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**GRAND CANYON MONITORING AND RESEARCH CENTER**

**FY 1999**

**BIOLOGICAL RESOURCES PROGRAM**



## GCMRC - FY99 BIOLOGICAL RESOURCES PROGRAM

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### MANAGEMENT OBJECTIVE(S):

-- Maintain and enhance the aquatic food base in Glen and Grand Canyons.

FY99 Project:       **AQUATIC FOOD BASE RESEARCH AND MONITORING**

PI(s):            **Dean W. Blinn & Joe P. Shannon, Northern Arizona University**

PROJECT COST: \$178,086

PROJECT DURATION: One year.

### RFP OBJECTIVES:

- 1) Determine impacts alternative operating criteria have on the food base.
- 2) Monitor community structure, density, distribution, and composition of algae, macrophytes and macroinvertebrates along the mainstem and tributaries in a manner compatible with research and monitoring activities on fish.
- 3) Identify key parameters (i.e., nutrient levels, water quality, community structure) associated with the maintenance and enhancement of aquatic food base for long-term monitoring.
- 4) Data collections that enable distinction between the effects of dam operations and natural variation on the aquatic food base and previous monitoring efforts.
- 5) Linkages between nutrient levels, water quality and community structure (benthos, drift, etc.) in relation to dam operations, Lake Powell input and tributary influences.
- 6) Determine if and at what densities the standing aquatic food base in Glen Canyon is a limiting factor in higher trophic level productivity in association with different operating criteria.
- 7) Determine the effects of large fluctuations associated with dam releases on the aquatic food base in Glen and Grand Canyons and associated fish resources.

## **PROJECT ACTIVITIES:**

**--Monitor community structure, density, distribution and composition along the mainstem and tributaries, and making linkages and distinctions between dam operations, Lake Powell input, tributary influences, and inherent variation in the aquatic food base.**

**-- Identification of parameters (i.e., nutrient levels, water quality, community structure) that maintain and enhance the aquatic food base.**

**-- Link the aquatic food base to fish diet and habitat preferences.**

### **Specific activities proposed by Blinn and Shannon:**

**1. Monitor the effects of modified low fluctuation flows from Glen Canyon Dam on the benthic algal and microinvertebrate community in the Colorado River between GCD and Diamond Creed (RM278).**

**2. Monitor the effects of modified low fluctuating flows from GCD on the organic drift in the Colorado River between GCD and Diamond Creek.**

**3. Inventory the phytobenthos, macroinvertebrates and drift in 11 major tributaries in Grand Canyon National Park.**

**4. Construct an aquatic/riparian foodweb using stable isotope analyses.**

## GCMRC - FY99 BIOLOGICAL RESOURCES PROGRAM

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### MANAGEMENT OBJECTIVE(S):

--Maintain or enhance existing population of HBC in lower 1,200 meters of the LCR.

--Maintain levels of recruitment of humpback chub in the mainstem and LCR.

--Verify the status of and management for healthy, self sustaining populations of: (1) flannemouth sucker, bluehead sucker, and speckled dace in the mainstem Colorado River in Grand Canyon and its tributaries; and (2) native fish in Glen Canyon based upon the capability of the habitat to support those fishes.

-- Minimize, to the extent possible, interactions between native & non-native fishes.

-- Evaluate through monitoring and research the reasonable and prudent alternatives specified by the US Fish and Wildlife Service.

**FY99 Project: MONITOR NATIVE FISH OF THE COLORADO RIVER ECOSYSTEM**

**PI(s): Owen Gorman, U.S. Fish and Wildlife Service**

**PROJECT COST: \$485,285**

**PROJECT DURATION: One year.**

### RFP OBJECTIVES:

- 1) Establish linkages among dam operations and the resulting flow regimes and related abiotic (e.g., temperature, turbidity) and biotic (e.g., food base) parameters on spawning, reproductive success, larval transport, recruitment, habitat use, food availability and diet.
- 2) Monitoring to annually evaluate the status and trends of native fish populations, especially humpback chub and flannemouth sucker, in the Colorado River ecosystem. Monitoring activities should consider parameters such as: abundance, age structure, growth rates, condition, year class strength, distribution (i.e., spatial patterns of abundance) reproductive success and overall recruitment in response to dam operations. Monitoring activities should utilize PIT tags to augment existing databases, as appropriate.

