Upper Colorado Arm and Upper San Juan Arm of Lake Powell.

#### Methods:

- 1) Light traps will be utilized in the upper San Juan Arm of Lake Powell to collect larval fishes for identification, enumeration and developmental timing. Locations will include river inflow backwaters in the Piute Farms area, as well as mid-channel locations and embayments between river mile 0 to -11. NPS staff will conduct placement of light traps and field collection of specimens to be sent to the University of New Mexico for identification.
- 2) In addition to light traps, seining, electrofishing, and/or netting surveys will be conducted from spring through summer to establish habitat utilization and timing of use by various native and non-native species from river mile 0 to -11, with particular emphasis upon adult razorback suckers. Sampling trips will be coordinated with other agencies and researchers as much as possible to

optimize on efficiency of field data collection, while reducing negative impacts of duplicative sampling on fishery populations. Physical habitat parameters to be evaluated include slope, substrate, depth, vegetation, and flow, as well as water quality measurements such as temperature, DO, pH, conductivity, turbidity (suspended sediments), dissolved nutrients and trace elements. A digitized GIS map (provided by BR from low overflight) will be developed with overlays of habitat information and fishery data. Landsat images (from USGS participation) will be utilized to correlate with field collected water quality data to enable the development of computer models to predict water quality based on remote sensing.

- 3) Food availability in the form of plankton and benthic macroinvertebrates will be surveyed at the same time as the light traps, and habitat mapping. Plankton abundance, sediment deposition, nutrient and trace element cycling will be monitored in conjunction with fishery surveys. Some of this work may be done by cooperating agencies such as USGS, FWS, BR and Utah Department of Environmental Quality.
- 4) Results from spring 1993 light trapping of larvae, and YOY fishery surveys in the upper Colorado River inflow reach of Lake Powell will be used to compare with larvae found in San Juan Arm during inflow conditions. Food web analysis can be used to determine potential survival of endangered fish larvae if they drift into Lake Powell.

Budget:

	NPS FUNDED	UNFUNDED
Personnel	31,375	
Travel/per diem (field work)	3,400	
Travel/per diem (meetings)	3,000	
Vehicle/equipment use	6,000	
Equipment & Supplies	10,000	
Analytical		(contaminants 5,000)
Larval Fish ID		10,000
Subtotal	53,775	
Agency overhead(10%)	5,377	
	NPS FUNDS	UNFUNDED
TOTAL	\$ 59,152	10,000

#### IV. CONTAMINANTS RESEARCH

##### SAN JUAN RIVER CONTAMINANTS RESEARCH

###### Background:

As early as 1984, studies identified potential inorganic and hydrocarbon contaminants in the San Juan basin. The need for a comprehensive contaminants study as a part of the overall San Juan River Research Program was identified in 1991 at the outset of the seven year research plan. In 1992, several proposals were put forward to initiate contaminants research in the basin and a draft comprehensive work plan prepared. A need was identified to summarize the existing water quality/contaminants data in the basin and determine trends and data gaps as a basis for refining the contaminants research plan. That study was initiated in 1993 and a draft report is nearing completion.

Other contaminant studies are either presently in progress or in the planning stages in the basin. A Department of Interior detailed level irrigation drainwater study is presently underway in the basin with sampling programs in the upper San Juan River from Navajo Dam to below Shiprock. Sampling includes both inorganic and hydrocarbon contaminants.

A continuing sampling program for selenium is being conducted by the Bureau of Indian Affairs as a requirement of the section 7 consultation on the Navajo Indian Irrigation Project. Sampling includes water, macroinvertebrates and fish from Navajo Dam to Bluff.

The Bureau of Land Management is presently preparing a polycyclic aromatic hydrocarbon sampling program in the San Juan Basin downstream to the four corners area. Sampling will include riverine, terrestrial and atmospheric sites in the New Mexico portion of the drainage associated with oil and gas production and power plants.

The Park Service is presently conducting contaminants studies in the San Juan arm of Lake Powell and there is a multi-agency proposal for a water quality monitoring plan for all of Lake Powell.

In addition to these studies that are either on-going or are planned for starts in 1994, the San Juan River Biology Committee is in receipt of several proposals to complete contaminant studies in the basin. While all of the studies have merit, none address the development of a comprehensive plan or detail the logical integration of the study into a comprehensive plan.

###### Objectives:

- 1) Update comprehensive contaminant research plan.
- 2) Initiate synoptic survey of contaminants to compliment existing and proposed data collection program.
- 3) Identify and initiate biological effects studies for contaminants of concern identified in objective 1.

### Methods:

- 1) The draft report of the San Juan River water quality and contaminants data synthesis study will be reviewed and used to identify research needs. Work plans from ongoing and presently planned contaminant studies in the basin will be reviewed. All existing proposals and the initial comprehensive plans identified will be studied to extract concepts useful to the comprehensive plan. From these sources, the comprehensive plan developed in 1992 will be updated to guide the research studies to be conducted in 1994.
- 2) Utilizing the comprehensive plan, a synoptic survey of contaminants will be completed to supplement the data set presently being collected in the basin for identification of contaminants and location of sources.
- 3) Contaminants of concern identified in the 1993 water quality and contaminants study will be selected for biological effects studies on Colorado Squawfish and Razorback Sucker. Existing studies of acute and chronic toxicity will be identified and the results analyzed for transferability to the San Juan. Studies identified as necessary for completion will be prioritized and the first set of acute toxicity studies initiated.

### Timeline:

The draft comprehensive contaminants research plan will be developed and presented to the coordinating committee on October 19, 1993. Until the plan is developed the detailed methods of objectives 2 and 3 cannot be developed. The details of objectives 2 and 3 will be presented at the October 19 meeting as well.

### Budget:

Although the details of the work plan for 1994 are not completed, it is important to preserve adequate funds to initiate the program in 1994. Initiation of the synoptic sampling is critical to allow the contaminant research to arrive at conclusions by the end of the seven year research period. Second in priority is the initiation of the biological response effects. It is anticipated that \$100,000 will be required in 1994 for these two activities. Detailed budgets will be presented at the October 19, 1993 meeting.