- 3) **Competitive and predator-prey interactions with non-native fish and the influence of dam operations, including potentially increased water temperatures, on these competitive and predatory interactions, if any.**
- 4) **Assess the condition of adult humpback chub and other native fish. Utilize results of aquatic food base studies, as appropriate. Evaluate the effects of existing and potential parasites, diseases, and other factors on the condition of mature humpback chub and other native fish.**
- 5) **Examine the importance of the LCR, backwaters, and nearshore habitats to differing parts of the life cycles of native fish.**
- 6) **Temperature studies: Determine optimal, upper and lower water temperature limits on reproductive success, and growth and survival of larval, juvenile, and adult fish. Evaluate effects of increased water temperatures on various factors which may affect population survival (e.g., parasite distribution and abundance, swimming performance).**

**PROJECT ACTIVITIES:**

**Not described until project is awarded.**

## GCMRC - FY99 BIOLOGICAL RESOURCES PROGRAM

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### MANAGEMENT OBJECTIVE(S):

-- In the Colorado River corridor below Glen Canyon Dam to the confluence with the Paria River, natural reproduced fish should compose at least 50% of the Age III rainbow trout. Sufficient suitable spawning habitat should be maintained to reach this objective.

-- The total populations of rainbow trout (age II plus) in this reach should be maintained at approximately 100,000 fish as determined from population estimation.

-- Rainbow trout should achieve 18 inches in length by Age III with a mean relative weight (Wr) of at least 0.80.

**FY99 Project: MONITOR THE LEES FERRY TROUT FISHERY**

**PI(s): Bill Persons, Arizona Game and Fish Department**

**PROJECT COST: \$125,000**

**PROJECT DURATION: One year.**

### RFP OBJECTIVES:

- 1) **Synthesize existing information (published and unpublished data) on the Glen Canyon/Lees Ferry trout fishery and determine the fishery's likely response (growth, reproduction, recruitment population structure, size and distribution) to dam operations.**
- 2) **Monitoring activities for determining population size, structure, growth, distribution, reproductive success and overall recruitment in response to dam operations.**
- 3) **Develop methods for estimating the proportion of natural reproductive success in combination with stocking quantities and rates to determine desired levels of recruitment balanced against the carrying capacity for a range of dam operations.**
- 4) **Develop evaluation criteria for, and measure and assess the health and condition of the rainbow trout population.**
- 5) **Evaluate changing health and condition factors in relation to changes in the aquatic foodbase and nutrient levels as determined in the aquatic food base RFP.**

## **PROJECT ACTIVITIES:**

**1) Analyzing and summarizing existing data (lengths, weights, food habits, effort, catch location) from AGFD data collected from 1984-997 and integrating these data with a review of literature associated with other regulated river trout fisheries.**

**2) Determining the existing status of the trout fishery as it relates to dam operations and developing an evaluation criteria that measures and assesses the health and condition of the rainbow trout.**

**3) Integrating these data with data concerning the aquatic food base to develop methods to estimate the extent of spawning success, and stocking needed to reach healthy, sustainable population levels of trout relative to dam operations.**

**Collection and analysis methods used to address these project objectives include electrofishing in times of the year that coincide with changes in the aquatic food base, creel surveys and PIT-tagged recapture information. Variables collected at such times include, lengths, weights, food habits, effort, catch location. Distinguishing between inherent variation and dam affects will be done using Canonical Correspondence Analysis, while the ANOVA and regression analysis will be used to examine the effects of time on stocking density and recruitment.**



## GCMRC - FY99 BIOLOGICAL RESOURCES PROGRAM

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### MANAGEMENT OBJECTIVE(S):

-- Preserve or restore (where possible) natural species composition and abundance within riparian and upland communities affected by dam operations.

-- Emphasize the preservation of unique plant communities and any special status species (Federal, Tribal, and State designations) to ensure their perpetuation within the system.

**FY99 Project: MONITOR WETLAND AND RIPARIAN VEGETATION**

**PI(s): Tina Ayers and Mike Kearsley, NAU**

**PROJECT COST: \$79,980**

**PROJECT DURATION: One year.**

### RFP OBJECTIVES:

- 1) Monitor the community response (i.e., community structure, diversity, density, distribution, and extent of riparian and marsh vegetation) to dam releases along the Colorado River ecosystem.
- 2) Compare 1998 riparian and marsh vegetation data with historical monitoring data to evaluate change over time (i.e., the spread and contraction of communities, change in species composition, etc.), in relation to dam operations.
- 3) Monitor non-native/invasive vegetation with respect to recruitment, spread and survivorship.
- 4) Examine habitat integrity and composition as it is related to threatened and endangered species (e.g., Southwestern Willow Flycatcher, Kanab ambersnail), and linkages between vegetation, aquatic food base, fish habitat, and sediment-related resources.

### PROJECT ACTIVITIES:

(1) Are riparian plant assemblages in the new high water zone changing through time in response to the hydrologic regime imposed by Glen Canyon Dam?

**(2) Are there important changes in the physical structure of vegetation in the study sites which affect the suitability of habitats for avifauna from one year to the next?**

**(3) How do previous measurements of vegetation structure in the 11 study sites relate to more widely used measures of bird habitat structure?**

**(4) Are the distributions of species of special concern changing in long-term study sites?**

**(5) Can significant interactions between riparian vegetation and sediment and riparian vegetation and aquatic resources be measured?**

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### MANAGEMENT OBJECTIVE(S):

-- Protect, restore, and enhance survival of native and special status species (Federal, Tribal, and State designations). Ensure that the required habitat for these species is preserved. Maintain native faunal components of the ecosystems for the benefit of threatened and endangered species.

-- Maintain a natural age-class distribution through out the majority of their natural range in Glen and Grand Canyons, emphasizing the need to recruit into breeding age classes.

-- Evaluate the viability of food chain(s) for native fauna, including the Peregrine Falcon, Southwestern Willow Flycatcher, and other special status species.

-- In as much as such management is not deleterious to naturally occurring ecosystem components, consider and mitigate impacts to special status species that may use the river corridor opportunistically (Bald Eagle). Maintain self-sustaining fish populations as forage to provide opportunities for bald eagles. Monitor for nesting.

**FY99 Project: MONITOR RIPARIAN AVIFAUNA, WITH PARTICULAR EMPHASIS ON THE ENDANGERED SOUTHWESTERN WILLOW FLYCATCHER**

**PI(s): John Spence, NPS/GLCA**

**PROJECT COST: \$80,900**

**PROJECT DURATION: One year.**

### RFP OBJECTIVES:

#### Grand Canyon Riparian/Aquatic Avifauna

- 1) Collect and interpret data on the current and historic distribution and population densities of wintering and spring and summer avifauna, and their relation to habitat patches, within the Colorado River ecosystem (River Miles -15 to 278).
- 2) Relate habitat structure/composition of survey areas to dam discharges and river flows during the study period, to breeding bird distribution and density.

### **Endangered Southwestern Willow Flycatcher**

- 1) **Collect detailed monitoring data of southwestern willow flycatcher habitat condition, habitat use and nesting success, and nesting fidelity, including the dynamic nature of its colonizing behavior through the study period and in comparison with previous data and other SWWF monitoring programs.**
- 2) **Relate current SWWF distribution to past data to provide a comprehensive analysis of population change through time.**
- 3) **Evaluate the effect of brown-headed cowbird (Molothrus ater) on the abundance and/or distribution of SWWF and what management alternatives should be considered to counteract this effect, if it is negative, in a fashion that does not interfere with SWWF territory occupation or nesting success.**

### **PROJECT ACTIVITIES:**

**This project involves monitoring SWWF and other riparian avifauna population trends in the river corridor, synthesizing existing information concerning SWWF biology and distribution in the corridor, and collecting data associated with life history and the effects of dam operations on life history traits and habitat requirements. Additionally, this project will census overwintering avifauna.**

**Spence intends to address these objectives by using fixed-radius point counts and walking surveys to determine habitat use, home range size, and nest placement characteristics. He will use power analysis to determine which species are effectively monitored in this manner. Spence will also make efforts to correlate species composition and abundance with habitat to determine which variables are most closely linked to birds and are most useful for long-term monitoring. Lastly he will compare current data with previous data to determine trends associated with changes in the riparian avifauna community.**

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### MANAGEMENT OBJECTIVE(S):

-- Protect, restore, and enhance survival of native and special status species (Federal, Tribal, and State designations). Ensure that the required habitat for these species is preserved. Maintain native faunal components of the ecosystems for the benefit of threatened and endangered species.

-- Maintain a natural age-class distribution through out the majority of their natural range in Glen and Grand Canyons, emphasizing the need to recruit into breeding age classes.

-- The population of Kanab Ambersnail should be inventoried and maintained near current levels. Efforts to establish additional population center should be guided by the recovery plan for the species.

**FY99 Project: MONITOR THE ENDANGERED KANAB AMBERSNAIL AT VASEYS PARADISE**

**PI(s): Vicky Meretsky and Dave Wegner, SWCA Inc.**

**PROJECT COST: \$43,511**

**PROJECT DURATION: One year.**

### RFP OBJECTIVES:

- 1) Relate food availability, habitat patch composition, area of cover, and condition at Vaseys Paradise to the historic and recent condition of those patches, and population requirements for sustainability.
- 2) Determine and statistically compare the historic (1995-97) and current population distribution, abundance, age-class/size distribution, population density, and condition (i.e., occurrence of Kanab ambersnail trematode parasite) of Oxyloma haydeni kanabensis at Vaseys Paradise as it relates to natural variation and to the local stage-discharge relationship.
- 3) Monitor abundance and food habits of Peromyscus predator at Vaseys Paradise.

**PROJECT ACTIVITIES:**

**This project involves conducting monitoring and research activities to determine how the KAS population at Vaseys Paradise may be affected by alternative dam operations and to distinguish natural population variation from the effects of dam operations.**

## FY99 Biological Sciences Program Budget

<b>FY99 Program Activities</b>	<b><u>FY99</u></b>
1) Proposal to Monitor the Aquatic Food Base Dean W. Blinn & Joe P. Shannon Northern Arizona University	\$178,086
2) Proposal to Monitor the Native Fish Owen Gorman et al. U.S. Fish and Wildlife Service	\$485,285
Additional Activities: -- Overwintering mortality of HBC	\$TBD <sup>1</sup>
3) Proposal to Monitor the Rainbow Trout Fishery William R. Persons et al. Arizona Game and Fish Department	\$125,000
Additional Activities: --Lees ferry Trout Symposium	\$TBD <sup>2</sup>
4) Proposal to Monitor Wetland and Riparian Vegetation Tina Ayers and Mike Kearsley Northern Arizona University	\$ 79,980
5) Proposal to Monitor Avifauna and the Southwest Willow Flycatcher John Spence Glen Canyon National Recreation Area	\$ 80,900
6) Proposal to Monitor the Kanab Ambersnail at Vaseys Paradise Vicky J. Meretsky & Dave Wegner SWCA, Inc.	\$ 43,511
7) Proposal to Develop an AEAM Model for the Colorado River Ecosystem Josh Korman, Ecometric Research Inc.	\$ 50,000 <sup>3</sup>

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<sup>1</sup> Modification to existing contract being developed.

<sup>2</sup> Modification to existing contract being developed.

<sup>3</sup>This program is also funded through contributions from the Physical and Cultural Resource programs.

<b>FY99 Program Activities</b>	<b><u>FY99</u></b>
<b>8) NEW STUDIES</b>	
-- Plan for establishing a 2 <sup>nd</sup> Population of HBC	\$ TBD <sup>4</sup>
-- Plan for Endangered Fish Research Flows	\$ TBD <sup>5</sup>
<b>9) GCMRC In-house Studies<sup>6</sup></b>	
a) Factors Influencing Benthic Standing Mass in the Colorado River Mike Yard, GCMRC	\$46,662
b) Effects of GCD on Shoreline Habitat Suitability and Use by Native Fish Barbara Ralston, GCMRC	\$ 5,000
c) Mainstem Temperature Monitoring Bill Vernieu	\$ 3,000
d) Genetic Relatedness between Ambersnail Populations Larry Stevens, GCMRC	\$ -0-
e) Synthesis of Backwater Information Larry Stevens, GCMRC	\$ -0-
<b>10) Contingency Funds / Unsolicited Proposals</b>	<b>\$ -0-</b>
<b>TOTAL</b>	<b>\$1,097,424<sup>7</sup></b>

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<sup>4</sup> Proposals currently under review.

<sup>5</sup> Proposals currently under review.

<sup>6</sup> Proposals all related to stated Stakeholder Objectives and Information Needs and are currently undergoing independent, external peer review.

<sup>7</sup> Biological Resources Program was budgeted at \$1,193,000 for FY99. Additional expenditures for the Overwintering Mortality of HBC, Trout Symposium, Endangered Fish Research Flows and 2nd Population of HBC will result in an overrun in the existing budget.